Impact of Macro Policies on the Nile Basin Environment

A Synthesis of Studies in
Eight Nile Basin Countries

July 2009

Nile Transboundary Environmental Action Project 2009

Contributors:
Dr. Ir. Denis Bandushubwenge (Burundi);
Dr Mohammed Maamoun Mowafy and Dr Alaa Saad Marzouk (Egypt);
Dr. Zelalem Hailu (Ethiopia)
James A. Atema and Z. Ngalo Otieno-Ayayo (Kenya)
Rukazmbuga D.T (Rwanda)
Dr Mirghani Tagelsid and Dr Hasan Bashir Nimir (Sudan)
Dr Oswald Mashindano (Tanzania)
Dr. Emmanuel Kasimbazi (Uganda)

First published in 2009 by the Nile Transboundary Environmental Action Project (NTEAP)
Al Jamhurya Street
Plot 15 House No. 2
P. O. Box 2891, Khartoum, Sudan
Tel: 00 249 183 784226/29
Fax: 00 249 183 784248

Study coordination and concept development: Gedion Asfaw
Editorial Consultant: Dr. Justin Lupele
Design and Typesetting: Evans Chisamba

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

The Nile Transboundary Environmental Education Action Project (NTEAP) wishes to acknowledge the many people who contributed to the success of this publication.

The production of synthesis and summary of the country reports on impacts of macro policies on key environmental issues would not have been achieved without the efforts and support of the NTEAP staff and authors of the country reports as well as other participants from the Nile Basin countries who participated in a number of workshops.

Finally NTEAP is grateful to The World Bank, the United Nations Development Programme Global Environmental Facility (UNDP GEF) for supporting this initiative.

FOREWORD

The Nile Basin Initiative (NBI) is a partnership between riparian countries of the Nile; namely Burundi, Democratic Republic of Congo, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda. The NBI's shared vision is to "achieve sustainable socioeconomic development through the equitable utilization of, and benefit from the common Nile Basin water resources". To translate this shared vision into action, there are two complimentary programmes: the Shared Vision Program (SVP) which creates a basin wide enabling environment for sustainable development; and the Subsidiary Action Programmes (SAPs) engaged in concrete activities for long term sustainable development, economic growth and regional integration of the Nile Basin countries.

The Nile Transboundary Environmental Action Project (NTEAP), one of the seven projects under the Nile Basin Initiative's (NBI) Shared Vision Programme, is mandated to provide a strategic environmental framework for the management of the trans-boundary waters and environmental challenges in the Nile River Basin.

As part of a broader plan of raising environmental awareness, NTEAP seeks to enhance the understanding of common and high priority policy issues that affect the environment of the Nile Basin. This will be done through policy studies of the patterns of economic development and priority transboundary environmental issues. The Nile Transboundary Environmental Analysis which was developed by the riparian countries in collaboration with the World Bank, UNDP and GEF identified priority environmental issues and threats in the Nile Basin. Better understanding of how these environmental threats are influenced by macro and sectoral policies and identifying the root causes is essential to explore possibilities of jointly addressing the threats.

In August 2006, the NTEAP held a planning workshop in Tanzania on impact of macro-sectoral policies on the Nile Basin environment. The workshop discussed the concept note on macro policies prepared by NTEAP, reviewed country papers and decided on the kind of studies that could be carried out in line with macro and sectoral policies. Topics were selected on the basis of their relevance to the Nile Basin, significance of trans-boundary aspect and where policy intervention/policy reforms will be required. Four research themes/topics emerged. These were looking at the impact of macro/sectoral policies: on soil erosion; non point pollution/pesticide pollution; exploration and development of oil projects; and deforestation in the Nile Basin. Each author was asked to examine the severity and extent of the environmental issue (based on the topic) and discuss the required policy interventions and /or policy reforms in each of the cases.

This publication is the consolidation and synthesis of eight country reports Burundi, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda. The report assesses the potential impact of macro and sectoral policy issues on the chosen environmental issue (topic) and recommends necessary policy measures for transformation and promoting sustainable development.

During the 2nd regional workshop that was conducted to validate the studies and the draft synthesis report, discussions were held on the role of regional organizations in influencing national policies. The discussion on influencing national policies that was facilitated by the NTEAP National Project Coordinators is compiled and presented in the synthesis report. This will assist in future follow up with regards to influencing national policies to the better management of the Nile Basin environment.

While the summary and synthesis serves as a 'snap shot' of the impact of macro and sectoral policies at the national and regional levels, we hope that this document will be useful to any organisation or practitioner investigating the impact of macro and sectoral policies on Nile Basin environment.

Gedion Asfaw

Regional Project Manager

Nile Transboundary Environmental Action Project

Part of the NTEAP broader plan of raising environmental awareness envisages to enhance the understanding of common and high priority policy issues that affect the environment of the Nile Basin. This has been done through various country based policy studies that focuses on patterns of economic development and priority transboundary environmental issues. The Nile Transboundary Environmental Analysis which was developed by the riparian countries in collaboration with the World Bank, UNDP and GEF identified priority environmental issues and threats in the Nile Basin. Better understanding of how these environmental threats are influenced by macro and sectoral policies and identifying the root causes is the backbone upon which this report is built. The report provides opportunities to explore possibilities for cooperatively addressing the threats.

Objectives

The primary goal of producing this synthesis report was to disseminate the country research findings to all of the Nile riparian countries. The studies are expected to build on two key macro and sectoral policy issues identified in the Nile River Basin Transboundary Environmental Analysis: (a) The policy issues and potential interventions related to the complex and variable relationship between site-specific deforestation for fuel wood and the dynamics of the sometimes distant energy markets being supplied; (b) The policy issues and potential interventions related to the complex and variable links between agricultural productivity, pesticide subsidies and non point-source pollution of water supplies.

Conceptual Framework

Macro-economic policies greatly influence the use of resources and ecological services. Fiscal, monetary, trade, investment, pricing and institutional policy shifts all affect the scale and rate of environmental degradation. The precise impact of macro-economic policies on the environment is difficult to determine because of vague environmental indicators. Macro-economic policies, whether or not successful in generating economic growth, indirectly impact the environment due to change in income, public revenues, and innovative capacity.

Understanding the linkages between macro-economic policies and the environment is difficult. Some of the appropriate tools to assist in understanding these linkages include the Environment-Economic Policy Matrix, general equilibrium modelling and environmental accounting. While the first one is a fairly simple method requiring basic understanding of economics and environment the last two tools require special expertise in modelling and advanced statistics. The relationship of macro-economic and sectoral policies and the environment are examined at a country level. The complexities increase when attempts are made to extend the studies to regional or basin wide level.

This report provides somewhat, in-depth analysis of the root causes of deforestation, soil erosion, non point pollution within the Nile Basin. The important aspects of the studies are the identification of the policy issues which encourage or discourage environmental degradation in the basin and the potential interventions in terms of policy reform.

Methodology

The process of conducting the studies included the following:

- Compilation of an annotated bibliography with regards to the topics of studies;
- Identification of candidates, institutions and researchers and selection of the study participants;
- Conducting a regional workshop to plan the studies at which background technical papers were discussed
- Conducting the studies in each of the eight participating Nile Basin Countries
- Discussing the studies at two regional workshops in Tanzania (2006) and Khartoum (2009)
- Dissemination of the studies

The studies were carried out by national consultants from eight Nile Basin Countries i.e. Burundi, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda. These were teams of researchers drawn from all the eight participating countries. The results will be widely disseminated as a key step towards a more informed environmental policy debate in the Nile Basin.

Outputs

The following are the outputs of this synthesis report:

- Study on the policy issues and potential interventions related to the relationships between site specific deforestation for fuel wood and the dynamics of the distant energy markets being supplied;
- Study on the policy issues and potential interventions related to the links between agriculture productivity, pesticide subsidies and non-point pollution of water supplies;
- Establishment and strengthening of networks of researchers working on transboundary environmental issues; and
- Dissemination of experiences and lessons learned.

The Nile Trans-boundary Environmental Action Project (NTEAP) is among the seven projects under the Nile Basin Initiatives (NBI) Shared Vision Programme (SVP). The NTEAP's overall objective is to provide a strategic environmental framework for the management of the trans-boundary water and environmental challenges in the River Nile Basin.

The project is expected to improve the understanding of the relationships of the water resources development and the environment in the basin, and provide a forum for discussion of development paths for the Nile Basin with a wide range of stakeholders.

Among others, NTEAP focuses on five major components namely, institutional strengthening to facilitate regional cooperation; Community level land, forestry and water conservation; environmental education and public awareness; Wetland and biodiversity conservation; and Basin wide water quality monitoring. A number of outcomes are envisaged out of the NTEAP initiatives. Chief among them are:

- Increased regional cooperation in environmental and water management fields
- Increased basin-wide community action and cooperation in land and water management
- Increased number of basin-wide networks of environmental and water professionals and increased number of experts knowledgeable on the environment
- Greater appreciation of river hydrology and more informed discussion of development paths
- Expanded information, knowledge base and know how on land and water resources available to professionals and NGOs
- Greater awareness of the linkages between macro/sectoral policies and the environment
- Greater awareness and increased capacity on trans-boundary water quality threats

As part of its broader plan of raising environmental awareness NTEAP envisages to enhance the understanding of Nile Basin environmental threats, common and high priority policy issues that affect the environment of the Nile Basin. Better understanding of the River Basin environmental threats, their root causes and how these threats are influenced by macro and sectoral policies is necessary for riparian countries collectively spearheading the process to address the threats and the respective root causes. This is what puts the current study in to context.

In response to the spelt out initiatives and to fulfill the study context, NTEAP organized a planning workshop in Tanzania in August 2006 on impacts of macro and sectoral policies on Nile basin environment.

The purpose of the workshop was to discuss the concept note on macro-policies and the environment prepared by NTEAP, review country papers on macro/sectoral policies and the overall environment and recommend whether or not it is worthwhile to conduct respective studies in the respective countries.

The workshop discussed and agreed the usefulness of conducting the studies on impact of macro/sectoral policies on Nile Basin environment and selected four research themes. These were impact of macro/sectoral policies: on soil erosion; non point pollution/pesticide pollution; exploration and development of oil projects; and deforestation in the Nile Basin. Each author was asked to examine the severity and extent of the environmental issue (based on the topic) and discuss the required policy interventions and /or policy reforms in each of the cases.

Objective

The objective was to produce a synthesis on the following topics of research:

- Impacts of macro/sectoral policies on deforestation and required policy intervention/reform
- Impacts of macro/sectoral policies on soil erosion and required policy intervention/reform
- Impacts of macro/sectoral policies on non point pollution/pesticide pollution and required policy intervention/reform
- Impacts of oil exploration/development on Nile environment and required policy intervention/reform

Report: Each team prepared a concise report on the respective topics with specific attention given to problem analysis extent of the threat/impact (deforestation, soil erosion, non point/pesticide pollution, oil exploration) in the Nile Basin, influence of macro and sectoral policies on these threats, potential policy interventions/reform to address the threats, validation process of the proposed policy reform including process of formalizing adoption of the proposed reform.

Regional Meeting: The research teams participated at a regional meeting and present their report. They fine tuned their reports on the basis of the discussions at the regional workshop before submitting the final version in both soft and hard copies to the PMU in Khartoum. The studies content revolved around the following key questions:

i. Are there visible and very obvious impacts on the Nile environment on account of or caused by national macro/sectoral policies?
ii. What are the extent and severity of these impacts (deforestation, soil erosion, pesticide pollution, oil exploration/development) as they relate to transboundary impacts?
iii. How and which macro/sectoral policies are influencing or causing these impacts? Including a convincing discussion on the cause-effect relationship of the policy with the impact.
iv. What are the recommendations on policy interventions or reform?
v. How would the recommended policy reform be formalized at national level?
vi. How would we ensure that the policy reform is producing the intended results?

The studies relied on desk studies and virtual exchange of information among partner researchers as per the proposed twining arrangements.

Conduct of the study

The studies were conducted by individuals from universities and research institutes who participated at the August macro policies workshop in close consultation with the environment agencies of NBI countries.

The teams worked closely with the National Project Coordinators (NPCs) in the respective countries and were coordinated by the Regional Project Manager (RPM) in Khartoum. The research studies involve desk studies and heavily drew on secondary data and exchange of experience among participating countries.

NTEAP support

NTEAP coordinated the study and developed a concept note, the outline for both the country studies and the regional synthesis report.

The NTEAP facilitated the conduct of the studies through the respective NPCs. Researchers were assisted in acquiring data and information, in communicating with partner researchers in other countries, and a modest honorarium on successful completion of the assignment

Suggested Outline of report

In this summary and synthesis report some country reports did not exactly fit in the suggested report outline. There were some variations but in the main, the report followed the following suggested outline:

- **Background**

  Purpose of the study

- **Introduction**

  A brief on the environment of the Nile Basin part of the country

- **Impact description**

  Problem analysis including the description of the extent and severity of the selected impact (e.g deforestation) focusing on the Nile basin part of the country, analysis of the transboundary effect. (Quantitative and qualitative)

- **Causes of Impact**

  The major causes of the impact focusing on policy aspects

- **Macro/sectoral policies**

  Analysis of how the said impact is caused by the identified macro or sectoral policies

- **Remedial measures**

  Recommended policy intervention, policy reform

- **Validation of proposal**

  Recommended ways of validating the suggested proposal, say through piloting

- **Formalization of proposal**

  Recommended process for the adoption of the suggested policy reform, say through public consultation, advocacy, involvement of decision makers

- **Evaluation process**

  Suggested ways of evaluating the success of the proposed policy reform

BURUNDI

IMPACT OF MACRO POLICIES ON DEFORESTATION

Dr. Ir. Denis Bandushubwenge

Introduction

Burundi covers an area of 13,518 sq km of the Nile Basin. This is about 48.6 % of the total area of the country. This area represents the south most part of the Akagera Sub-basin in the southern part of Lake Victoria Basin. The Kibira Forest is the most important natural forest cover of Burundi. It is a humid tropical mountain forest rich in endemic flora and fauna species.

In addition to its hydrological importance, it is of high economic, scientific and tourist potential. The other natural formations are mainly constituted of natural forest reserves covering 14,000ha. They include the Vyanda Reserve, Bururi Reserve, the Monge Reserve, Rumonge Reserve and Kirwena Reserve. These forest reserves are under threat from increasing demand of firewood and timber for the country. Thus the most serious environmental problem in Burundi is deforestation which leads to soil erosion, loss of soil fertility and inadequate water supply. Consequently, these lead to decreased agricultural production which is the mainstay of the national economy, recurring hunger situations and shortage of wood resources for different uses by rural and urban households.

CAUSES OF DEFORESTATION

Causes of deforestation in Burundi can be broadly classified as; causes of political origin; causes of juridical origin and causes of institutional origin

Causes of political origin

Bad governance

The unlawful exploitation of forests is partially due to lack of respect of laws. Some legislation contains provisions with measures for environment protection. Local administrative authorities regard state forests as sources of direct and easy income leading to abusive logging.

Tree cutting is carried out in disregard of the law banning unauthorised forest exploitation. Cases of abusive logging for income, bush burning for extending grazing areas, inadequate mine and quarries exploitation and poor monitoring of forests by local administration has resulted into continued depletion of environment in general and the forest cover in particular.

Lack of National Vision for long term development

The existing macro and sectoral policies are based on short and medium term plans. The main strategies for development and protection of environment need to be based on a long term vision for sustainable development. Some of the short and medium term plans include the National Environment Strategy (NES) and the National Agricultural Strategy.

The Strategic Framework for Poverty Control (SFPC) is a fundamental policy for poverty alleviation and for nature protection projected up to 2015. This period is relatively short to plan for the protection and conservation of environment.

Lack of National Forest Policy

Major strategic directions in the forest sector are still based on the five-year plan of the Ministry of Forestry. Although the document contains essential elements of a forest policy, it is very general in terms of standards and measures to manage forests. It is important for the Ministry of Forestry to have a policy document clarifying basic principles and objectives to guide all stakeholders involved in the sector. The principles and objectives must ensure the sustainable utilisation of forest resources. A lack of National Forest Policy has led to poor management of the wood sector. There is less interest of private operators in the sector as it does not generate sufficient incomes.

Lack of a policy for alternative sources of energy

Lack of policy on alternative sources of energy has contributed to overexploitation of forested areas. Wood remains the main source of energy in rural and urban areas. High population growth, excessive and often abusive logging in forests has increased demands for fuel wood. A policy on alternative sources of energy needs to be put in place with a view to reducing human pressure on fuel wood. There is a need to encourage the production of energy sources based on domestic wastes, the use of peat, solar or electric energy in order to reduce human pressure on forests reserves.

Inadequate use of arable land is also a root cause of land degradation. Extensive agriculture has led to over cultivation of land causing excessive erosion on the watersheds of the Burundian part of the Nile Basin. Exploitation of marshes is carried out without consideration of the existing marsh zoning. This has contributed to the drying up of marshes. The dried up lakes in the North of the country (Gacamirindi and Twinyoni) are cases in point.

Socio political conflicts

Socio-political conflicts that Burundi has faced since 1993 have negatively affected the environment in general and the forest cover in particular. For example, internally displaced people have settled near forest reserves and exploited forests indiscriminately. The settling of refugees need to be based on a rational plan for managing

environmental resources. Settlement of internally displaced persons without carrying out an environmental impact assessment is a root cause of immense forest destruction in Burundi. Donor funded projects that sought to restore forests before the socio political conflicts broke out have been interrupted due to loss of donor confidence in the country.

The existing plans and programmes of Ministry of Land Management, Environment and Public Works (MLMEPW) have a clear orientation to restore forests and to reduce erosion. However, most of actions planned since 1993 have not been implemented due to lack of funding. For example, the low budget of 1.5 % of national budget allocated to the environment sector in 2008[1] cannot enable the Ministry to operate even if essential activities are planed in its sectoral policies.

To address environmental issues that arise from socio political conflicts, Burundi has ratified a number of International Conventions. They include the Convention on Biological Diversity (CBD); the United Nations Convention to Combat Desertification (UNCCD) and the United Nations Convention on Climate Change (UNCCC). Nevertheless, plans and programmes identified within these Conventions on addressing socio-political conflicts remain unfunded and hence, not well implemented.

Causes of juridical origin

Incomplete and often flawed laws

Legislation related to environmental management contains many shortcomings and inconsistencies and thus difficult to implement. There is also lack of strict adherence to internal legislation such as the Environment, Forest and Land Codes. There is need to harmonise legislation within these codes.

Lack of implementation texts and tools for existing laws

Some laws lack implementation texts to be operational. For example, the Forest Code lacks regulation on transfer and concession of State land. This causes transfer related problems of State's land properties to third parties as private land properties. This can be attributed to the allocation of land containing quarries to private persons by administration officials for revenue generation. However this has had the consequences of uncontrolled exploitation of land and forests found on it.

Causes of institutional origin

Burundi has low institutional capacities in terms of human, material and financial means to address the issue of deforestation. There is also poor inter-sectoral coordination that leads to isolated and fragmented environmental management interventions by relevant ministries. Lack of an inter-ministerial coordination, monitoring and evaluation synergy is the root cause of the low implementation of plans and programmes on restoration, protection and conservation of the environment.

Poor coordination and inter-ministerial monitoring-evaluation

The management of natural resources depends on the involvement of many stakeholders and Ministries. The lack of a framework of coordination of focal points with clear responsibilities undermines the implementation of plans and programmes oriented to environmental management. The coordination of the National Water Commission (NWC) confirms this argument.

Low civil society and stakeholder participation

The civil society and local communities are not fully involved in the management and protection of environment. The absence of a policy to involve all stakeholders in the management of natural resources through a participatory approach is one of the root causes poor environmental management.

The Conventional on Biological Diversity underscores the need for the equitable sharing of natural resources as a strategy of ensuring adequate environmental management. The population living near gazetted areas need to use natural resources of these areas to acquire raw material for craft-related activities and medical plants.

The impacts of deforestation and the depletion of animals and plants have an influence on the environmental behaviour of the Nile Basin zone. The local communities have the right to access right natural resources like forests in order to improve their livelihoods. However, they also have a responsibility to participate to the sustainable management of the resources.

Forests management need to be decentralized in line with the principle of responsible sharing of benefits among local populations, the private sector and the State. Recently (March 2008), a study was carried out to evaluate the actions of various stakeholders in the Nile Basin. The aim of the study was to formulate operational recommendations for the Government and the civil society on sustainable management of natural resources.

Low level of training and information

The level of environmental awareness, training and information among the population on addressing environmental issues is still very low. Even though public and private media are integrated in land and water management by giving information on environmental education, there is lack of coordination and planning. Public and private radio-televisions have already taken significant moves to broadcast information on environmental issues in their weekly programmes.

However, the lack of a strategy to intensify information on management of natural resources is the cause of the gradual absence of vibrant environmental education programmes.

Good coordination of all stakeholders involved in the provision of environmental education and awareness programmes is required in order to increase the levels of environmental literacy in Burundi. This involves identifying key partners and ensuring the monitoring-evaluation of the impact of the training, information and environmental education.

[1] *Country Budget Law 2008*

Extent and severity of deforestation

Burundi has fourteen protected areas that represent variable ecosystems. Amongst these are mountain forests, dry forests and grassy savannas. These protected areas are threatened by unlawful exploitations of precious forest species, deforestation, fire to prepare land for grazing and cultivation. A number of factors hinder the conservation of the natural protected areas.

They include:

- High levels of poverty around the areas
- Lack of appropriate conservation policies and legislation
- Inadequate financial resources for the management of protected areas
- Lack of awareness of environmental importance of protected areas

The high Burundian population and animal movements due to socio-political conflict since 1993 exerted significant pressure on the bio-physical environment. This has led to increased deforestation and encroachment on protected parks. According to the World Bank, during the 1990 - 2000 period, an average of 9 % of forests was destroyed each year. This constitutes the highest rate of deforestation in the world. 93.7 % of Burundian households use wood as energy source (mainly for cooking). More than 79.4 % of urban population use charcoal as energy source. Over 30,000 ha of forests have been destroyed and the rate of forest cover decreased from 8 % in 1992 and to 6 % in 2000.[2]

Mountain forests with precious plant species have been subjected to over-exploitation for a long time now. The overexploitation of forest resources is characterized by an unlawful cut, sawing, and irrational harvesting, de-barking of trunks for medicinal use and charcoal burning etc. In several areas of the country, peasants get fire wood and charcoal from the most valuable species. Trunks are used to build cowshed and leaf stalks for roofs of houses. Due to increased fishing activities, big trees are cut to make pirogues**.** The baking of construction material (tiles, bricks) and the use of wood as energy in food transformation (drying of tea leaves) has led to exploitation of standing forests.

Land clearing for food or industrial crops has significantly modified vegetation cover in Burundi. According to National Strategy and Action Plan on Biological Diversity of 2000 (NSAPBD), the previous forests observed in the past years on crest from North to South are but represented as very distant shreds. They have been destroyed by farmers and pastoralists looking for rich soils and grazing areas respectively. Former savannas with trees occupying 150,000 ha 50 years ago have been reduced to 90,800 ha of which, 50,800 ha are protected under Ruvubu National park (SNPA-BD, 2000) Farming after land clearing and burning has led to progressive degradation of savannas in the East. In highlands and on the level of central plateaux, some valleys with Cyperus and *Cyperus pseudocladus* are replaced by traditional food and vegetable crops. The introduction of crops like rice and tobacco coupled with fishing practices has aggravated the already precarious situation of marshes.

The extensive cattle rearing system in Burundi has caused overgrazing of natural grasslands. This has resulted into a reduction of ecosystems and degraded soils. This environmental issue is prevalent in the Eastern part of the country and on Congo-Nile crest where natural spaces and lawns are degraded. In central plateaux with vegetation adapted to degraded soil, *Eragrostis olivacea* is the most common plant species. Prevalence of this species has contributed a high level of soil acidity in the region.

Erosion and soil losses

The root causes of soil erosion are deforestation, population pressure, poor agricultural techniques and practices, effects of climate change (high temperatures and heavy rains) and the geological nature of soils. The magnitude of water run off also varies with the same factors conditioning solid transports but depends specially on rain intensity, soil type and water saturation.

Land resource in Burundi is over-exploited with the tendency to cultivate on steep slopes and small plots. The population pressure is the cause of the use of all lands for agriculture. An estimated population of 7.3 millions in 2004 with an average density of 250 inhabitants per sq km exerts a strong pressure on natural resources in general and in particular on arable areas as more than 93 % of Burundian population depend on agriculture and livestock. Based on the current population growth rate, it is projected that there will be 11 millions of inhabitants in 2020 with an average density of 392 inhabitants per sq km (BEP, 2007). Following the National Action Against Land Degradation Programme (NAALD) data (2003), land atomization due to high population density is responsible for insufficient agricultural plots (0.5 ha / household). Soil is exposed to erosion due to continuous cropping and lack of fallows. The practices for protecting soils against erosion constitute an investment in terms of time and energy that peasant families cannot manage alone.

Soil losses and the rate of water run off on farmed plots vary significantly. The losses depend on rain intensity, land cover, soil type, slope and its length, degree of soil humidity, agricultural practices and management systems. The experimental results of IASB show that on a bare plot recently ploughed, soil losses can reach more than a hundred tons per hectare for one set of heavy rains. These losses are equivalent to 1 cm of superficial soil taken on the whole plot and if the phenomenon occurs several times in similar conditions, all arable layers disappear.

Extensive farming in densely populated Burundian zones of central plateaux (Muramvya-Gitega) has already led to excessive atomisation of land on which, agricultural exploitation for the rural area averages 0.3 ha per household. That phenomenon has already had its impact on water erosion varying from 15 to 18 tonnes of lost soil / ha / year. The excessive erosion has its transboundary impact given that the waters of Akagera and Akanyaru tributaries contain substances in suspension that are likely to degrade the water quality. This is proven by the reddish clay sediments deposited along Ruvyironza and Ruvubu rivers.

[2] *BEPBEP (2007)*

The effects of erosion and soil losses on the ecosystems of Nile Basin zone lead essentially to bare lands of the Burundian part of the Nile Basin. They also lead to an accumulation of sediments in Nile waters of other countries. The consequences of soil erosion include modification of biodiversity in the region. Climatic conditions are often linked to the vegetation cover; deforestation; negatively impacts on precipitation's distribution in Burundi and the sub region. This case is illustrated by extension of dry season with a rainy season characterized by torrential rains in 2006, 2007 and 2008. Equally, the displacement of sediments originating from erosion along Akagera and Akanyaru rivers will have an impact on the biodiversity of marshes in the sub-region. This is explained by a deposit of red clay alluvium in the sub-basins of Ruvubu and Akagera modifying progressively the wetlands and aquatic zones of regions crossed by these waters.

Decrease of soil fertility

There is rapid decrease of soil fertility in Burundi due to soil depletion that results from water erosion and intensive agricultural activities on small plots. Decrease of fertility is also accompanied by an increase in soil acidity and the rate of free aluminium. For example, the amount of humus in soils in central Burundi has decreased from 4 % to 0.5 % with the rate of mobile aluminium decreasing from 2 % to 6 %. Erosion is accelerated by downstream ploughing activities that progressively remove the arable layer, lack of organic matter restoration due to progressive loss of soil fertility, removal of harvest residues and agricultural waste and insufficient organic manure. The decrease of soil fertility is the basis of reduction of crop productivity and frequent and recurring hunger situations in Burundi.

Deteriorating of water quality

The degradation of the water quality in rivers and lakes of Burundi is often caused by movements of suspended soil sediments in water run off. The material in suspension is responsible of high turbidity and excessive sedimentation in aquatic habitats. This turbidity is unfavourable to biological productivity of water. This explains the low potential in fish in rivers of the Nile Basin. The sedimentation is responsible for silting on wetlands and in lakes. A major part of this sediment load is washed into Akagera and Akanyaru ending up in Lake Victoria.

Climatic variability

As a result of severe deforestation in several places of the country, there is evidence that the climate has considerably changed. Unusual climatic conditions have been experienced over time. For example, the rainy season, has shortened from 9 months to between 5 and 6 months since 2005. Often the climatic disturbance is accompanied by other serious consequences such as floods and in some cases drought. Such climatic changes will not be limited to one country but will affect the entire region. Effects of climate change in the Nile basin include flooding, drought and famine, human displacements from country to country, loss of habitats and biological species and ecological imbalances.

Drying up of water sources and courses

As water used for farming is mainly from rain, any climate change causes a significant reduction in agricultural production. It also negatively impacts on biodiversity in general and on forest resources in particular. Water as a resource has been a major tool in the strategies for socio-economic development of the country. Many sectors such as energy, health and agriculture depend on water. However, water quality lowers due to climate changes and deforestation. The drainage and drying up of marshes for agriculture purposes have increased land under cultivation to the detriment of natural ecosystems and forests. For example, Gacamirinda Lake in Kirundo Province, disappeared due to drainage and farming without an aforestation plan. Other water sources disappeared in the central and eastern parts of the country due to lack of a recovery plan for swampy lands exploited for agricultural purposes. The drying up of waterways in Burundi has disastrous consequences on the countries ecosystem as well as that of the Nile River Basin. The water of Akagera and Akanyaru rivers getting into the Nile Basin has diminished.

In addition to agricultural and livestock products, wild plant and animal species, the disappearance of species has been caused by lack of clear policy for creating alternative resources for use by the population. The list of species under threat of disappearance on the national level has been increasing with time (BEP 2007). Animal species have been affected by human population explosion increased farming activities. Currently, 101 species are under threat of disappearance. According to data published by PEP (2007), 45 species are endangered and 10 mammalian species are reported to have become distinct (BEP, 2007). The depletion of biodiversity is noticed at worrying proportions at the intra specific level.

Degradation of wetlands

The degradation of wetlands is a result of inadequate agricultural practices, mine exploitation, overexploitation of plant and animal resources. Important wetlands in the sub-basin of Akanyaru-Nyabarongo-Akagera are transboundary. They constitute water reservoirs and biological resources shared by Rwanda and Burundi. Their degradation by the lowering of the water level of those wetlands or the drying up could have as negative impact such as loss of plant and animal resources.

The swamp and lake settings of the Akanyaru-Nyabarongo-Akagera system and that of Ruvubu constitute a reservoir for water storage playing an important role in the regulation of water flow in the medium and lower parts of Akagera. Water is retained during periods of floods and released during the dry season. Its destruction would thus result in fluctuations of Akagera water level with floods during the rainy season.

MACRO/SECTORAL POLICIES

Burundi has developed a number of environmentally related policies for the protection of natural resources and the environment in general. The majority of these are sectoral in nature and lack monitoring and enforcement. This section discusses some of the macro policies especially those which relate to forest protection. The section also

looks at the effect of these macro policies on the protection of forest

Strategic Framework on Growth and Poverty Alleviation (2004)

The Strategic Framework for Poverty Control (SFPC) was formulated in 2004 within a framework of sustainable recovery of economy and national reconciliation. To improve environmental protection, SFPC clarifies areas of intervention based on environmental threats in a post-conflict country. These areas include:

- Equipping and training specialists on water issues
- Training and equipping the environment police
- Formulating plans on natural resource management
- Invigorating the NEC
- Reforesting all Watersheds
- Protecting natural resources under threats
- Exploring exploitation of community forests as a source of incomes
- Involving the private sector in natural resource management

In short, the SFPC is a complete policy for the country's development in general, and to protect and conserve environment in particular. However, the strategic framework lacks efficient mechanisms of lobbying and advocacy. As is the case with other policies, lack of implementation of the SFPC is attributed to poor funding. Donors seem reluctant to support a number of projects, including those which are environmental in nature. However, the World Bank through the Global Environmental Facility (GEF) supports activities in the forestry sector.

Programme of Priority Actions for implementation of the Strategic

The Government of Burundi, in collaboration with its development partners has drawn up a programme of priority actions for implementation of the SFPC for the period 2007-2010.

The programme gives clear orientations on environment management for this period, considering the population pressure and agricultural methods used in Burundi. It outlines the government priorities for the rural sector to promote agriculture and to conserve ecosystems. The creation of job opportunities is seen as a solution to reduce population pressure on resources. The restoration of destroyed natural resources and the protection of existing environment resources have also been identified as priorities in the SFPC.

Framework for Poverty Alleviation (2007)

While natural resources continue to be degraded, there is lack of human, technical and financial means for the priorities identified in the SFPC. Although the good content of the priority programme for poverty alleviation and environment protection are well articulated, the evaluation of Millennium Development Goals in Burundi shows a delay in implementation of objectives referring to the vision for 2015 set targets.

National Strategy and Action Plan on Environment

The National Strategy for Environment (NES) is perceived as a response to malfunctions of the agricultural sector and environment protection specifically to settle the conflict between development objectives and those of natural resources protection. The National Strategy for Environment in Burundi (SNEB) was set up in 1992 and updated in 1997.The Environmental Action Plan (EAP) was completed in 1998. The National Environment Strategy proposes measures to address the balance between development interests and environment concerns in Burundi. Based on the NES, the Ministry for Environment has developed a five-year Implementation Plan of 2006. The plan focuses on problems the Ministry for Environment is facing in the area of environment protection.

There is need for the harmonisation and stronger synergies in the planning and implementation of projects and programmes in the environment sector in Burundi. The assessment report on the implementation of *Agenda 21* in Burundi shows that inter-sectoral integrations are low. It also highlights lack of coherence and harmonization of interventions. The report further states that development policies have had a negative impact on the environment in particular for agro-sylvo- zoo-technical sectors, handcraft and industry, energy and mines. The socio-political context of crisis in the country hindered implementation of environmental action plans.

Sectoral policies and their impact on forest management in Burundi

The National Energy Strategy

Electricity in Burundi is mainly generated from hydroelectric power (more than 95%). A low proportion is generated from thermal. Electricity production from other sources such as wind, and photovoltaic is still marginal. Despite the dependence on hydroelectric power, the rate of electrification is very low in rural areas. The number of households with supply is 1900 of the 1,400,000 households, representing 0.1%.

In the framework of progressive disengagement of the State from the production and distribution of electricity, the Government decided to liberalise the generation and supply of electricity to allow the participation of the private sector. This approach is based on law n°1/014 on liberalisation and regulation of electricity sector, promulgated on August 14, 2000. It is assumed that when the private sector invests in the power generation, many citizens of Burundi will have access to hydropower electricity and reduce on the consumption of wood-energy is about 95% of the total available energy. This represents more than 6,400,000 cubic metres of wood energy used at the national level per year. In 2004, this consumption was about 5,900,000 cubic metres. The rural area use more than 76% of the total consumption at a rate of 2.93kg/person/day. The agro-industry, commercial and institutional sectors use 24% of the energy. Charcoal consumption is about 346,617 tonnes representing an average of 0.67kg/person/day. This is an excessive

consumption since it requires more than 188,000 ha of forest with a rate of exploitation of 34m3/ha/year. This poses an environmental threat of deforestation if measures are not taken to reduce charcoal consumption.

In order to reduce the dependence on fuel wood, the Burundi Centre for Studies on Alternative Energies (BCSAE) was established in 1983. The Centre carries out activities of applied research and diffusion of alternative energies from solar, wind and biomass. A number of biogas projects were created at the time. Thus, before the 1993 crisis, a good number of installations were made all over the country. More than 50KWC with photovoltaic installations, more than 320 biogas installations and some wind energy units for water pumping were created. Currently, more than 70% of biogas installations are out of use due to lack of maintenance and vandalism. More than 50% of solar energy installations have broken down or have been stolen. After 1993 crisis, the development of these technologies slowed down following the suspension of foreign funding and reluctance of the private sector to invest in this area.

National Agricultural Strategy (July 2008)

The National Agricultural Strategy provides major orientations for the promotion of a market-oriented modernised agriculture for the period 2008-2015. The document highlights the main constraints of the Ministry of Agriculture and the agricultural sector. It provides the major activities to be undertaken in order to resolve the identified constraints and the cost implication. However, the strategy lacks a proposal for a clear policy to promote intensive agriculture for a country with high population growth and accelerated soil erosion. The strategy also lacks mechanisms to mobilise funds to implement short, medium and long term objectives.

National Strategy and Action Plan on Biological Diversity (May 2000)

Within the framework for the implementation of the Convention on Biological Diversity in Burundi, a national framework to develop a policy on conservation of biodiversity was created. Burundi formulated a National Strategy and Action Plan on Biological Diversity (NSAPBD) in May 2000. The Strategy addresses conservation and sustainable use of elements from the biological diversity and fair and equitable share of benefits from their utilisation. The Action Plan on Biological Diversity requires the country to carry out a detailed study on the:

- Diversity of wild plants and animals
- Diversity of cultivated and domestic species
- Diversity of biological resources
- Access to results of biotechnology
- Assessment of the impact of bio-security
- Aspect of fair sharing of benefits from natural resource exploitation
- Socio-cultural aspects in natural resource management
- Analysis of the legislative, political and institutional framework related to the CBD objectives.

The Strategy identifies threats to biodiversity in Burundi as well as actions to counter these. Although the strategy highlights the importance of setting up a framework for the coordination and inter-sectoral dialogue, it does not include mechanisms for coordinating actions of different multi-sectoral and multidisciplinary partners.

As biological resources are used differently at different levels, a participatory approach to the management of these resources is desirable. However, the strategy in its current form does not provide for communal and integrated participatory approaches to natural resource management. It lacks an important regulation related to access to common resources for the population living near gazetted areas. The National Committee in charge of biodiversity management has turned into a mere body of information exchange; instead of playing the role of monitoring and evaluation as well as finding solutions to current issues.

National Action Plan to fight against land degradation (December 2003)

The creation of a National Action Plan for protection against land degradation (PAN) took place in December 2003. This was with the view to implement the United Nations Convention against Desertification. The programme considers problems related to management of natural resources and ecological balance. It focuses on the following:

- Sustainable use of land by the drawing up a Territorial Zoning Plan;
- Promotion and implementation of management techniques of watershed;
- Mitigation of effects of climatic disturbances;
- Contribution to poverty alleviation;
- Contribution to good governance;
- Institutional promotion; and
- Promotion of sensitisation, education and information actions for the population.

For each focal area, actions to be carried out and partners have been identified. The programme provides modalities for monitoring and evaluation by a multidisciplinary steering committee. The lack of policy for fund mobilization might have contributed to the failure to achieve objectives that are well detailed in the PAN. The lack of technical, human and financial means did not allow carrying out planned actions.

National Policy of Water Resource Management and Plan of Action (August 2001)

The national policy of Water Resource Management was developed to correct existing shortcomings in relation to the tools for water resource management in Burundi. The policy clarifies general principles for water management policy. It proposes major orientations towards the development and management of water resource in agricultural production, supply of drinking water, industrial promotion, energy and environmental protection. The national policy for water resource management also considers the reality that Burundi shares water resources with other neighbouring countries.

While water is a resource intervening in socio-economic development of the country, the policy of water resource management must be grounded on a number of basic principles taking into account social, economic and cultural aspects of Burundi. The following are the basic principles upon which the Burundian policy is built:

- Political commitment to sustainable development of water resources;
- Cooperation for respect of national sovereignty in the area of water management;
- Safekeeping of water and environment quality;
- Obligation of the State to use the resource to satisfy the population's fundamental needs;
- Multidisciplinary water management;
- Responsibility of neighbouring countries for the management and maintenance of common waterways.

Implementation of this policy faces many challenges that have to be overcomed. Some of the challenges include:

- Low interest in management, protection and conservation of water resources;
- Persisting confusion between the roles of management, protection, conservation and exploitation of water resources;
- Insufficient human, technical and financial means;
- Insufficient consultation between various partners in water sector;
- Low mobilization of funds in the water sector;
- Low population's understanding of the strict implementation of the law organizing the public hydraulic domain;
- Insufficient specialised permanent frameworks in planning and management of water resources;
- The scattered habitat on an uneven relief, does not allow an easy and rational exploitation for agro-sylvo-zootechnical ends; and
- The phenomena of climate change that is reducing the water potential.

Institutional and legal frameworks

Institutional Framework

The MINATETP lacks human and financial means to implement set plans and programmes for the management of land; water; forest; and air. In order to strengthen its capacity, the MINATETP works with other line ministries. However, the intersectoral coordination is still weak. Focal persons have been appointed in line ministries such as the ministries of Planning, Agriculture, and Communication, Mines and Energy, Public works and other government institutions to form the National Environment Commission (CNE).

The CNE was established as a body for reflections, arbitration and assessment of environmental impacts. However, the commission seem to concentrate on information exchange and as an informal network for meetings. It is also characterised by overlapping even creating rivalries in the process of sharing, roles and responsibilities. Thus most institutions have elected to operate in isolation.

The environment police in charge of overseeing protection of forests and gazetted areas are facing institutional-related constraints. The officials of protected areas do not have authority over the environment police.

Research in environment is a responsibility that is shared by the University of Burundi (Faculty of Sciences, Faculty of Agronomics), INECN and NGOs involved in environment. However, the research output is negligible. There is little or no investment in research that focuses on the environmental related topics.

This brief review of the institutional framework shows that there is little institutional capacity for the development and implementation of policies on environmental impacts. The MINATEP and MINAGRIE both lack qualified personal to support work in the environmental field. This is exacerbated by the fact that like the other line ministries, the two ministries also work in isolation.

Legal Framework

Burundi has enacted a number of laws for the protection of the environment in general and natural resources in particular. These laws are, in the main, adequate to protect the environment and natural resources. However, lack of implementation strategies and programmes affects the efficient application of laws. These laws include: the Republican Constitution; communal law; creation of National Parks and reserves; forest code; land code; environment code; mines and oil codes; and plant protection code.

The Constitution of the Republic of Burundi

The Constitution of Burundi recognizes the importance of environment protection and promotion of natural resources. Given that the development of the rural area constitutes the basis for the promotion of agro-sylvo-zootechnical development, the support to the agricultural sector can highly contribute to improve protection and restoration of land cover in general and forest heritage in particular. Article 56 stipulates that the State has an obligation to favour the country development, and that of the rural areas in particular. In addition, Article 69 stresses that public goods are sacred and inviolable. Each one must scrupulously respect and protect them. Each Burundian citizen has the duty to defend the nation's heritage. Any act of vandalism, corruption, dilapidation or other act disturbing the public good is punished within conditions specified by law. Despite the clear and real content of the first law of the country on fundamental duties of citizens and individuals to protect and safeguard the environment, the country is exposed to a high risk of natural resource deterioration by illicit use.

Communal Law

Law n°1/016 of April 20, 2005 on organisation of communal administration. Communal Law clarifies in Article 31 that one of the attributions of the Communal Administrator is to take measures on environment preservation. Article 84 related to communal estate, properties belonging to

communal public estate are not subjected to trade when they have not been regularly dedicated to public use. The State can transfer to communes, in exchange for payment or for free, all or part of its land plots set within its boundaries. As the article reads, the commune can use properties having a private form for commercialisation. However, the law lacks precisions on modalities for the exploitation of resources of private heritage notably, natural resources (forests, water and quarries) based on attributions of the communal administrator referring to Article 31 of the communal law. Further, inadequate management of natural resources is practised on the level of local territorial administration (commune) due to misinterpretation of the law and lack of its implementation texts.

Creation of National Parks and Natural Reserves

The decree-law n°1/6 of March 3, 1980 on creation of National Parks and Natural Reserves determines the juridical system for gazetted areas notably on the ban of their concession and transfer, special measures on flora and fauna conservation, prohibition to set settlements near national parks and natural reserves, visits within gazetted areas. The text does not define categories of gazetted areas "national park", "natural reserve", or "integral natural reserve".

The creation of parks and reserves did not adequately consider the needs of neighbouring communities. The communities living near the gazetted areas need to exploit natural resources from those areas for survival. They are therefore obliged to use the resources irrespective of the government's compelling policies and decisions. In addition, these communities have a traditional knowledge that they have used to for sustainable use of natural resource management.

The Forest Code

Law n°1/02 of March, 1985 on the forest code determines a set of specific regulations governing the administration, planning, exploitation, and the monitoring of forests. It integrates several statements for conservation and sustainable use of forest resources and other statements on integrity of forests officials. The Forest Code focuses on the protection of plant biodiversity.

For example, Article 77 promotes the establishment of natural reserves called integral reserves within or outside the parks. These are areas that follow strict measures to ensure protection of endangered plant species in the country; the reconstitution of plant species, the conservation of botanic gardens and arboretum constituting reserves for plant species on the brink of disappearance, rare or outstanding species.

Article 88 states that preservation of biological diversity, recovery of degraded ecosystems and regeneration of plant species under threat or about to disappear constitute an obligation for the State, the local communities, and individuals.

However, the code has shortcomings such as failure to define the status of public and private forestry, failure to clarify the administration powers, and conditions or procedures to prevent abuse of resources, and by prohibiting their use instead of regulating them (articles 45 and 56).

The Land Code

Law n°1/008 of September 1st; 1986 on creation of the Land Code. The Land Code comprises provisions calling on all stakeholders involved in protection of land to guard against any land degradation such as that resulting from soil erosion. In Article 171, protection of soils against erosion is a national obligation and measures for this objective can be declared of public importance. Referring to this code, if soil protection is a national obligation, forest cover is also an obligation that must prevail at all levels. Analysis of the code shows that there is no provision for the protection of the land resources against degradation. Moreover, the Land Code limits application of the Forest Code: discordance in terms of competences for decisions on transfer and concession of forested land.

Environment Code

The fundamental principles of environmental legislation are registered under the Environment Code but are not known and are therefore not applied. Moreover, there is a tendency to consider the protectionism vision of the Environment Code while it was conceived to reconcile environmental quality and socio-economic development; for example, the Code promotes agricultural intensification and at the same time encourages environment protection.

Mines and Oil Code

The Mine and Oil Code governs the exploitation of mining and quarrying activities. The person(s) that require mining rights are obliged to prove the existence of the volume of mine reserves to be exploited. However, this is not respected and quarry's exploitation is often carried out in forest reserves in breach of the law. Failure to abide by this law is the major cause of illegal mine and quarry exploitation, affecting obligatorily plant cover in general and forest reserves in particular.

Plant Protection

Decree-law n°1/033 of June 30, 1993 bearing on plant protection. The phytosanitary legislation exists but its major orientations are not applied. With the ministerial Ordinance n° 710/550/309 of May 21, 1999, an officers' service card for phytosanitary inspectors in charge of phytosanitary invigilation was created but unfortunately it is not working. Implementation texts could clarify police's regulation for phytosanitary inspectors. Moreover, this legislation does not match with procedures, measures and phytosanitary standards prepared for States which are members of the East African Community.

Shortcoming and Inadequacies of the laws

The above laws have some shortcomings and inadequacies either in terms of updating or implementation. These include the following:

- Juridical shortcomings for example in the area of biotechnologies, use of income from exploitation of

biological resources, definition of environmental standards, specific regulation for marshes;

- Sectoral codes (forest, mine, land, law on public the hydraulic domain, law on gazetted areas) are not harmonized with the environment code;
- There is no implementation text for codes, this renders legal obligations unoperational;
- The codes are not known by the various ministerial services, communes, the environment police and the public. As they are not translated into Kirundi, they cannot be easily popularised;
- Contradictions exist between the codes (for example between the forest code and the land code), this results in difficulties of interpretation;
- Being scattered, theses texts are not easy to consult and it is important to compile them in one set for their easy consultation;
- No evaluation has been done on implantation and effects of regulatory texts.

Recommendations

This section provides some suggestions for remedial measures that should be taken to reduce deforestation. The section is divided into three major parts. These are political, institutional and legal frameworks respectively.

Political Framework

Good Governance

During the 1993 crisis in Burundi, the government faced a big challenge to win donor confidence as most donors fled the country or simply withheld financial support to the programmes. The government could not guarantee the security of foreigners. The signing of a cease fire between the government and rebel leaders demonstrated that there was hope for peace. Good governance is slowly being assured in the country. But this needs to be supported and strengthened by the citizens.

Public security

To operationalise development plans and programmes, it is necessary to boost security for persons, properties and services. This is important especially in the aftermath of the war. Reference policies exist and they notably include the CSLP, the National Environment Strategy and the National Agriculture Strategy.

National vision for development

Burundi faces challenges whose solutions require long term projections such as the management of agricultural areas; expansion of urbanisation; and sustainable exploitation of mines and quarries, among others. The integration of sustainable development principles in national policies could be achieved by taking into account the socio-political environment at national and international level.

The integration of millennium development goals into the National Development Vision is important for the orientation of development plans and programmes. Given that most policies have been developed without a National Vision for Development, policy formulation should embrace the vision.

Inter-ministerial coordination

Environment constitutes a common heritage whose safekeeping for a country is the duty of the State, communities, public or private organisations and individual citizens. For the success of this mission, a structure of a horizontal coordination of stakeholders is key. The sectoral policy must therefore be revised to reflect mechanisms for inter-ministerial coordination in order to ensure synergy in the environment management.

The absence of mechanisms for inter-ministerial coordination undermines the functioning and the implementation of objectives of various ministries. Coordination and collaboration principles should be incorporated in sectoral policies of all line ministries.

Agriculture reform policy

The lack of clear policy on agricultural reform in Burundi is on of the causes of environmental degradation. Thus agricultural Reform Policy must be incorporated into the five year plans of the ministries involved in the management of environment such as the MINATETP and MINAGRIE. The sectoral policies of MINATETP and MINAGRIE must be revised to incorporate mechanisms for adequate agricultural reform to reduce human pressure on natural resources.

Financial mobilisation

The sectoral policies of key ministries responsible for environment management must include strategies for financial mobilisation to carryout planned activities. The setting up of a policy for fund mobilization would allow the timely implementation of plans and programmes. For every plan and programme there is a need to identify partners; assign responsibilities to intervening parties and to establish results on each level; and advocate adjustments in case of failure or shortcomings. Monitoring and evaluation framework should be an integral part of the implementation process.

National Strategy on Sustainable Land Management

The National Strategy on Sustainable Land Management need to clarify the major orientations arising from the prospective vision of society and international commitments taken in the framework of sub-regional integration. Once clarified, these orientations can serve as references for the development of future tools for the planning of spaces and future sectoral interventions in the territory.

National Forest Policy

Considering the population's needs for fuel wood, food and habitat, the government must set up a coherent policy on the recovery of the destroyed forest cover and the development of destroyed forest heritage. The policy should promote the participation of the State, public administration, schools, NGOs and the population at large.

Other related strategies that might strengthen the National Forest Policy may include the following:

- Develop agro-forestry around the natural forest to limit pressures on floristic species;
- Conceive and implement income generating projects such as small-scale stockbreeding to limit pressure on fauna species;
- Involve communities and the local administration in the management of natural resources.
- Promote use of indigenous knowledge systems on the richness and management of parks and reserves;
- Encourage the bringing of flora species of scientific/ or economic interest to family exploitations;
- Plan extension of forested areas in the country;
- Promote forest research and domestication of species;
- Set up incentives for private reforestation in provinces;
- Promote techniques allowing the economy of wood like carbonisation techniques;
- Stimulate emergence of professional operators; in the forestry sector.

Strengthening Institutional framework

Boosting the MINATETP

Strengthening intersectoral integration and coordination can be enabled through the National Commission for Environment. However, the state funding of less than 1% must be increased if the operations of the commission have to achieve its intentions.

There is also need to create a structure within the MINATETP that would be responsible for monitoring and evaluation. Its activities would include: Environmental Impact Assessment (EIA), evaluation of effects of sectoral projects and macro-economic policy on environment. The current EIA team in MINATETP must be reinforced by multidisciplinary team.

INECN and IGEBU

The human and infrastructure-related capacities of institutions in charge of INECN management and monitoring of environment are too low to produce any meaningful results. The IGEBU needs a new working orientation with technical and scientific tools responding to the current requirement and challenges resulting from climate change and natural calamities.

Wildlife Police

There must be a clear law for management of policemen and a large-scale training on environment management. The current set up where the forest police are attached to the Ministry of Home Affairs renders INECN (which is in charge of gazetted areas) useless. Further forest police need to be trained in modern natural resource law enforcement techniques.

Research and training in environment

There is need to enhance Research and Training in the environmental area at the University of Burundi and Burundi Agricultural Resource Institute. The development of an exchange programme between INECN and ISABU and other stakeholders in environmental research and training is also needed.

Involvement of local communities in environmental management

A major part of forest reserves belong to communal administration under the Ministry of Home Affairs and Public Security.

There is need for a law or policy that encourages and promotes communal management of forest resources. Hence co-management framework that supports community participation must be put in place.

Civil Society's Participation

The civil society has a major role to play in management and protection of the environment. However, its impact in Burundi is still low. There is need for policies that support civil society as a watchdog on the environment.

Role of the media

Currently the media is integrated in water and soil management. The role of the media can be expanded in the environmental sector. Both public and private media can provide the checks and balances in the environment sector.

Environmental training, information and education

Burundi does not have a coherent system of environmental information and monitoring to guide environmental strategies. Basic statistical data related to land and forest resources is not available. The Centre for Environmental Information at the MINATETP needs to be strengthened and equipped with tools, human and financial resources if it has to accomplish its vision.

Legal Framework

The legal frameworks and legislation that are supposed to support the development of environmental related policies are weak and exist as discrete entities. Thus there is need to strengthen existing laws and develop new ones in areas where they do not exist.

Revision of existing legislative texts

Burundi has a number of legislations that need to be revised, harmonised with international conventions and treaties signed and ratified by the government.

The regulatory texts must be harmonized for a better exploitation. For example, the sectoral codes including the forest, mine, land, law on public hydraulic domain, the law on gazetted areas are not harmonized with the environment code and this leads to misinterpretation. There is need for the forest code to clearly define the status of private and public forests and clarifying modalities for administrative authorization, conditions or procedures of authorization to avoid abusive cases of logging in forests (Articles 45 and 46). On the level of biotechnologies, there must be a regulation on biological resource use, definition of environmental standards.

The laws of Burundi must further be harmonized with existing laws in the sub-region and especially in the East African Community (EAC). These include the phytosanitary legislation of Burundi on procedures, measures and phytosanitary standards of EAC.

These procedures and phytosanitary measures are prepared by Member States of the community to prevent the introduction and dissemination of pests in compliance with Chapter 18, Articles 105-108 of the EAC Cooperation Treaty.

The translation into Kirundi of the various texts and especially the Codes would facilitate their popularisation as they are not known the general populous.

Elaboration of missing laws

For effective management of natural resources in general and of forests in particular, some new laws need to be enacted. They include forest legislation which could give weight to some statements of the Forest Code. Even if the impact of uncontrolled use of fertilizers and phytosanitary inputs is not really quantified, it is obvious that regulation of production and commercialisation of inputs should to be well articulated and popularised.

Implementation texts and tools for existing laws

There are many laws which have no implementation texts. A good example is law n°1/014 on liberalization and regulation of the electric energy sector promulgated on August 14, 2000. For the implementation of this law, there is no Office for regulating electricity sectors to allow a big number of the population to participate in the electric energy sector. This could significantly reduce human pressure on forests.

Implementation of International Conventions and Treaties

The national focal points of various international and regional conventions signed by Burundi do not have efficient means to apply planned provisions. There is need to identify priority areas for action and mobilisation of resources for implementation. Negations with cooperating partners for funds to implement some of the conventions and treaties should be put in place.

References

Analyse participative par zone écologique de la qualité de la conservation de la biodiversité, de la durabilité, de la 'exploitation de ressources biologiques et de l'équilibilité du partage des bénéfices qui en découlent. Bujumbura, décembre 1999.

Auto-évaluation Nationale des Capacités à Renforcer pour la gestion de l'environnement mondial. Stratégie et Plan d'Action de Renforcement des capacités pour la gestion de l'Environnement mondial. Bujumbura, juin 2007.

Code de l'Environnement : Bujumbura, juin 2000

Code foncier : Bujumbura, septembre 1986.

Code forestier: Bujumbura, mars 1985

Convention Cadre des Nations Unies sur les Changements Climatiques

Convention des Nations Unies sur la Latte contre la Désertification.

Convention sur la Diversité Biologique

Etude thématique sur les programmes et projets relatifs à la Biotechnologie et biosécurité au Burundi. Bujumbura, juin 2005.

Etude de l'évaluation de l'implication des parties prenantes dans les actions de l'initiative du Bassin du Nil :Bujumbura, mars 2008

Identification des parties prenantes de l'ANCR et inventaire des acquis. Bujumbura, mars 2006.

Législation phytosanitaire du Burundi

Plan National de mise en œuvre de la Convention de Stockholm sur les polluants Organiques Persistants au Burundi. Bujumbura, mars 2006.

Politique Sectoriel du MINATETP. Bujumbura, avril 2006

Politique sectoriel du MINAGRIE. Bujumbura, Mars 2006

Profil Environnemental de Pays (BEP) du Burundi. Bujumbura. Juin 2007.

Programme d'Action National de Lutte contre la Dégradation de terres. Bujumbura, décembre 2003.

Programme d'Actions Prioritaires de mise en œuvre du CSLP 2007-2000. Bujumbura, 2006.

Projet : Auto-évaluation Nationale des Capacités à Renforcer pour la Gestion de l'Environnement Mondial (ANCR). Analyse du Secteur thématique : Biodiversité. Bujumbura, janvier 2007.

Projet : Auto-évaluation Nationale des Capacités à Renforcer pour la Gestion de l'Environnement Mondial (ANCR). Analyse du Secteur thématique : Changement climatiques. Bujumbura, janvier 2007.

Projet : Auto-évaluation Nationale des Capacités à Renforcer pour la Gestion de l'Environnement Mondial (ANCR). Analyse du secteur thématique : Désertification. Bujumbura, décembre 2006.

Projet d'Aménagement des bassins versants (PWM). Rapport d'évaluation. Bujumbura, décembre 2005.

Projet Habilitation du Burundi à formuler sa seconde communication nationale sur les changements climatiques. Bujumbura, janvier 2007.

Projet Habilitation du Burundi à formuler sa seconde communication nationale sur les changements climatiques. Inventaire des effets de serre. Module : déchets. Bujumbura, mai 2007

Projet Habilitation du Burundi à formuler sa seconde communication nationale sur les changements climatiques. Inventaire des gaz à effet de serre. Module : Agriculture. Bujumbura, mai 2007

Projet Habilitation du Burundi à formuler sa seconde communication nationale sur les changements climatiques. Inventaire des gaz à effet de serre. Module : Energie.. Bujumbura, mai 2007.

Projet Habilitation du Burundi à formuler sa seconde communication nationale sur les changements climatiques. Inventaire des gaz à effet de serre. Module : Procédés industriels. Bujumbura, mai 2007.

Projet Habilitation du Burundi à formuler sa seconde communication nationale sur les changements climatiques. Inventaire des gaz à effet de serre. Module : Utilisation des Terres, Changement d'Affectation des Terres et Forestière. Bujumbura, mai 2007.

Renforcement des Capacités pour la mise en œuvre de la stratégie Nationale et Plan d'Action en matière de la diversité biologique. Bujumbura, décembre 2003.

Stratégie National pour l'Environnement

Stratégie Nationale et Plan d'Action en matière de la Diversité Biologique SCPA-DB. Bujumbura, mars 2000.

Analyse diagnostique transfrontalière pour le bassin du lac Victoria, Bujumbura 2007.

EGYPT

THE IMPACT OF MACRO POLICES ON NON POINT PESTICIDE POLLUTION

Dr Mohammed Maamoun Mowafy
and Dr Alaa Saad Marzouk

The River Nile Basin is contaminated mainly with chlorinated hydrocarbon insecticides (CHI). Although they were banned in 1972 and officially stopped at the beginning of 1980s. DDT, and its metabolites and other CHI such as aldrin, dieldrin, HCH, toxaphene are still detected in River Nile Basin. Pesticide pollution has adverse effects on human health in the region.

Two kinds of toxicity are associated with pesticide pollution **acute** toxicity and **chronic** toxicity. Acute toxicity appears ie after short time exposure to a pesticide. Its effects are skin irritation, vomiting, headache or death immediately or after several hours of exposure to pesticides. On the other hand Chronic toxicity symptoms appear after month (s) or several years from the exposure. The effects of chronic toxicity on humans include cancer (carcinogenesis), non carcinogenic tumours (onogenesis), birth defects (teratogenesis), infertility due to reproductive toxicity, immune suppression and brain damage due to neurotoxicity.

Environmental issue description

There are several reports from EPA and other organizations accounting for the severe hazardous toxicity of pesticides. The impact of pesticides on human is often recorded in international organisation publications. These toxicological studies are expensive and need advanced infrastructure, technology and financial investment. Thus international reports are only used as reference materials when investigating pesticide pollution in countries such as Egypt.

According to Windham (2002), it is not only organo-chlorines or organo-phosphate insecticides that have hazardous effects, but also synthetic pyrethrines which, were considered safe insecticides a few years ago and used for domestic purposes. The most common widespread effects of these insecticides include; spontaneous abortions, birth defects, neurological effects, cognitive and behavioural effects, reproductive effects and cancer. In the new cancer hospital in Egypt, the number of children suffering from cancer is increasing.

A World Health Report entitled *Organic Farming Worldwide A 100% Pesticide Risk Reduction* (2000) indicates that as many as 25 million agricultural workers in the developing world may suffer at least one incident of pesticide poisoning each year. Chemically synthesized pesticides caused tremendous hazardous effect (over 40000 reported cases of pesticide poisoning in 1980, EPA, 1980).

In a series of the articles entitled *Home and Lawn Pesticides More Dangerous than Previously Believed* Bell (2001) mentions that 19,000 fetal deaths (stillborn) occur each year in the United States. According to Bell (2001), a mother who lived within one mile from an agricultural area that used pesticides stood two - fold greater risk of having a stillbirth. Primary defects which contribute to the death of the child were urinary system and multiple congenital anomalies. The data are of high importance as it was first to determine risk if limiting exposure to the 3 - 8 week gestational period. It demonstrates the true risk to pregnant mother in school, homes, offices and neighbourhood mosquito control projects. Pyrethroids are still used for controlling mosquito in truck applications. This raises concerns regarding exposure to pregnant women living in mosquito spray areas.

Water Pollution with Pesticides, and Other Pollutants

In an article written by Salah Hassanein entitled *The River Nile, the Life of Egypt* he stated that the picturesque of the River Nile, the life of Egypt is becoming a serious hazard to people. Its water contains a chemical stew of heavy metals, dioxins, PCBs, DDT and other pesticides, untreated animal and human wastes and diseases carrying bacteria. These pollutants come from different sites and discharge into Nile Basin canals, lakes, and ground water.

Aquatic Weeds

One of the problems faced in the River Nile riparian countries is the rapid growth of water hyacinth. This has led to the growth of water snails, losses of water and hinders water flow in the Nile Basin. Snails are the intermediate host of the parasite *Schistomes schistosomiasis* which causes bilharzia or schistosomiasis in humans. Schistosomiasis is a waterborne disease that is the main cause of liver and kidney diseases in Egypt. In an attempt to control snails in waterways, a lot of pesticides such as copper sulphate and baymscide are used. However use of these chemicals does not only kill the snails but fish and other aquatic life as well. The use of these chemicals has since been banned.

Before 1990, Egypt depended completely on chemical treatments to control water hyacinth which was stopped because of environmental concerns. Since then, Egypt controls water hyacinth by physical means. Mechanical harvesting and obstructions such as floating boom in canals has proved a great success. Sometimes farmers collect water hyacinth and other aquatic weeds from canals manually.

Nevertheless the problem still exists and nuisance. Most eastern and southern African countries are currently implementing biological control programmes. Water hyacinth weevil *N. eichhorniae* and *N. bruchi* are being reared and released in most water bodies. The extensive release of weevils which began in 1980s and 1990s in Kenya,

Malawi, Tanzania and Uganda, and proved successfulness.

Pollution of Nile water with Pesticides

There is little data available on the existence of POPs in drinking water. Tarek and Osasma from the National Research Centre, Cairo (2007) monitored the chlorinated insecticides in Ismailia canal which is considered the main source of drinking water plant in the Great Cairo.

The canal is 130 km long and is a branch of the River Nile which goes east to El- Sharkia Governorate and then to Ismailia. The canal is susceptible to industrial wastes discharges from many industries, paper, petroleum, and petroleum derivatives.

Table 2.1: Determination of chlorinated hydrocarbons in Ismailia Canal water (ppb), 2007.

Food contamination Cotton, sunflower, soybean, butter oil, vegetable oil, milk cream and fish were found to be contaminated with OCI (Ayoub, 2000). The results of analysis showed that the percentage of fatty food samples contaminated with OCI residues reached 53, 50, 46, 46, 54, 61,50 ,97 and 55% in corn oil, sunflower oil, soybean oil, cotton seed oil, vegetable oil, butter oil, butter, milk cream and fish respectively. DDT was the prevailing contaminant with 100% frequency followed by hexachlorohexane (HCH), lindane, heptachlor, hexachlorobenzene, and dieldrin. The local oils were slightly more contaminated with OCI residues than imported oils.

The Level of OCI in fat tissues taken from human bodies after surgical operation in Behara governorate where the largest agricultural activities take place ranged from 0.44 3.19 ppm in 1987. Mother's milk and infant's blood and fatty tissues found with traces of DDT, DDE and other OCI as an impact of MOA policy which depended on these pesticide chemicals before 1982.

Effect of use of pesticide

Due to intensive use of pesticides during 1950s 1990s in Egypt, many farmers and agricultural workers were exposed to serious health problems. The policy of MOA at that time depended completely on chemical pesticides in the controlling program. According to the report entitled *Cancer Risk of Pesticides in Agricultural Workers* by the JAMA (1988) it was reported that 10 out of every 14 Egyptians farmers who between 1980 and 1984 had been diagnosed with having hepatic ongiosarcoma, had been repeatedly exposed to organophosphorous, organochlorine and arsenical pesticides for an average of 14 years. Agricultural workers have higher death rates from malignant brain tumors (Grufferman, 1985).

Pesticides including insecticides, herbicides, and nematicides, especially those bearing chloro-, fluro-, or bromo-, in their structure are highly persistent and can last over 50 years in soil, water, or sediments. These pesticides could cause significant hazard to human or animals.

In the early 1980"s DDT and other halogenated pesticides as ethylene di-bromide aroused great concern as potential carcinogen (cancer causing substances). It is estimated that about 1% of the applied pesticide reaches the target pest and the other 99% ends up in water, soil and air. These amounts go directly to human and animals bodies. The aquatic system is liable to heavy contamination, where fish is caught from the heavily polluted drains, causing serious health problems to the farmers.

During the summer (from June to September) cotton and rice receive the biggest amount of pesticides in Egypt as the cultivated areas of the two crops reaches about 3 million feddans (feddan = around acre). Cotton farming consumes the highest amount of insecticides while rice consumes the highest amount of herbicides. The polluted water from fields of the two crops goes directly to the drains after short time of pesticide application supporting the proliferation of aquatic weeds.

Table 2.1 : Determination of chlorinated hydrocarbons in Ismailia Canal water (ppb), 2007

Organic compounds	Site (1)*	Site (2)**	Site (3)***
á-HCH	126.62	81.96	47.6
ß-HCH	96.1	14.86	3.78
ä-HCH	612.13	211.48	79.75
gamma-HCH	242.46	158.92	71.23
Heptachlor	91.81	51.4	19.58
Aldin	13.88	7.7	3.04
H. epoxide	115.7	33.52	16.54
endosulfane I	303.46	24.19	7.58
Dialdrin	105.4	14.68	5
p,p-DDE	20.08	16.33	7.18
Endrin	9.66	7.75	2.66
endosulfane II	7.25	5.51	2
p,p-DDD	71.52	17.57	3.21
endrin aldehyde	32.06	16.62	3.13
endosulfane sulfate	26.13	23.2	6.49
p,p-DDT	38.15	14.34	6.21
endrin ketone	14.38	10.37	7.39
Total	1926.79	710.4	292.37

* 8km from the beginning of Ismailia Canal (Mostord Drinking Water Treatment Plant)
* *10km from the beginning of Ismailia Canal (after oil companies)
*** 65 km from the beginning of Ismailia Canal (Middle of the Canal)

Trafficking in Obsolete Pesticides

Trafficking in the obsolete banned and restricted pesticides from the developed countries to the third world countries has significantly contributed to pesticide pollution. According to the FASE Research Report 1996$_b$, 4th custom records for shipments

from the USA showed that at least 108,000 metric tons of banned and restricted pesticides were shipped the USA and dumped in the third world market. Table 2.2 shows the trafficking of banned and restricted pesticides in the developed countries which are dumped in the developing countries market.

In Egypt, EEAA began a project in 2004/2005 to collect obsolete pesticides and kept them in a store in Giza governorate (Al-saff district). They collected more than 1000 tons of obsolete pesticides among them were 8 tons OCI. In the Suez custom there are 220 tons of OCI which were about to enter the Egyptian market. As a result of lack of money and effective approach to the disposal of these chemicals, impounded obsolete pesticides are stored in different parts of the country and could illegally leak to the market and cause serious negative impact to the environment. Mansour (2004) in an article entitled *Pesticide Exposure Egyptian Science* confirms that a number of long persisted organochlorines and highly toxic organophosphates which have been banned or severely restricted are still marketed and used in many developing countries. The misuse of pesticides by concerned individuals, in addition to lack of or weak national controlling policies is the causes of pesticide pollution.

Although banned in 1980s DDT and other chlorinated hydrocarbons such as lindane, chlordane, toxaphene, etc. their residues still exist in the environment. The existence of POPs residues are known to persist in the environment for over 50 years. Egypt still faces risks of pesticide pollution as some of the Nile Basin countries still use DDT and other chlorinated insecticides to control mosquitoes and other human vectors. These pesticides leak directly to the water body of the River Nile.

Sallam *et al* (2006) found more chlorinated hydrocarbons in the River Nile sediments in Upper regions of Egypt from Aswan to El-Aiat than in the North regions. Organophosphorous insecticides (OPI) concentrations, on the other hand, were higher in the North Egypt than in Upper Egypt. The most common OPI detected in the surface sediments in the River Nile in North Egypt were chlopyrifos, ethion, fenitrothion, Prothiophos, chlorpyrifos-methyl, primiphos methyl and Phenthioate. The authors attributed the existence of OPI residues in this area to the intense agricultural activities (cotton, maize, rice and potatoes) and Kafr El- ziat pesticide company that discharge its wastes to the Nile. However, these chemicals have a short life span in the environment. The source of pollutants is closely related to human activities, such as domestic and industrial discharge, agricultural chemical application and soil erosion.

The following factors associated with poor use of pesticides by farmers, poor regulations on pesticide application and a lack of market control policy have contributed to an increase in pesticide pollution in Egypt.

Causes of Pollution from Pesticides

The following are some of the causes of pollution from pesticides and health hazards:

Farmers in Egypt like those in the other third world countries do not wear protective clothing or safety glasses when spraying pesticides. Direct exposure to the pesticide is known to increase risk for testicular cancer in agricultural workers (Wiklund and Holm, 1986).

Table 2.2 : Banned and restricted pesticides spilled in the third world market, (ton/year)

Category Banned or	1992	1993	1994	1995
suspended	2.036	1.708	3.008	6.779
Severely restricted	3.361	4.136	2.612	10.109
Restricted	26.096	32.066	32.732	90.894
Total	31.520	17.910	38.352	107.782

- **Poor disposal of empty pesticide bottle** Some farmers use the pesticide waste bottles for domestic purposes, e.g. as water containers. This poses a health hazard to the users. Others throw pesticide waste bottles in the drains or rice fields where fish is caught leading to pesticide pollution.
- **Overuse of pesticides** Farmers sometimes use over dose of pesticide to control the target pests believing that it is the most excellent way for achieving good effects. This results into high levels of pollution and pest resistance.
- **Failure to follow instructions on pesticide application** Farmers who often do not read application instructions found on the labels well expose themselves to risks of pesticide pollution. One such instruction is the Pre-Harvest Interval (PHI) the safe time to harvest a crop after application and occasionally harvest the crop few days after pesticides treatment. For instance, tomatoes are treated over 20 times with fungicides and insecticides as the crop is vulnerable to pest attack. Harvesting the crop a short time after pesticide application might cause high contamination levels of pesticide residues which can result into health hazards to the consumers.
- **Lack of a proper market policy** This has led to an increase in the number of both registered and unregistered pesticide products into the local market from different sources. Sometimes the contents and source of pesticide products are not clear. This affects the credibility of agricultural production for foreign markets.
- **Poor controls on pesticides use** There are limited controls on pesticides shops, storage and formulators located in small villages and farms. Furthermore, there is poor coordination, cooperation and information exchange amongst stakeholders in pesticide industry

Macro /Sectoral Policy for Pesticides Management

Before 1982, Egypt consumed high quantities of all pesticide categories in the pest control programme, insecticides in particular. Highly toxic chemicals were used to control cotton leaf worm as cotton was the main cash crop at that time. The intensive use of chlorinated

hydrocarbon, organophosphate, carbamate and pyrethriod led to serious environment risks whose effects are still being felt in the country. The introduction of macro sectoral policy for pesticides management in 1982 sought to mitigate environmental risks resulting from pesticide pollution. The policy of the Ministry of Agriculture and Land Reclamation (MOA) was to start integrated pest management program (IPM) by applying pesticides when necessary and using other alternatives. Following this policy, pesticide quantities reduced from about 16 thousands metric tons in 1988 to about 7.5 thousands metric tons in 2001.

The highest amount of pesticide consumption was during 1953 1982 when the pest control programmes depended entirely on the use of pesticides. The highest amount of 35,000 tons was recorded in 1972 at a time when the cotton leaf worm had acquired resistance to the chlorinated insecticides. Since cotton was the main economic crop, the Ministry of Agriculture and Land Reclamation began to explore the use of other insecticides. In 1972 organophosphate insecticides replaced the chlorinated insecticides DDT, endrin, dieldrin, toxaphene and others. High quantities of orgaonophosphate insecticides such as chlopyriphos, (dursban), Leptophos (Phosphyl), Phosfalon (Cyolane), and Mephosfalon (Cytrolane) were introduced in 1972.

The use of pesticides began to decrease gradually from 1982 following protests from many environmental organisations against the use of hazardous pesticides. There was a marked decrease in pesticide use (from 15830 tons in 1989/1990 to 11750 tons in 1990/1991 growing season) when the Ministry of Agriculture and Land Reclamation started applying sex attractants (pheromones) to replace insecticides as insect control in cotton fields. Pesticides consumption reached its minimum of 3,714 tons in the 1995 /1996 growing season reaching. However, the application of pheromones as a pest control tool was stopped due to a significant reduction of cotton yield in the 1996/1997 growing season. The use of insecticides resumed and this explains the rise in the consumption of pesticides since the 1997 growing season.

According to the international organisations such as EPA, WHO and IARC, some pesticides were known to cause serious health problems that range from tumors carcinoma, kurtosis, adenomas, and teratogenicity. As a result, the Minister of Agriculture on July 31 1996 banned 28 pesticides (common names) which included 8 fungicides, 2 acaricides, 12 herbicides and 6. This ban which was hurriedly implemented had far reaching impacts on the pesticide market due to the:

- lack of alternatives pesticide to replace the banned ones.
- existence of large amounts of banned pesticides in the market with no way of disposing them except to utilize pesticides in the pest control program. This doubled or tripled the prices of the banned pesticides on the black market.
- entry of large amounts of banned and counterfeit pesticides in the Egyptian market through the borders.
- issuance of many decrees that created more confusion in the pesticide market rather than correcting the situation.

Through Decree No 719 of 2005 47 obsolete pesticides were banned following recommendations from a new Pesticide Committee. This ban included all the pesticides banned in 1996 plus 19 others.

The 1996, 2005 and 2007 Decrees which were issued by three different ministers indicate that the registration and regulation of pesticides in Egypt was influenced by the vision of the minister and his advisors and not the long term policy or strategy of the Ministry of Agriculture.

IPM Policy in Egypt

Integrated Pest Management (IPM) is a system which combines all suitable techniques that include environmental manipulation, use of biological control products, host plant resistance and pesticides to keep pest populations at level below those causing economic injury. One of the basic tenants of IPM is that optimal pest control systems are specific and dependent on extensive knowledge of the ecology of an area. While pesticides are potential tools in any IPM programme they are only used where and when field monitoring of pest levels indicates that other techniques have failed. Within an IMP program system it is important for farmers have at their disposal safe, effective and efficient methods of applying pesticides which allow them to respond to pest outbreaks.

Inefficient and time consuming pesticide application methods may lead to an inability to respond to pest infestation in time and often results in a regime of unnecessary prevention treatments. The implementation of this strategy could avoid the impact of pesticide pollution. Environmental risks associated with pesticide pollution include human health hazards, environmental contamination, destruction and reduction of biological pest controls, pesticide resistance and food contamination.

The IPM policy of MOA was introduced in 1980s to reduce pesticide application and included the following approaches:

The use of more efficient application methods to improving spraying

machines

The improvement of spraying equipment is important in reducing pesticide pollution, especially in irrigation canals that have fish the main source of protein for Egyptian farmers. When applied as part of a cotton IPM programme, the introduction of improved ground spray application methods such as the use of micron Ultra Low Volume (ULV) has halved pesticide dosage rates. The availability of effective ground treatment methods has phased out aerial application. Cotton is now treated on small block basis that depends on pest levels determined by scouting .This has resulted in an overall delay in the start of pesticide treatment, giving beneficial insects better chance to get established. This has had an overall reduction in number of treatments carried out and an increase in cotton yields. Under a GTZ project Egypt improved pesticides spray equipment. This drastically reduced the losses and drift of sprayed pesticide solutions. The sprayers are now available in the pest control units in all cotton growing regions. The sprayers should be made available to the other crops as well.

Table 2.3 : Pesticides banned according to the Ministerial decrees of MOA, Egypt

Decree No. 874/1996		Decree No. 719/2005	
Pesticide	Class	Pesticide	Class
Propargite	AC	Propargite	AC
Mancozeb	F	Mancozeb	F
Maneb	F	Maneb	F
Chlorothalonil	F	Chlorothalonil	F
Folpet	F	Folpet	F
Procymidone	F	Procymidone	F
Iprodione	F	Iprodione	F
Captan	F	Captan	F
Cyproconazole	F	Cyproconazole	F
Alachlor	H	Alachlor	H
Propoxur	I	Propoxur	I
Dimethoate	I	Dimethoate	I
Cypermethrin	I	Cypermethrin	I
Permethrin	I	Permethrin	I
Carbaryl	I	Carbaryl	I
Tetrachlorovinphos	I	Tetrachlorovinphos	I
Etofenprox	I	Etofenprox	I
Dicofol	AC	Dicofol	AC
Clofentezine	AC	Clofentezine	AC
Fosetyl-Aluminium	F	Fosetyl-Aluminium	F
Propiconazole	F	Propiconazole	F
Triadimenol	F	Triadimenol	F
Benomyl	F	Benomyl	F
Hexaconazole	F	Hexaconazole	F
Oxadixyl	F	Oxadixyl	F
Tebuconazole	F	Tebuconazole	F
Triadimefon	F	Triadimefon	F
Terbutryn	H	Terbutryn	H
Atrazine	H	Atrazine	H
Trifluoralin	H	Trifluoralin	H
Bromacil	H	Bromacil	H
Metolachlor	H	Metolachlor	H
Oxyfluorfen	H	Oxyfluorfen	H
Oxadiazon	H	Oxadiazon	H
Bromoxynil	H	Bromoxynil	H
Linuron	H	Linuron	H
Simazine	H	Simazine	H
Pendimethalin	H	Pendimethalin	H
Dichlobenil	H	Dichlobenil	H
		Aldicarb	N
		Tetraconazole	F
		Thiophanate methyl	F
		Butachlor	H
		Thiamethoxam	
		Pymetrozine	I
		Thiabendazole	F
		Propargite	Ac

Use of resistant crop strains

This approach involves the genetic manipulation or selection of plant varieties which have pest resistant qualities. Resistance may be due to physiological factors such as toxic compounds produced by a plant or morphological factors where cuticles thicken to increase pest tolerance. The Seed Breeding Department of Agriculture Research Centre (ARC) has successfully produced many resistant crop varieties of wheat, maize and cotton. Many vegetable varieties (e.g. tomatoes, cucumber, and water melon) resistant to diseases and viruses are imported from Netherlands or USA. The increase in the use of such strategies will reduce pesticide application and consequently, minimise pesticide pollution in the Nile Basin.

The use of biological pest controls

In the Plant Protection Institute, a project was started in the mid 1990s to rear a big mass of *Trichograma* predator for the purpose of controlling insects. The predator has been successfully used in the control of bollworms that used to cause 20 - 40 % losses in cotton yields. Different breeding laboratories for *Trichograma* exist with the biggest ones in Monofia and Kafr El- Shaikh regions. There is need to find biological pest controls for other crops (especially vegetable crops) to reduce the impact of pesticide pollution.

The role of natural enemies in pest control is well known. Biological pest control is generally cheap, effective permanent, and non disruptive. Unfortunately, this strategy is opposed by pesticide companies.

Cultural pest control measures

Cultural control measures include the timing of planting and harvesting, tillage, trap crops, and crop rotation. Such measures involve modification of management practices and make the environment more unfavorable for pest survival, movement, or reproduction.

The use of microbial pesticides

Microbial pesticides are formulated from microorganisms or their by-products. They are generally specific and selective and therefore, control pests with little or no impact on non target organisms. *Bacillus thuringiensis* or BT is the most widely used microbial insecticide.

Different BT formulations (e.g. Agreen, Protecto and Dipel) are used in the pest control program in Egypt. Many tons of **Agreen, usually** produced by the Genetic Engineering Institute of Agriculture Research Centre are used annually in controlling cotton and vegetable crops pests. The active ingredients in BT formulations are crystal toxins produced by the bacterium. When ingested, these crystals bind the gut of certain larvae, causing them to stop feeding and die. **Protecto** which is produced by the Plant Protection Institute of Agriculture Research Centre produces the same effect. **Dipel** that is imported into the country is another BT formulation used to control insect pests. The use of microbial pesticides needs to be spread all over the country.

The use of natural toxins produced from fungus (Spinosad)

Spinosad group of fungi was introduced in the pest control program in Egypt as well as in different countries as an alternative to many hazardous pesticides. The fermentation toxin products are from the fungus *Saccharpolyspora*. The Spinosad group showed high efficiency in controlling cotton leaf worm and cotton boll worm in the 2006 and 2007 growing seasons. It was traded under the name Spentor or Tracer and used in very low doses of about 50 gram / acre. It should be mentioned that spinosad group is highly effective against the control of mosquitoes. This new group of pesticides should replace the use of chlorinated insecticides such as DDT which is still used in many Nile Basin countries.

Oils

Mineral oil, essential plant oil, vegetable seed oil and fatty acids are effective in controlling sucking insects and many plant pathogens. They are efficient, cheap and safe. Petroleum oil is being used intensively in citrus and horticulture. Vegetable oil sprays used for cooking and salad are more readily available than most other oils. They are biodegradable and thus less disruptive to the environment.

Fatty acids extracted from oil are highly efficient against many sucking insects, aphids, and termites which destroy many crops. The insects transmit viruses in tomato and almost all vegetable crops. Fatty acids also control many plant pathogens such as early and late blight in potatoes and tomatoes and powdery mildew in grapes, apricot, mango, cucumber and other crops. The product **Anti stress** is marketed in Egypt for these purposes.

Organic farming development strategy

Organic farming system is now becoming a popular form of farming as the pesticide risks increase. Lady Eve Balfour, a pioneer in the organic movement defined agriculture sustainability as **Permanence.** This was during the first IFOAM International Scientific Conference held in Switzerland in 1977**. Permanence** means adopting techniques that maintain soil fertility, utilize only renewable resources, do not pollute the environment, and foster life energy within the soil and all food chain cycles.

Pesticides are completely not used in organic farming. There are many steps to naturally intensify the regulating power of nature. The first step is to establish a system as closed as possible with cycles which allow nature to work. Strategies include seven or nine year crop rotation, using the disease suppressive potential of compost , planting hedge rows, integrating forestry into agriculture, mulching and other necessary steps for establishing healthy soil for healthy plants and animals. Domestic birds are used in the organic farm tactics, where ducks have successfully controlled weeds in rice fields in Japan and geese control couch grass in potato fields. This potentially eliminates pesticide pollution and earns the farmer extra income.

For insect control, organic farmers use pheromones and colour traps to attract insects in the greenhouses or the open field. Pheromones are used to attract male insects which are then trapped to reduce mating with females. There are many small scattered organic farms in Egypt. Most of them are dedicated for exportation purposes and few for local market. Majority of these farms are hired to investors from Germany or Italy. Inspectors from the mother countries check the rule of the farming processes periodically to ensure the product quality complies with international standards.

Other efforts to reduce health and environmental risks of pesticides

More efforts are being made by researchers, APC and executives from MOA as a policy to reduce health and environmental risk of pesticides. These include the followings:

- Aerial and ULV applications were stopped in 1990.
- Development of conventional application to reduce spray volume.
- Promotion of anti-drift nozzle and/ or special equipment for herbicide on horticulture and field crops treatment.
- Minimizing the use of powder or dust formulations.
- Promotion of less hazardous formulations suitable for the hot climate.
- The use of soluble sachets for highly toxic WP (wetable powder) materials.
- Promoting the use of appropriate protective clothing (overall, gloves, glasses, masks and head covers) during pesticide application.
- Introduction of suitable packages (bottles / sachets) or small area with clear instruction for not being reused.
- Using of spot treatment technique in area of infestation or strip treatment for some crops (horticulture / sugarcane).
- Instruction not to wash pesticides equipment in irrigation canals or pour the left-over solution in current water or to bury empty containers near water canals.
- Co-operation between MOA, pesticide industry and NGO's to follow FAO and Croplife International regulations and standards. This has led to the distribution of publications and pamphlets on the safe handling, storage, transportation and use of pesticide to end users.
- Establishment of periodical training programme between MOA and Pesticide industry and NGOs on the safe handling, storage, transportation and use of pesticides.
- All instructions for poisoning accidents and treatment are clearly labelled on the pesticide.
- Four major poison medical centers have been opened in key cities, with specialized medical poisons clinics in University Hospitals. However, there is a lack of information system or networks for records of pesticide poisoning in Egypt.

Pesticide legislation and regulations

Pesticide legislation and regulations in Egypt are governed by adequate laws and ministerial decrees which comply with international organizations' regulations (i.e. EPA, EU, FAO etc.). However, assistance from FAO, in reviewing and updating local regulations to conform to the provisions of

the Code of Conduct, is required.

The registration and regulation of pesticides is controlled by the Agricultural Pesticide Committee (APC). According to the law, the Minister of Agriculture is responsible for the selection of the members in consultation with his advisors. He can re-formulate or add some members if there is need in order to implement the policy of the Ministry of Agriculture according to his vision. Sometimes the misuse of a pesticide by farmers or applicators leads to deregistering for use in Egypt though it may be registered and used in other countries.

A strong registration scheme is applied in Egypt and will be continued with full governmental control in the future. However, it needs more explanation and stability in order to be fully understood and observed by pesticide dealers and manufacturers.

Data required for registration are in accordance with FAO recommended list; and local pesticide experts are capable of evaluating such scientific data before product registration and release in the country.

Adequate infrastructure and analytical facilities are available to support the registration process in Egypt. However, updating of technological knowledge and upgrading of laboratory facilities is needed.

Pesticide label compliant with FAO guidelines on good labelling practices and with WHO on recommended classification of pesticide by hazard. A colour coding system and the use of pictograms are incorporated in pesticide labels, and will be continued in the future better handling and safety measures.

Monitoring the quality of pesticides at the point of importation or manufacture and in local markets is done. However, pesticide residues in food, water and soil, label compliance and poisoning cases need to be monitored on regular basis, with a neat record keeping system.

Training In collaboration with relevant NGO's (i.e. CropLife Egypt) and pesticide manufacturers and dealers, several training courses on safe and efficient use of pesticides for retail shop workers are being offered. However, assistance is required in organizing multilevel training of trainer's courses for extension workers, farmers and commercial/professional pesticide users. Training of medical staff on diagnosis and treatment of pesticide poisoning is required. There is also more need for training of pesticide registration, evaluation and analysis staff through FAO assistance.

Pesticide Legislation and regulations This is governed by adequate laws and ministerial decrees that comply with international regulations and standards (e.g.. EPA, EU, FAO etc.). However, regular review and updating of local regulations to conform to the provisions of the Code of Conduct is required.

Disposal of obsolete pesticides Advice on current methods of the disposal of obsolete pesticides is from FAO or other international organizations. Transfer of new technologies and upgrading disposal facilities as well as training are needed.

Poisoning information centres These are available in hospitals of major cities. Redistribution of these centres to cover main agricultural areas with intensive pesticide usage is required. Communication between these centres and regulatory authorities is essential, to provide the centres with current information, on registered pesticides and corresponding symptoms and treatment, on a regular basis.

Record keeping by regulatory authority on all aspects related to pesticide registration and control started only recently. No record keeping system was adopted for various registration activities, only individual efforts. A new computerized information system is under development. Help is needed in this area to adopt an advanced computerized record keeping system to facilitate national, regional and international information exchange.

Monitoring the quality of pesticides This is done at the point of importation or manufacture and in local markets. However, pesticide residues in food, water and soil, label compliance and poisoning cases need to be monitored on regular basis, with a neat record keeping system.

Weakness in legislation & regulations

Although there are many positive and strong areas in the registration and regulation policies of pesticides in Egypt, there some weak areas that need to be improved:

- Technical explanatory documentations of registration scheme are lacking, thus producing confusion in the understanding of implementation steps
- Increase in the number of registered plant protection products from less developed countries and unrecognized sources.
- Low investment in local industry. The interest of the local industry is only in formulation and re-packaging.
- Support for research and development is at its lowest.
- Shortage in equipment, technical facilities and regulations to carry out pesticide quality control or assurance tests.
- No official local specifications for exportable or domestic crops to meet the European or USA requirements.
- Limited control on pesticide shops, storage, and formulators located in small village and farms.
- Limited control on food and fresh crops for domestic use.
- Limited co-ordination, cooperation, and information exchange between various stakeholders.
- Invasion of various unknown products into the local market where their sources or contents are not clear.

Recommendations

Pesticide use and control

- Egypt should be divided into different agro-ecological zones or areas. Each area should have its own pest control programme.
- In the past few years PHI have been done in CAPL in order to match the Egyptian requirements. Equipped laboratories and well-trained personals are a must and should be considered.
- Since unidentified pesticides have invaded the Egyptian market from china and other Asian countries, Pesticide Inspectors should be provided with incentives,

transportation and clear and effective law.

- Government should support the local pesticide industry, whose interest is in formulation or re-packing with minimum research and development initiatives.
- Government should set up a local guideline for food quality (pesticide residue limit, for example). The guideline should be established in order to encourage the food exportation to Europe or the USA.
- Increase budget for research and development.
- Establish a training programme in pesticide handling and regulations.
- Work with NGOs in pesticide regulations and control.
- Enforce policies that make pesticide traders and manufacturers cooperate and take part in the formulation of regulations and policies.

Training

Short term training programmes on pesticide is required for small scale farmers who are the most affected by pesticide hazards. For example, in Fyuom governorate where Netherlands funded a training programme on pesticide handling, pesticide usage and the level of pollution were significantly reduced. So the programme should spread out in the other governorates as well.

Integrated Pest Management

Dialogue among stakeholders should be encouraged in the implementation of IPM programme. Participation of farmers in the IPM programmes generally shifts to less toxic and less persistent pesticides and greater reliance on other biological control measures. Non Governmental Organizations, big agricultural investors and dealers of bio-pesticide companies should pool their resources to support IPM programmes.

Training programmes should be developed for agricultural engineers and extension officers in the governorates in order to update their skill and information.

Guide reprints and brochures should be available. The need for training materials and experienced trainers is of significant importance.

Strengthen cooperation and institutional linkages among various, donor's agencies, NGOs, civil society and government departments in the implementation of programmes such as IPM.

Storage and disposal of pesticides

One of the concerns of environmentalists is the disposal of the invalid pesticides and their waste containers. Farmers sometimes use the pesticide containers in households for drinking cups. Sometimes used pesticide containers are thrown in waterways. A proper waste management policy should be put in place.

References

Abdel Azeem and others. 2007. Effect of long-term heavy metals contamination on diversity of terricolous fungi and nematodes in Egypt - a case study. The Lanzague of Science A, pp., 2.

Abdel- Shafy H.I and Alu R.O., 2002. Water Issue in Egypt: Resources, Pollution and Protection Endeavors. CEJOEM, vol.8. No. 1. 3-21.

Aly O.A., and M.I. Badawy, 1984. Organochlorine residues in fish from the River Nile. Bull. Environ. Contam., 33 : pp., 264 252.

Annual Report of Pesticide Committee for Agricultural Pests, 2005.

APRP water Policy Program, survey of Nile system pollution sources. Water Quality Assessment.

Ayoub M. M. , 2000. Monitoring of some organochlorine in some fatty foods. Ph.D. degree, Institute of Environmental Studies and Research, Ain Shams University.

Bell,E.M,I.H. Picciotto, and J.J Beaumont, March 2001Epidemiology 12(2). Fetal Disease Linked to Agricultural Pesticide Use During Weeks 3-8 of pregnancy .

Cancer risk of pesticide in agricultural workers, 1988. JAMA, Aug., (26). No., 7.

Chang, C.N., Feng, H.C., Chao, A.C., Lin, J.G. 1995. Characteristics of the disinfection byproducts (DBPs) and process control techniques of the disinfection process using preozonation and post-chlorination. Water Supply 13: 59-65.

Dogheim S.M., E.N. Nasr, M.M. Almaze and M.M. El-Tohamy, 1990. Pesticide residues in milk and fish samples collected from two Egyptian governorates. Chemical contaminant monitoring: Pesticide residues in milk and fish samples collected from two Egyptian governorates. J. Assoc off Anal. Chem., 73 (1), pp., 19-21.

Dogheim, S. M., M. Almaz, N. Kostandi, and M. Hcgry, 1986. Chemical contaminants monitoring. Pesticide residues in milk and fish samples collected from Upper Egypt. J. Assoc off Anal. Chem., 71 (5), pp., 872 874.

Dogheim S.M., M. El-Shifeeu, A.M.H. Afifi and F.E. Abd-Aleem, 1991. Levels of pesticide residues in human milk samples and infant dietary in lake. AOAC.

Edwards E.M. Bell, I.H. Picciotto, and J.J. Beaumont, 2001. Fatal death to living close to agriculture pesticides use during week 3-4 pregnancy. Epidemiology, 12 (2).

El-Dib, M.A. and Rizka, K.A., 1995. THMs formation during chlorination of raw Nile River water. Water Research, 29, 375 378.

El-Dib, M.A. and Rizka, K.A., 2000. Chlorinated disinfection by products in drinking water at Beni-Sueif, Egypt: A case study. IV International Conference, Water Supply and Water Quality, Poland, Sept., 92 102.

FAO, 1986. International code of conduct on the distribution and use of pesticides. Rome Food and Agriculture Organization of the United Nations, pp. 28.

Grufferman Dellezell E., 1985. Mortality among white and nonwhite farmers in North Carolina 1976 to 1978. Am J. Epidemiol., 121: pp., 391 402.

Guidelines for Regulating Bio-Pesticides in Egypt. 2006.

Nystrom, A., Grimvall, A., Hrantz-Rulcker, C., Savenhed, R. and Ackerstand, K. 1992. Drinking water off flavor caused by 2,4,6-trichloroanisole, water. Science
and Technology. 25:241 249

Osama A. Ali. and M.I. Badawy (1984) Organochlorine residues on Fish from the River Nile, Egypt. Bull. Environm. Contm.toxicol.33:246-252.

Osama A. Ali and S.J. Tarek, 2008. Evaluation for treatment steps in Mostorod drinking water treatment plant. Bull. NRC, Egypt, vol 33, No. 1.

Pest Control Strategy in Egypt, 2006.

Pesticides Manufacturing in Egypt, 2006.

Phiri G, L. Navarro, M. Bashir, C. Cilliers, Y. Fayad and A. Khattab, 2008. Water hyacinth management capability in AME: Key issues emerging from surveys and case studies.

Proceeding of the First Conference of Agric. Pesticides Committee, November 12, 2005.

Safia A. Ahmed, 1986. Assessment of compliance of industry and sewage work with antipollution Law 48/1982 for the protection of River Nile and water ways. M.Sc Thesis, Faculty of Medicine Ain Shams Univ.

Sameeh, A. Mansour (2004) Toxicology in the New Centuary opportunities and Challenges Proceedings of the 5th Conference of Toxicology in Developing Countries vol198,91-115 pp.

Tarek S.J. and Osama A.Ali, 2008. The effect of industrial waste of oil companies on the distribution of organic pollutants in Ismailia Canal water. Bull, NRC, Egypt. 32.

Tvedten S. (2002) . Not Just A River in Egypt.

WHO, 1990. Public Health Impact of pesticides used in Agriculture.

Wilkins K., Ditch J., Holm L., 1986. Testicular cancer among agricultural workers and licensed pesticide applicators in Sweden. Scand J. Work Environ. Heath . 12 : pp., 630-631.

Woodruff, W. John, L. Durant Lawrence, L. Donhoffner, Bruce W., 2001. Human cell mutagenicity of chlorinated and unchlorinated water and the disinfection byproduct 3-chloro-4-(dichloromethyl)-5-hydroxy-2(5H)- furanone (MX),Mutation research, 495: 157-168.

ETHIOPIA

IMPACT OF MACRO/SECTORAL POLICIES ON DEFORESTATION AND LAND DEGRADATION

Dr. Zelealem Hailu

Introduction

Due to the increasing demand for fuel wood and the rapid depletion of resources, millions of people in Ethiopia cannot get sufficient fuel wood to meet their minimum energy needs. Fuel wood resources are consumed faster than they are being replenished. Degradation of forest, woodland and shrub land is caused by harvesting of wood (mainly for fuel) in excess of the natural yield and results in a reduction in woody biomass. In the Abbay (Blue Nile) Sub-basin an estimated 14 million tons of wood are unsustainably harvested as fuel wood and charcoal each year. This represents an annual accumulating loss of sequestered carbon of approximately 7 million tons valued at ETB 189 million/yr (US$ 21 million/yr). Other unquantifiable losses are of non-timber forest products (fruits, medicinal products, gums and resins, etc) and biodiversity.

Causes of deforestation and land degradation

Deforestation and land degradation are the major environmental threats depriving the top fertile soil and aggravating the food insecurity situation in the country. The negative externalities of the problem are not limited to Ethiopia. Rather it has transboundary implications. Hydropower, irrigation, water supply and flood control reservoirs in Sudan and Egypt are affected by siltation of eroded sediment from the Ethiopian highlands. This fact assured that land degradation problem in Ethiopia is major environmental threat with spill over effect to the downstream countries such as Sudan and Egypt.

Topographic Condition

Cultivation of steep lands without applying conservation practices is one of the major causes of land degradation. According to the Ethiopian Highland Reclamation Study (EHRS, 1984), some 1.900 million tones of soil were annually eroded, equivalent to an average net soil loss of 100 tons/ha and an annual loss of 8 mm in soil depth.

The Nile Basin portion of Ethiopia areas such as the Amhara region, the source of Blue Nile, is generally characterized by steep slopes and erodible soil type. In addition to this, the area has got strong and short rain season from mid June to mid September. During these periods, the rivers are turbid and full of suspended solids which cause major land degradation and impact on water quality. For instance, the sediment inflow into Lake Tana is estimated to be $107m^3$/year. This leads to loss of its storage capacity of 6% /100years (JICA, 1997). This sediment inflow has got transboundary implication in the reduction of both the quality and quantity of the Nile Water. Figure 3.1 shows the problem of land degradation *on uncultivated land.*

Figure 3.1: Illustration of land degradation on uncultivated land in highlands

Traditional Cultural Practices

Poor farming practices and continuous cropping without nutrient recycling, and improper land use practices are among the causes for accelerated soil erosion and ecological degradation. Most widely grown crops in the different farming systems include teff a tiny pinhead size grain with a production potential between 4 to 6 quintals per ha.

Land preparation for teff production requires several repeated ploughings and the planting is done at a time of high rainfall amount and intensity in July, which contributes to accelerated soil erosion. This has contributed significantly to high soil loss rate and to the aggravated land degradation in the region.

Using crop residues and dung to meet rural household energy needs rather than for ameliorating soil fertility to increase agricultural productivity and deforestation are causing severe loss of biodiversity, which in turn is negatively affecting water resources, infrastructure stability and ultimately the overall economy.

Lack of Awareness

Land degradation is a slow process. Farmers are not able to see the problem of land degradation as a result of their unwise cultivation in marginal areas. In some areas farmers are even unaware of the problem till their land is out of crop production.

However, close observation of natural resources shows that the effects of land degradation such as sedimentation, flooding, deterioration of fresh water supply from springs, streams and lakes, and losses of other environmental benefits are becoming clearer and obvious in the country.

Over Grazing

Ethiopia is one of the African countries with the largest livestock population. Livestock are in most cases kept for prestige. This practice leads to having large numbers of livestock beyond the carrying capacity of the grazing land and consequently leads to massive land degradation. The country's livestock population is estimated to be 78 million by 1994 livestock census figures. From this 78 million livestock population, 75% (48.5 million) is located in the highland areas above 1500 m.a.s.l. Therefore, the pasture and rangelands in the highlands are severely overgrazed. Thus, overgrazing is much more critical in the highlands compared to the lowland areas and less degraded areas.

Rapid Population Growth rate

The rapid population growth rate of about 2.9% per year demands every year bringing new land for agricultural practice. This in turn leads to clearing of forest covers and converting of marginal lands to crop lands. Furthermore, forest resources are also demanded for construction of houses for the ever-growing population. This pressure over the land contributes to land degradation. The estimates of deforestation vary from 80,000 to 200,000 hectares per annum.

Dependence on Fuel wood as source of energy

The existing dependence on firewood as a primary source of energy, coupled with the alarming rate of population growth and inefficiencies in use, bring about an ever-widening gap between the demand and the supply of fuel wood. The demand far outstripped the supply. In 1997, the deficit in fuel-wood consumption was 41.2 million m^3. In 2005, the gap grew to 58.1 million m^3. As a direct consequence, an aggressive deforestation process has caused the destruction of 200,000 ha of forest and the erosion of 2 billion m^3 of topsoil annually. Agricultural land is also deteriorating in quality every year.

A typical situation of the critical condition of the firewood demand in the country is shown in Figure 3.2. Firewood appears to be the dominant source of household energy needs in rural areas of the basin.

Figure 3.2: Photo At a firewood market; source Rami, UN-EUE

Extent and Severity of deforestation and land degradation

Accelerated and indiscriminate deforestation leads to land degradation, soil erosion and the loss of soil fertility. It also upsets the agricultural production functions for farmers and leads, all things being equal, to reduced crop yields. Land degradation affects agricultural production in two major ways. First, erosion results in loss of soil depth, which in turn results in the decrease of the capacity of soils to hold water for plant growth. Second, the use of animal dung and crop residues for fuel wood purposes disturbs the soil nutrient cycle and reduces plant production. In addition to this, it accelerates surface runoff, imposing further losses on agricultural production. This renders the country vulnerable to recurrent food shortage problems.

Forest clearance and its resultant soil erosion have created chronic problems for dams and reservoirs constructed in the lower reaches of river basins. Deforestation and degradation which occurred for a very long time in the Ethiopian part of the Nile Basin has increased the on-site erodibility of soil, loosening it, and destroying its protective layer. When the eroded sediment enters into rivers and thence to dam reservoirs, it has serious negative consequences. The consequences can be in terms of reduction in water supplies and hydroelectric power production. Silted water brings greater wear and tear to hydroelectric turbines. Reservoir sedimentation leads to a reduction in the expected benefits such as irrigation, hydropower, navigation, flood control and other related purposes by shortening the life span of reservoirs. It also progressively impairs the drainage system downstream, reduces the carrying capacity of the irrigation canals and increases the probability of floods.

Macro and Sectoral Policies

Energy Policy

Efforts of soil and vegetation conservations appear to be unsuccessful in Ethiopia. Policy issues have not been supportive in reversing the situation (Feyera, 2006). For example, alternative energy provision is believed to be a solution to support the reversal of deforestation. But, the effort towards this objective is insignificant.

The current energy supply practice in Ethiopia seems to treat large hydropower as the sole source of renewable energy in the country. In other words, the energy supply practice seems to be based on the premise that grid-based large hydropower generation is sufficient to cater for all energy needs in the country. This conclusion is unavoidable as long as the energy policy requires 'cost-effectiveness' as the criterion to set energy development priorities. As a result, other forms of renewable energy are not being accorded high priority. Therefore, the potential of renewable energy to abate the large scale environmental degradation in the basin cannot be tested at the moment. Even though not directly, the energy policy has somehow adversely impacted negatively on the Nile environment.

Macro economic policy

The macro economic policy of the country is a continuation of the policies started in 1994 by reorienting the budgetary resources towards poverty reduction strategy. The policy

calls for strong revenue performance through tax reform programmes, and improvement of the monetary and financial sector performance. Subsidies are discouraged to bring about economic stability and economic performance. While it is necessary to restrict subsidies to direct production enterprises for the sake of economic efficiency, the renewable energy technology deserves to receive financial subsidization and tax rebate incentives as it can bring about huge intangible benefit in the form of environmental protection. The restriction is probably the cause for the mild and thus inconsequential growth of renewable energy technology in the country.

Agriculture Sector Policy

The Ethiopian Government has put agriculture at the heart of its effort to generate economic growth and development, which is manifested in its Agriculture Development Led Industrialization Strategy (ADLI). Within the agricultural sector, the strategy focuses on the improvements in the productivity of peasant farms and pastoral activities, and the establishment of large-scale farms particularly in the lowlands. In the strategy, the development of agriculture is viewed in three sequential phases with improvement of traditional agricultural practices through the use of improved seeds at first; followed by expansion of small scale irrigation schemes, agricultural infrastructure and modern technological inputs (such as fertilizers, pesticides, etc.). At the second and third stage, it envisages to create non-agricultural employment generating schemes. Recognizing the fact that market forces alone cannot ensure the development of the agricultural sector. The strategy underlines the need for state support in terms of policy intervention and resource allocation.

Policy in Non-farm sector

Rural development has been largely associated with agricultural development in Ethiopia. As a result, attempts to achieve rural development have focused on improving agricultural productivity. The past rural development approaches such as the package approaches are focused on raising the productivity of the farmer by providing modern inputs or encouraging technological diffusion. These rural development packages, however, neglect the rural non-agricultural sectors as sources of employment and income. The fact that crop yields in Ethiopia remain low and farm sizes are small and fragmented suggests that rural households have to supplement their income from offfarm income sources. Thus agricultural strategies need to enhance and promote rural non-agricultural activities as a substantial part of rural development strategy in Ethiopia.

Leaving aside the production of crops and the tending of livestock, this view takes into account diverse range of activities, including the processing of agricultural products, manufacture of handicraft and other goods, commercial activities as well as the provision of other wide range of services. Surveys have identified various types of handicraft activities, food and drinks, and trade as well as small industries as the main categories of non-farm activities in rural Ethiopia.

The non-farm sector development needs its own policy that should complement the currently available policies particularly relating to education, food security, and agriculture. Regional, zonal and woreda governments need to examine their policy towards the rural non-farm sector and design appropriate strategies. Similarly, the rural non-farm sector need not be considered as a residual sector and an institutional framework to support and facilitate the sector in place.

If sufficiently supported, the non-farm sector could make a difference in the drive to implement renewable energy solutions for rural communities. However, the non-farm sector is currently unable to do so because it is in a weak position. The main reason for this is the lack of appropriate policy and institutional support, lack of appropriate technology and other socio-cultural factors. A number of factors account for weak development of the non-farm sector. Most of these constraints are related to the limited purchasing power of the rural people, the nature of the non-farm sector, lack of appropriate policy and institutional support, lack of suitable technology, and other socio-cultural factors, (Tegene, 2006). Thus, the agricultural policy and related strategies and guidelines require amendments to make them more supportive of the intervention of the non-farm sector in promoting renewable energy technologies.

Economic Policy

Ethiopia's economic policy during the transitional period implied a radical change from the past. It involved and implied policies geared towards: (1) Macro-economic stabilization (euphemism for *reduced spending on subsidies*, public sector layoffs, devaluation, etc); (2) Restructuring of public expenditures in favour of "economic sectors"; and, (3) promotion of agricultural productivity, (Demessie, 2006). The overall development strategy was termed Agricultural Development Led Industrialization (ADLI) and it was subsequently augmented with strategic plans like the Poverty Alleviation and Sustainable Development (PASDEP). The aim of the PASDEP is to lay out the direction for accelerated, sustained and people-cantered development as well as to pave the groundwork for the attainment of the MDGs by 2015. During the PASDEP period, Ethiopia is expected to continue to pursue on the ADLI strategy, but with important enhancements to capture the private initiative of farmers and support the shifts to diversification and commercialization of agriculture. The policy documents advocate that in order to eradicate the daunting poverty challenges faced by the country and to improve people's livelihood, it is imperative to have an accelerated and sustained economic growth.

Among others, reduction in spending on subsidies is considered a necessary precondition for economic stability. Especially when it comes to direct production sectors, reduced subsidies are essential for economic efficiency and for competitiveness in the international market. However, when one considers environmental protection like afforestation and rehabilitation of degraded land, it becomes necessary to find ways to support such programmes through subsidies because such ventures are not expected to yield immediate benefits in the form of financial income. Related to this is the issue of renewable energy technology that in this study is taken as an important part of the environmental rehabilitation initiative.

Renewable energy can ease the burden on indiscriminate usage of biomass as a source of energy and thus help reduce further environmental degradation. Thus the benefit remains to be largely intangible. Therefore, renewable energy initiatives should be supported through governmental subsidies, funds raised by the NBI- SVP, and international environmental funds like the Clean Development Mechanism, the Global Environmental Fund, Carbon Trading and the like. Therefore, the policy needs to make slight amendments by allowing subsidies as well as tax rebate/exemption from importation of renewable technologies. Otherwise the impact on the environment will worsen in the coming years.

The Environmental Policy

The Environmental Policy contains a number of very useful points regarding the promotion of renewable energy. However, implementation of the policy is hindered because of the restraining effect of the factors in the energy policy discussed above. Therefore, the environmental policy does not give sufficient support to bring about the necessary intervention.

The policies on the environment give alternative sources of energy their due places in the future of energy development in the country (EPA, 1997a; EPA 1997b). The need for the use of alternative energy sources such as solar power, wind, biogas, agricultural bio-fuel, liquid bio-fuel or small hydroelectric plants for towns and villages remote from the national grid has also been well recognized. The following are some of the policy guidelines set for the development and management of the country's energy resources in general and use of alternative sources of energy in particular:

- To adopt an inter-sectoral process of planning and development which integrates energy development with energy conservation, environmental protection and sustainable utilization of renewable resources;
- To promote the development of renewable energy sources and reduce the use of fossil energy sources both for ensuring sustainability and for protecting the environment, as well as their continuation into the future;
- To develop alternative energy sources for towns and villages remote from the national grid;
- To place an increasing reliance on energy efficient technologies, sustainable use of renewable resources, and the development of indigenous energy resources;
- To acquire, develop, test and disseminate appropriate and improved energy use technologies (e.g. improved stoves, charcoal kilns, solar powered cookers and heaters);
- To demonstrate and support the use of other energy sources (e.g. Geothermal Solar, etc.) in the various economic sectors where it is currently little used such as in transportation, irrigation, crop-drying, food processing, fish drying, and thermal heating;
- To promote and assist the private sector to assemble and manufacture energy development facilities and end-use appliances.

The policy statements are all well formulated and relevant. But, they seem to lack the necessary emphasis in proactively embracing the renewable energy option as an instrument of reversing environmental degradation. The policy lacks the necessary strong arm that could push renewable energy technology to the forefront. Therefore, it fails to impact the environment positively.

Although not highly cost-effective, renewable energy is an uncontested means of reversing the energy crisis as well as the environmental problem in the country and in the Nile Basin. Therefore, the environmental policy should have strongly favoured the promotion of renewable energy regardless of what it may cost in financial terms. The policy, as it stands today, is not adequately accompanied with relevant guidelines and strategies that could enable the achievement of the set out goals in practice on the ground.

Energy and Hydropower Sector Policy

The energy policy, as stated by the Ministry of Mines and Energy (MME) 1994, outlines the need to rely mainly on hydropower to increase the electricity supply and to take advantage of geothermal, solar, wind and other renewable energy resources wherever appropriate. It also calls for the need to encourage energy conservation in industry, transport and other energy using sectors to ensure that energy development is environmentally friendly; and to provide appropriate incentives to the private sector. The energy policy accords the following order of priority for the development of various energy resources:

- Hydropower Development
- Oil and gas resources development
- Traditional energy development through reforestation programs

The policy gives priority to the planning and expansion of the energy supply required for economic development, particularly the implementation of the ADLI, while at the same time, taking measures to transform energy consumption in the country from traditional to modern sources. This will be carried out in an integrated manner through proper coordination with development planning and implementation and the strengthening of the linkages of the energy sector with other sectors of the economy. The policy also emphasizes the need to take energy utilization and efficiency increasing measures *as well as the promotion, whenever feasible, of indigenous energy sources which are cost-effective and reliable*. In line with the energy policy, the hydropower sector policy issued by the Ministry of Water Resources, MoWR 1999, also underscores the need to subject hydropower development schemes to strict environmental and stakeholder considerations as well as meeting *economic criteria*.

Thus, hydropower development has been accorded highest recognition and priority in both the water and energy sector development policies. Currently, more than 95% of electric energy generation in the country is from large hydropower. There is an existing total hydropower capacity of 814 MW in the country as shown in Table 3.1. Massive efforts in large hydropower construction are taking place which will

increase the capacity by five times in a few years time when the construction of the plants is completed.

Table 3.1: Hydropower Generation in Ethiopia

Plants	*Capacity (MW)*
Total Existing Capacity	814
Amerti Neshi Fincha	100
Tekeze	300
Tana Beles	460
Gilgel Gibe II	420
Gilgel Gibe III	1870
Total	3964

The growth in capacity is useful to meet the growing industrial demand in the country, the supply needs of rural towns to be connected under the Universal Energy Access Programme and the planned energy export to neighbouring countries in the framework of the regional power trade.

Both the energy and the hydropower policies underscore cost-effectiveness as basic criteria to develop the indigenous energy sources. Such requirement of cost-effectiveness is likely to exclude small hydropower and other forms of renewable energy sources from being potential candidates for development as their economic viability or cost-effectiveness is much less than large hydropower due to economies-of-scale. Thus, the criterion of cost-effectiveness, which is visibly embedded in the energy and hydropower sector policies, happens to be the major impediment to the promotion of indigenous renewable energy sources in Ethiopia. Conventionally, cost-effectiveness is evaluated without taking intangible benefits into account. As a result, the intangible benefits of the various forms of indigenous renewable energy sources such as the prevention of environmental degradation are not considered as advantages as they should have been.

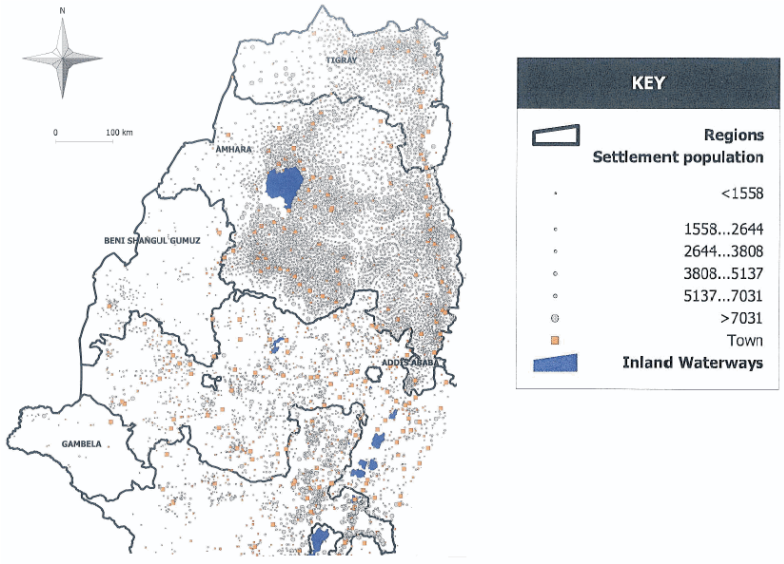
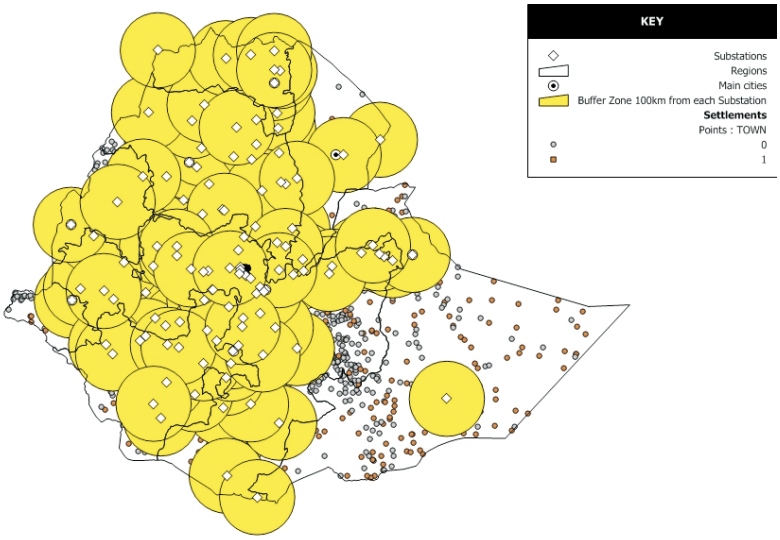


Figure 3.3 Rural Settlements in Nile basin, source Master plan of off-grid rural electrification

Therefore, renewable energy resources have been marginalized till now and they will remain so in the future unless the necessary policy intervention is taken.

The Ethiopian Electric Power Corporation (EEPCo) is the sole federal institution responsible for generating, transmitting, distributing and selling of electricity, whereas upstream activities of medium and large-scale hydropower project studies and design fall under the mandate of the water sector as per the current policy of the water management, (Michael, 2004). In accordance with the energy policy, the EEPCo generates and distributes electric energy from hydropower resources, which meet the criteria of cost-effectiveness. Naturally, this criterion favours large hydropower plants. Neither small hydropower plants nor any other form of decentralized renewable energy source get recognized because of economies-of-scale. Therefore, it is not surprising to find out that EEPCo's own policy discriminates decentralize/off-grid power supply in favour of centralized grid-based electrification. This brings to light the age old dilemma of the suitability of the grid to reach out to widely scattered rural settlements. Many researchers contest the validity of solely utilizing large hydropower through the national grid system to solve the problem of energy supply to rural Ethiopia (Hailu et al, 1988; Zelalem,1992; Zelalem,2002).

Rural areas in Ethiopia are characterized by either low-density settlement with relatively large distances between households or villages with fewer inhabitants. This has hindered the use of modern sources of energy. Ignoring rural inhabitants by allowing them to continue the current use pattern of traditional energy sources is bound to have highly negative consequences for the rural economy at large, as well as the environment and the ecosystem balance. The enormity of the number of settlements casts doubt as to whether the grid system could be cost-effectively extended to reach out to rural settlements. As compared to large hydropower almost all of the common renewable energy sources including small hydropower may seem less cost-effective especially if the grid extension costs are not taken as part of the generation costs of large hydropower systems. If one compares only the specific costs ($/kw) of small hydropower with large hydropower, the specific cost of small hydropower may come out to be 1.5 to 3 times that of large hydropower.



Solar energy specific costs are several times more costly. This fact gives EEPCo the justification to ignore all decentralized renewable energy sources and concentrate only on large hydropower development. This course of action taken by EEPCo remains to be in line with the energy sector policy, which stresses the need to maintain cost effectiveness of energy supply.

EEPCo has included in its strategic plan that it will extend the grid to cover the electricity needs of settlements within 100 km of any of its 33 kV substations. Based on this premise the off-grid Rural Electrification Master plan Study prepared a GIS buffer zone map to identify the future supply coverage area by EEPCo. The resulting map in Figure 3.3, shows that EEPCo's intended area of intervention covers nearly the whole of Ethiopia.

EEPCo's successful activities in achieving its mission of providing quality electricity services in Ethiopia are remarkable. However, there are certain issues which stand out as major concerns for environmental advocates who are interested in the promotion of renewable energy in Ethiopia. EEPCo simply fails to spell out that it cannot cover the energy needs of all rural settlements in the country. It does not make any effort to delineate those towns and settlements which it can cost-effectively supply from those which it cannot. This type of delineation is important because those settlements which do not fall under EEPCo's plan have to start as early as possible to search for a renewable energy solution to prevent dependence on firewood. Delay in doing so has its painful cost. Not only the concerned energy poor settlements but also downstream riparian countries are being penalized by the failure to take the right measures on time.

Ethiopian Water Resources Management Policy

The Ethiopian Water Resources management policy (EWRMP) is a recent Policy issued in June 2000. The main goal of the policy is "to enhance and promote all national efforts towards the efficient, equitable and optimum utilization of the available water resources of Ethiopia for significant socio-economic development on sustainable basis". In order to carry out its goal, the policy objectives include:

- Equitable and sustainable development of the Water Resources of the country for socio-economic benefits of the people;
- Allocation and appointment of water for efficient, equitable and sustainable use, according to integrated plans;
- Managing and combating droughts and related disasters through efficient allocation, distribution, storage and other means;
- Flood control and mitigation through various means; and
- Conserving, protecting and developing water resources and aquatic environment on sustainable basis.

The basic principles on which the above policy, goal and objectives are founded are:

- Water, as a natural resource, is commonly owned by the people of Ethiopia.
- As far as conditions permit, every Ethiopian has a right to access to water of sufficient quality and quantity to satisfy basic needs.
- Water need to be recognized both as economic and social good.
- Water resources development shall be rural-centred, decentralized, participatory and integrated approach.
- Management of water resource shall be according to the norms of social equity, systems reliability, economic efficiency and sustainability.
- Water resources management need to promote the participation of stakeholders, especially women and other user communities.

The EWRMP is a comprehensive document covering every aspect. It provides guidelines to inland water transport, aquatic resources, water for tourism and recreation, water allocation, environment, technology, water pricing, stakeholders, gender issues, water quality and enabling environment.

Recommendations

Policy framework

The macro and sectoral polices in Ethiopia are not direct causes for land degradation and deforestation. Almost all policies are supportive of environmental protection and poverty alleviation. However, all of them lack proper instruments to enforce the policies. Therefore, there is need to have a regular review of the various policies to reflect new developments in the country and to have strong enforcement arms to control the massive land degradation and deforestation problems.

Renewable Energy Solutions

The reduction of soil erosion in the upper reaches of the Nile River will decrease siltation and lessen the potential for natural disasters throughout the entire river. Ongoing land degradation in Ethiopia requires urgent action, and has to be addressed at different levels of society, including widespread soil and water conservation activities, and the introduction of renewable energy technologies which integrate local knowledge and farmer's initiatives.

If coupled with best practice environmental protection measures, the renewable energy promotion in Ethiopia will play a crucial role in preventing further degradation. There is a huge energy resource potential in Ethiopia, which if utilized, could minimize the present energy crisis prevailing in the country and enhance the process of rural electrification. Renewable energy resources need to be promoted and disseminated to provide energy services for income-generating activities and poverty alleviation. This will require harnessing of all proven and available renewable energy resources using imported and locally assembled technologies.

Addressing gaps in the existing energy policy is a key success factor for the promotion of renewable energy. It is stressed that except for photovoltaic components and systems, there is ample technical capability with facilities and human resources to partially or wholly manufacture or assemble a variety of renewable energy technologies. A clear-cut and progressive energy policy that purposely encourages productive energy end use in rural areas using alternative sources is urgently needed.

The recommendation to overcome deforestation problem, fuel wood shortage and to have sustainable environment and natural resource management would, therefore, be to couple environmental rehabilitation programmes such as integrated watershed management, afforestation, and soil and water conservation with the development of alternative renewable energy sources. Supportive intervention should be in place that could initiate the unreserved promotion of renewable energy technology together with the enhancement of best practice biophysical environmental rehabilitation.

The success of intervention measures could be tested at small scale level in the form of pilot projects. For example, successful biophysical measures in Ethiopia are cited as case study of best practice activity being undertaken by GTZ in the Nile Basin Region of the country.

Table 3.2 : Renewable Energy Resources in Ethiopia,

No	Energy Resources	Energy in 10^3 Tcal per year			
		Potential	% share	Exploitable	% share
1	Primary solar radiation	1,953,550	99.7	1,954	73.08
2	Wind	4,779	0.24	239	8.94
3	Forest Biomass	800	0.005	240	8.97
4	Hydropower	552.1	0.03	138.00	5.16
5	Animal Waste	111.28	0.01	33.73	1.26
6	Crop Residue	81.36	0.004	40.63	1.52
7	Human Waste	28.18	0.0014	28.18	1.05
Total		1,959,901.93	100.00	2,673.54	100

Source: CESEN, EEA 2002

The total exploitable renewable energy that can be derived annually from primary solar radiation, wind, forest biomass, hydropower, animal waste, crop residue and human waste is about 1,959x103 Tcal per year (EEA, 2002). Out of this, the share of primary solar radiation is about 73.08 percent, while the share of biomass resources is about 12.8 percent (Table 3.2).

It is well known that direct energy source in the world is solar energy. All other energy sources including hydropower are derivatives or indirect sources of energy. Studies indicate that for Ethiopia as a whole, the yearly average daily radiation reaching the ground is 5.26 KWh/m^2. This varies significantly during the year, ranging from a minimum of 4.55 KWh/m^2 in July to a maximum of 5.55 KWh/m^2 in February and March.

The abundance of solar energy in the Ethiopian portion of the Nile basin is shown in Figure 3.4. Unless properly tapped and used to prevent further degradation, this vast amount of solar energy would continue to burn the exposed land surface and thereby contribute to further degradation.

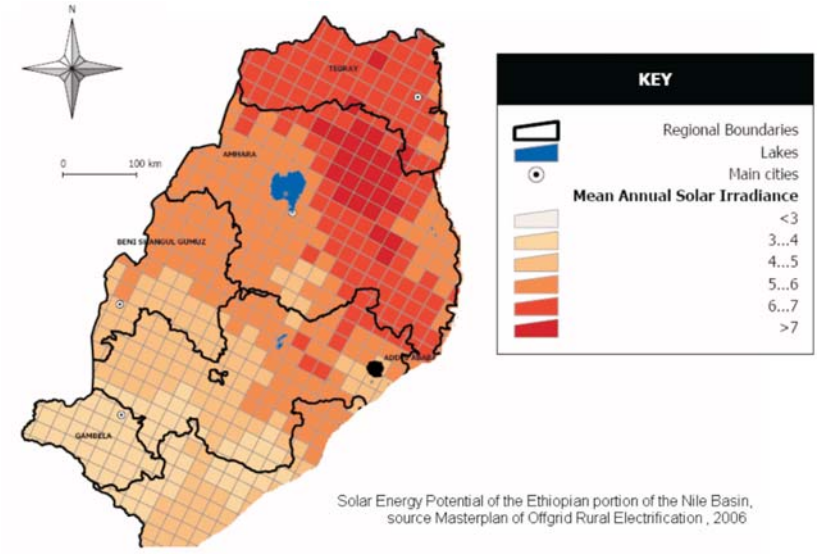


Figure 3.4 Solar Energy Sources in Nile Basin

Small Hydropower (SHP)

Around 300 million people across 760 counties are supplied by electricity from SHP but in Ethiopia focuses on large hydropower as the main source of energy. The developments of mini- and micro-hydropower, which are more suited to rural electrification, are not practiced yet. At present, there are only about a handful of small-scale hydroelectric plants (0.25-1MW capacity) in the entire country. The average annual potential (exploitable with small slope plants without reservoir) is estimated to be about 20 TWh/year. The electric energy generated from small slope plants, being smaller in capacity and geographically dispersed, is of great importance for rural electrification.

An important lesson about small hydropower development can be learned from China's experience. China has many large hydropower plants. One of the largest hydropower plants in the world i.e. the three gorges project with 17 GW capacities is built in China. However, China has not neglected small hydropower potential. For over three to four decades, China has witnessed remarkable development in the expansion of small hydropower. By the end of 2001 more than 40,000 small hydropower stations had been built in China, with a total installed capacity exceeding 26 GW and an annual output of 87.1 billion kWh. The Chinese leaders have shown deep commitment to rural electrification, and SHP is considered as one of the most important ways of achieving this.

Wind and other renewable energy sources

Ethiopia has also exploitable reserve of 10,000 MW wind energy with an average speed of 3.5 5.5m/s, 6 hours/day. Small towns, villages, farms and other scattered loads in remote areas provide ideal situation in which electricity generation from wind is convenient compared to conventional diesel generation or grid connection. Other renewable energy such as geothermal energy resources are available in the country to a moderate degree. Geothermal energy resources suitable for power production total about 700 MW.

Some successful experiences of Biogas energy in Ethiopia by some agro-based firms for their partial consumption from the waste they produce is elaborated in case study by Alemayehu (2005). The results are very much encouraging if conducted on a large scale.

References

Alemayehu Zeleke, (2005), The Application of Biogas in the Commercial Farm Unit, Germany, University of Flensburg.

Ayenew Tessera, (2004), The Imperative Need for Watershed Management in the Eastern Nile Basin, Proceedings of the Conference on Management of Water Resources in Ethiopia.

Demisse Fantaye, (2006), Agricultural and Rural Development Policy of EPRDF, Changes and Continuities, Rural Development Policies Trends Changes and Continuities, PSIR, AAU Press.

EEA (Ethiopian Electric Egency), (2002). Rural Electrification Symposium Proceedings, March 1-5,2002.

EFAP, (1991), Soil and Water Conservations, Report of Task Force 4.

ENTRO, (2007), Eastern Nile Watershed Management Project, Cooperative Regional Assessment (CRA) for Watershed Management, Distributive Analysis Draft Final Report.

EPA (Environmental Protection Authority), (1997a). The Conservation Strategy of Ethiopia Volume I: The Resources Base, Its Utilisation and Planning for Sustainability, Addis Ababa.

EPA (Environmental Protection Authority), (1997b). The Conservation Strategy of Ethiopia Volume II: Federal Policy on the Environment, Addis Ababa.

Ethiopian Forestry Action Program (EFAP) (1994a). The challenges for development,

Ethiopian Water Resources Management Policy, MoWR, 1999.

Feyera Senbeta, (2006), Problems of Environmental Degradation: Implications on Rural Development in Ethiopia, Rural Development Policies Trends Changes and Continuities, PSIR, AAU Press.

Final report, volume II, Ministry of Natural Resource Development and Environmental

Fistum Hagos, et al, (1999), Land Degradation in the Highlands of Tigray and Strategies for Sustainable Land Management, Socio-economic policy Research Working Paper No. 25, ILRI.

Hailu G. Marian, Haileleul Tebike, (1988), Small Hydro and/or Grid Extension for Rural Electrifictation, Alternatives and Complementary, SAREC-IDRC sponsored Research Project.

Hugo Rami, (2002), Food aid is not development, Case Studies from North and South Gondar, UN-Emergencies Unit for Ethiopia, UN-EUE.

Kassahun Berhanu, et al, (2006), Ethiopia Rural Development Policies, Trends Changes and Continuities, PSIR, AAU.

Lakew ,et al, (2000), Land Degradation and Strategies for Sustainable Development in the Ethiopian Highlands : Amhara Region, Socio-eocnomic policy Research Working Paper No. 32, ILRI.

Leslie H. Brown, (1973). Conservation for Survival, Ethiopia's Choice. Addis Ababa, Haile Selassie University.

Leslie H. Brown, (1973). Conservation for Survival. Ethiopia's Choice.Addis Ababa, Haile Selassie University.

Michael Abebe, (2004), Hydropower Development in Ethiopia vis-à-vis Perspective Regional Power Trade, Proceedings of the Conference on Management of Water Resources in Ethiopia.

MME, (1994), Energy Policy of Ethiopia,

MOFED, (2006), Plan for Accelerated and Sustained Development to End Poverty, PASDEP (2005/062 2009/10).

MoWR, (1997), Baro-Akobo River Basin Integrated Master Plan Study.

MoWR, (1998), Tekeze River Basin Integrated Development Master Plan Project.

MoWR, (1999), Abay River Basin Integrated Development Master Plan Project.

Mulugeta, (2006), Linkages Between Deforestation, Increase In Fuel Market Demand, Macro Policy Issues And The Need For Developing Alternative Renewable Energy Sources in Ethiopia.

Protection, Transitional Government of Ethiopia, Addis Ababa.

REES (2006), Final Report Off-Grid Rural Electrification Master Plan Study.

Tegene G. Egziabher, (2006), Rural Non-Agricultural Activities in Ethiopia: Nature, Problems and Prospects, Rural Development Policies Trends Changes and Continuities, PSIR, AAU Press.

Zelalem Hailu, (2002), Optimization of Small Hydropower Sites for Rural Electrification, Wasserbauliche Mitteilungen, Heft 22, Dresden University of Technology.

Zelalem Hailu,(1992), Microhydropower under Ethiopian Conditions, M.Sc Thesis, AAU Press.

http://cyber.law.harvard.edu/population/policies/ETHIOPIA.htm, Population Policy of Ethiopia, Office of the Prime Minister, 1993.

KENYA

IMPACT OF MACRO POLICIES ON NON POINT POLLUTION

By James A. Atema; and Z. Ngalo Otieno-Ayayo

Introduction

Like many areas in Eastern Africa and beyond, the surface water resources of Kenya are the result of the interaction between the physical relief and climate. Historically it has been recorded that geophysical activities in East Africa were turbulent and this led to the formation of the Great Rift Valley System that is more pronounced in Kenya than other Eastern Africa countries. This feature makes Kenya a country of marked physical contrasts, with a wide range of climatic conditions. The Rift Valley divides Kenya into two distinct and almost equal sections thus the Eastern and the Western Rift Valley with totally different and varying climatic conditions. Rainfall in Kenya is characteristically low and erratic with an uneven geographical and temporal distribution. Over 80 percent of the country receives less than 600 mm of rain per annum; 15 percent between 600 and 800 mm, and only 15 percent receives more than 800 mm. This low rainfall coupled with high rates of evaporation and seepage into groundwater reservoirs, reduces significantly the water available for run-off to less than 5 percent of precipitation with a range from 1 to 12 percent in the Rift Valley Basin and the Lake Victoria Basin, respectively.

Largely, the western part of Kenya drainage systems comprised of major rivers such as Yala, Nzioa, Nyando, Sondu and Mara.

These form the Nile Basin System part of Kenya. Lake Victoria is the repository of most of the river drainage systems where most of the Nile tributaries from Kenya empty their waters before joining the Nile River. Consequently socio economic and human activities undertaken on these river systems have a direct effect on the quality and quantity of water Nile Basin. The environment of this area is characterized by a very high density of population, high intensity on agricultural activities, fishing, cattle keeping, commercial cane and tea farming and logging.

Key Environmental threats

Environmental threats facing the Nile Basin in Kenya include deforestation, which affects the wetlands and exposes the water sources that feed the Nile River, soil erosion causing serious levels of siltation which negatively affects the river flow and impacting negatively on the quantity of water available especially in the downstream countries. Other threats include invasive water weeds infestation which impact on the river ecosystem causing loss of some fish species such as tilapia, floods, droughts, wetlands degradation. Pollution is a key threat that faces the basin. Most of these threats except for droughts and floods are human related.

A number of environmental determinants are considered to be key to sustainable development. Policies touching on these determinants require political will to be able to make meaning in addressing the positive as well as negative impacts of the determinants. Table 4.1 highlights key environmental issues in Kenya and their environmental impacts

Point and Non Point Sources of Pollution

Point sources of pollution occur when pollutants are discharged or emitted directly into a water body, while non point source pollution delivers pollutants indirectly through natural as well as human-made environmental changes. An example of point pollution is when there is an oil spill following capsizing of a ship transporting oil. Washing of fertilizer from agricultural lands by storm water run-off into streams, rivers and lakes represents non point pollution. The natural system may not have any of the pollutants

Table 4.1: Interactive matrix for analysis of environmental impacts of key sectoral issues

Key Environmental Issue	Biophysical Indicators	Socio-Economic Indicators	Underlying Causes of Impacts	Suggested Mitigation Measure
Deforestation	Decline in forest cover. Decline in rainfall and change in pattern. Increased soil erosion	Loss of livelihood due to declining availability of resources	Ambiguous land policies. Many people own land but dont have title deeds. Squatter problems. Lack of awareness on alternative resources for livelihood.	Encourage afforestation. Re-settle squatters. Revise land ownership policies. Create community awareness conservation and utilization. Create awareness on alternative energy sources.
Solid waste disposal	Aesthetic value of most urban communities lost	Increased incidence of diseases with unexplained etiology. Loss of tourist attraction and hence forexhange.	Poor environmental planning. Nonexistent environmental policies within the local government. Poor state of environmental awareness	Establish exchange programmes among twin cities in collaboration with other cities with working systems. Develop a culture of sound waste management through the education system and public awareness.

present until it is introduced to the environment by human activity.

Non point source pollution accounts for majority of contaminations in streams, rivers and lakes. This is the case with the situation in the water catchments of Lake Victoria and the Nile Basin. Non point source pollution occurs as water moves across the land or through the ground and picks up natural and human-made pollutants, which are eventually deposited in streams, rivers, lakes, wetlands and ground waters. The most common non point -source pollutants are sediments, nutrients, and pathogenic microorganisms from dairy or beef industries and toxic chemicals from various industries. Sedimentation impacts on water quality and quantity, affecting potable water supply and fisheries. In Kenya more than ¾ of waters have for a long time not been meeting water quality standards. Examples can be cited of Kisumu city, which sits on top of the largest inland water body but most houses in the city have no running taps of potable water. Similar experience is experienced by towns around Lake Victoria.

Extent and Severity of Non Point Pollution

Anthropogenic (man-made) and natural environmental conditions are frequently direct and/or indirect determinants of ecosystem health. This includes inferior health conditions and misery due to the confounding factors that come into play to worsen otherwise mild inherited disorders. Poverty can exacerbate the spread and severity of infectious diseases, while, on the other hand, affluence and industrialization can have negative impacts relating to pollution and affluence diseases such as leukemia and lymphomas. Absence of sound policies and regulations leading to dumping of toxic waste materials frequently lead to leakages into the soil and water bodies that humans interact with, leading to adverse conditions in man and the environment. In the urban and peri-urban environments where lack of sound policies have allowed human settlements without proper sanitation, human waste has contributed to non point -source pollution of surface and underground water systems.

Eutrophication in Rivers and Lakes

Phosphorus enrichment can promote excessive growth of aquatic plants (eutrophication), and cause undesirable changes in the structure and function of the ecosystem. It has been argued that point pollution from sewage/industrial effluents contribute more to phosphorus enrichment in water bodies than do agricultural activities (non-point pollution) (Jarvie *et al*., 2006), but it is not easy to quantify the contribution of non point sources and their effect can be enormous.

Fish of the families *Coregonidae* and *Salmonidae* are eliminated from the fish communities due to eutrophication, with the subsequence of other families such as *Cyprinidae* and *Percidae* starting to predominate (Reshetnikov, 1988). This and similar phenomena could possibly explain the disappearance of native fish species such as *Labeo victorianus* (Ningu) from the market in the Lake Victoria Basin. However, the major threat to *L. victorianus* would probably be habitat destruction occasioned by damming, and building of causeways, that prevent their migration for the purpose of breeding. This has an impact on the livelihood of the local communities that predominantly rely on fisheries. An example of such habitat change is seen in the building of the Mbita-Rusinga Island causeway, which the local communities claim has, together with the water hyacinth, reduced the fish diversity and biomass per capita.

It has been noted that due to eutrophication and the subsequent proliferation of waterweeds, especially water hyacinth (*Eichhornia crassipes*), there has been a drastic reduction in the catch of Lake Victoria Ngege (*Oreochromis esculentus*). This has a negative impact on the economy and nutrition of the lakeside communities.

Epidemics Resulting from Non-Point Pollution Effects

Domestic use of water in the Lake Basin includes direct washing of utensils, laundry as well as drinking of raw and untreated water from wells, rivers and lakes. At the beaches of Lake Victoria, these activities on water use are often performed at the same site where recreational activities such as swimming and bathing take place. The waters are often heavily impacted by non point -source pollution resulting in prevalence of disease causing microorganisms such as *Vibrio cholerae* (causing cholera), *Salmonella tiphy* (the organism that causes typhoid), *Entamoeba histolytica* (the organism that causes amoebiasis), *Escherichia coli* (that cause urinary tract infections), just to mention a few of the most common.

Many unplanned or poorly planned settlements operate without sanitary facilities, and when people leave their wastes uncovered, the same is swept to the water bodies when it rains and increases the microbial loads in the waters, often with the consequence of disease epidemics.

Deforestation

Decline in forest cover

It is estimated that between 1990 and 2005, Kenya lost 5.0% of its forest cover, or around 186,000 hectares. This loss could be attributed to a number of factors, most significant of which is deforestation for access to agricultural land and settlement. To some extent there is logging for utilization of the resources as a source of livelihood. It should be clearly noted that these forests are a source of rainfall, medicinal herbs, soil-cover to protect against soil erosion, hardwood timber for economic security and habitat for our rich biodiversity. The loss of forests is a loss of a great heritage.

Decline in, or changing rainfall patterns

Local communities around the lake have noted a great change in the water levels over the years, and they blame it on the changing rainfall patterns. They can prove by recession of the waters to points they could not reach twenty or so years ago. They say this has affected the fisheries because there are certain fish species that were abundant, being transported by flooding rivers that are nowadays hard to come by.

Soil erosion and siltation in water bodies

Land use activities expose the soil to degradation and

possible erosion. When the soil is eroded and carried by runoff water most of it ends up in rivers causing siltation. Siltation reduces the available water for aquatic fauna and flora, thus affecting fisheries and other uses of water. Many a times siltation has affected production of hydroelectricity, causing heavy losses.

Effect of siltation and reduction of lake levels on fish production

In addition to the effects of climate change, siltation reduces lake levels and changes fish habitat. This alters feeding and breeding areas of fish. According to Guchuki *et al*., (2006), most of the fish species such as *Protopterus aethiopicus* inhabit the littoral zones and use them for spawning. The loss of such habitats and critical zones compels the fish to relocate or they may perish. Heavy loads of silt, aggravated by deforestation, affect fisheries

Legislation and Mitigation

Several statute laws have been legislated in Kenya to try and control water pollution. Notable among these are the Water Act of 2002 and the Environmental Management and Coordination Act of 1999. These together with the Ramsar Convention have endeavoured to protect the basin from undue pollutants. Law enforcement mechanisms are however still wanting and heavy loads of pollutants are still released to the environment. Under the Water Act of 2002, every water resource belongs to the state. The government has the duty to control the use, but involves various stakeholders in the management of the resources. Water supply and sewerage is enshrined in the National Policy on Water Resources Development.

One way to mitigate non point-source pollution is to involve local communities and law enforcement personnel in implementing joint Local Agenda 21 in order to ensure sustainable development. Drainage waste water from the sugar belt can be collected in special drainage canals before they reach stream and rivers, and pumped back to an elevated point for re-use for irrigation and nutrient application to augment or supplement commercial fertilizer. Mitigation may also include filtration of storm water in street detention ponds (Han *et al.*, 1999).

There are no clear policies on waste management and subsequent land reclamation and land-use practices. In many countries, waste management (also referred to as cleansing) is vested in the local authorities, and every town or city is required by law to have an engineered landfill for ultimate disposal of solid and hazardous waste. As it is, there is open burning of wastes in the damp sites. It is well known that combustion of waste containing polyvinyl chloride (e.g. certain plastics) produce toxic substances in the form of dioxins, furans and polychlorinated bicarbons (PCBs).

These toxins are persistent, do not break down easily in the environment and can easily be accumulated in the food chain. In most damp sites in Kenya one would always encounter mixed wastes including medical wastes. These wastes are handled by unprotected handlers and "scavengers" who risk infections.

Solid waste management

Solid waste management has not been given the attention it deserves in most parts of Kenya. With the establishment of the Ministry of Environment in Kenya, there have been changes, with some attention being given to waste collection albeit using very crude methods of collection and transportation. Solid waste poses high risks to the health of the nation and is a good contributor to non point-source pollution. In Kenya, for example, the local government authorities are not compelled by any statute or policy (as a mandatory rule) to have and operate landfills for solid waste management. In effect the dumping sites used are a source of high risk to the environment. The leachate from these dump sites cause pollution to the nearby rivers and lakes.

Impact of solid waste policy in reducing undesired outcome

The existing solid waste management laws are not effective in controlling generation, collection, storage, transportation, incineration and final disposal. The Local Government Act (cap 265) of 1977 vests the powers to contract out services in the Local Authorities (LAs). The licensing of the waste operators is done by National Environmental Management Agency (NEMA) subject to Environmental Management and Coordination Act (1999). The licensed waste operators often do not have the capacity to manage the waste. Open lorries are used to transport the wastes and at the end of the day a good fraction of the waste is carried away by the wind before it reaches the dumpsite for disposal. Taxes paid to the LAs are enough to buy and maintain appropriate waste management equipment and constructing engineered landfills.

The public Health Act (Cap 242) of 1972 requires the cleansing department to facilitate provision of services. However, there are no standards to be followed in providing cleansing services and there is no involvement of the mass of the people to practice waste minimization, cleaner production and proper waste handling. Unfortunately, the general population is ignorant of their rights and would not raise an alarm when not served properly. They would rather pay extra taxes to the mushrooming waste operators to have their waste collected. To the common man in most parts of the country, especially those travelling, littering seems to be a culture.

Mitigating waste management and health delivery impacts

Even before considering the legal framework for waste management, there should be concerted efforts in promoting Environmental Education and Awareness, and the promotion of the hierarchy of solid waste management (waste minimization at source, separation, processing and/or recycling, land filling).

Several impacts of agricultural practices, dairy farming, urbanization and industrial activities on the environment have been realized in the Lake Victoria Basin. Some of these impacts stem from non-point pollution following indiscriminate application of toxic materials in the environment. Additional pollution comes as a result of run-off water system washing away agro-chemicals to rivers, lakes and subsequently the oceans, with deleterious effects

on wetland habitats and biodiversity. Paragraph 1, Article 5 of the Ramsar Convention on Wetlands (Ramsar Convention, 1971) commits the signatories to the convention to coordinate and support policies and regulations concerning the conservation of wetlands and their fauna and flora. This would, in effect, also improve the general ecosystem and public health.

A solution to these and many other environmental problems lies primarily on Environmental Education at all levels, and in embracing the principles of Agenda 21 (Agenda 21, 1992) at local, national and global levels. This entails precautions as we endeavour to meet the present needs of society without compromising the ability of future generations to meet their own needs. The following points are recommended:

- A landfill for every local authority, or combined landfill for several small local authorities that can share costs;
- Classification of waste generators and operators;
- Waste separation at source;
- Improved incineration standards;
- Public awareness and periodic training of operators;
- Compliance with the Basel Convention (1989) on hazardous waste;
- Compliance with the Stockholm Convention on Persistent Organic Pollutants (POPs)

Small and medium enterprises take advantage of non existence and/or poorly enforced solid waste management policies to pollute the environment. Eventually these mixed plastic wastes are burned, releasing dioxins to the environment.

The main conservation problem in the Mau is that facing many Kenyan forests: increasing pressure on productive land from an expanding population. A particular complication in this case is the presence of the forest-dwelling Ogiek people, several thousand of whom have been evicted from the forest since the mid-1980s and are awaiting resettlement.

The Okiek may have used the forest's resources sustainably in the past, but their hunter-gatherer lifestyle was in direct conflict with forestry policy. Immigration of other ethnic groups to the eastern edge of the forest (particularly from the densely populated western borders) has added to the number of people expecting to be resettled, and increased the pressure on forest resources. Current use of the forest by local people includes (illegal) hunting (*Tragelaphus euryceros* are often pursued using dogs, and this has had a severe impact on their population), honey-gathering (forest trees are cut and debarked to construct hives), fuel wood collection and grazing.

These activities, which might be carried out sustainably, are largely unregulated at present, causing further degradation and preventing degraded areas from recovering. It is estimated that 28% of forest cover in the eastern sector was lost between 1967 and 1989, and clearly this process is continuing.

The western boundary (flanked by well-established smallholdings or large tea estates) has been more stable. Unfortunately, a number of recent excisions have, for unclear reasons, targeted areas in the west, which contain the most valuable and intact tracts of closed-canopy forest. In the Eastern Mau, forest plots were allocated in the late 1990s to a reported 28,000 settlers. This may have destroyed much of the watershed for Lake Nakuru (IBA KE049). This and other illegal encroachments are formalized in degazettement proposals published in February 2001 and affecting more than a quarter of the current gazetted area. The degazettement notice covers some tracts of relatively intact forest as well as recently settled areas; it will have a permanent and serious negative effect on water catchment.

Mitigating Agro-chemical Pollution Effects in the Nile Basin Ecosystems

Agriculture is the backbone of the Kenyan economy. The use of agro-chemicals in large-scale commercial farming for maximum profits is therefore inevitable. This should however be planned to avoid undesirable impacts on public health and the ecosystem, especially where irrigation is practiced. The negative impacts are related to nutrients (i.e. fertilizers) and biocides (generic term for pesticides and other chemicals used for killing unwanted biological organisms), with consequences on eutrophication and eco-poisoning, respectively (Pearce, 1998).

It is noteworthy that there has been a sharp decline in agricultural extension services in many parts of Kenya. For example, in Nyanza, which is the most vulnerable province as far as non-point pollution effects are concerned, there are hardly any practicing extension officers (the kind that were uniformed and interacted with farmers almost on daily basis). This scenario pre-disposes non-experts to misuse of agro-chemicals, leading to increased risks to Public Health and Ecosystems Health. Consequently, an urgent need arises for training of users, extension workers and regulators to mitigate negative impacts of agrochemicals in agriculture and livestock production. This needs to be done in collaboration with the Environment counterparts in the form of joint training workshops.

Pursuant to the established legal and operational framework comprising Best Practices, Legislation, Monitoring and Compliance, Kenya has put in place structures that only need updating with the demands of changing times and technology, coupled with political will, to ensure success.

Livestock Sector

Law and policy in Kenya have not put in place stringent restrictions to control non point source pollution resulting from activities in the livestock sector. There are no properly designed abattoirs in most parts of the country and public health regulations concerning meat and meat processing are hardly followed. In the rural areas, for example, it is not uncommon to see a sick cow carried on an ox cart being taken to the slaughterhouse.

This is in spite of the fact that the law requires that meat must be inspected before being sold to the public. In the dairy farms there are no proper drainage systems to collect waste water for treatment. The spread of zoonotic diseases is therefore rampant.

Macro/Sectoral policies

International Conventions on Environmental Management level

Kenya is a signatory to many international and multilateral environmental agreements, however, coordination of implementation and synergy in terms of promoting conservation and national development is disparate and weak. Further the institutional arrangements in managing environmental issues are also uncoordinated. Consequently, synergy and linkages in implementation of these conventions at national and local level has been difficult. There is no common strategy for awareness raising and this leads to conflicting messages and actions by key stakeholders to the public (Angwenyi, A. 2006).

National level

Despite the fact that the UN World Headquarters of Environment-UNEP is located in Kenya, the country does not have a National Environmental Policy hence environmental management is guided by disparate sectoral legislations and degrees. The biggest oversight/omission is perhaps the lack of any direct mention of environmental protection by the supreme law of the country- the Constitution of Kenya. Section 71 of the constitution is the only section that can be vaguely associated with environmental protection. It deals with the right to life which encompasses in a farfetched manner the right to clean and healthy environment. The lack of visibility of environmental management and protection in the constitution cascades down to lack of national policy on environment (GOK (Government of Kenya, 1992). Currently the National Environment Authority is in the process of consultation with stakeholders to formulate a national policy on environmental protection and management. Whether this will be anchored in the new constitution in order to give environment the necessary visibility and legal strength required is too early to judge but nevertheless an advocacy issue.

The custodian of Environmental Management in the country is the Ministry of Natural Resources, Environment and Mines through the National Environment Management Authority (NEMA). Currently there are 77 Acts of Parliament related to various sectors that deal with environmental management in Kenya. Most of these Acts proceeded NEMA and some have mandates that contradict NEMA's mandate and yet NEMA has no legal control over them as the Act that established NEMA is not organic hence not entrenched in the constitution and cannot supersede the rest of the Acts in matters related to environmental protection. Most of these Acts are sectoral and have been purely couched to fulfil sectoral mandates which sometimes are in a collision with international environmental laws and conventions.

Although the mother ministry that is the repository of environmental policies is the Natural Resources and Environment through the National Environmental Authority (NEMA), other Ministries such as Water, Agriculture, Local Government, Trade and Industry, private sector amongst others etc also play key roles in environmental management in the country. As mentioned above these institutions have developed their own environmental protection and management statutes. Most of these statutes were couched either by their nature such as fisheries, forestry, wildlife or by function thus; agriculture, public health, industry or mining hence too specific and narrow in scope. An assessment of these institution policies on management of major issues such as solid waste disposal, water and air pollution, pesticides, and agro chemicals usage revealed major tensions in approach due to competing mandates. Some of the statutes in question include; land use, water resources, public health, disposal of hazardous waste, solid waste disposal, fisheries, forests, radiation.

Tensions in Sectoral Policies

The Ministry Agriculture in their effort to increase yields promotes increased use of agro chemicals including fertilizers and pesticides. Being in the main agricultural zone of the country i.e. Kericho, Nandi, Kisii and Western Province tea plantations; Chemelil, Muhoroni, Awendo, Mumias and Nzioa Sugarcane plantations and Bungoma Coffee, and Trans Nzioa and Uasin Gishu coffee estates, the Lake Victoria/ Nile basin has borne the brunt of non point pollution of its waters from these agro-chemicals and fertilizers through eutrophication. This has impacted on the quality of water in the basin.

Another key tension observed in this study between these Ministries on settlement of people. While the Ministry of Natural Resources and Environment has a clear mandate to conserve and reserve forests in order to purify and protect the environment, the Ministry of Agriculture is continuously under pressure (especially political pressure) to settle the increasing population. This has led to unplanned de-gazzetement and settlements in forest areas such as the Mau Ranges, Mt Elgon, Kaimosi, Kakamega forests etc. Opening up and exposing water catchments. Consequently a marked increase in soil erosion has occurred with direct effect on siltation and non point pollution in the basin waters.

Solid waste disposal which is major cause of non point pollution in the country has been left for city, municipal and county councils to handle. With increasing urban populations in towns and industrial development around the lake region, the councils have been unable to dispose this waste in a sustainable manner hence resorted to dumping it in rivers or the lakes with a direct effect on water quality in the basin. Again NEMA had no legal mandate to enforce compliance to environmental standards by these institutions. The major reason why councils have failed to dispose solid waste in accordance to international standards is limited financing. Most councils are broke due to under funding or mismanagement hence are unable to invest in modern facilities for solid waste disposal.

Summary and Conclusions

Indeed there are well meaning sectoral policies, and if implemented they can mitigate environmental degradation and subsequent negative impacts. Those implementing the policies seem not to have the capacity to do so, either because of lack of technical knowledge or in some cases lack of funds. For example, it is common knowledge that uncharacterized commingled solid waste could have hazardous substances and cause danger to the

environment when disposed of in the damp sites. In spite of this knowledge, there seem to be no effort to introduce and practice safer waste management methods. Policies on forestation have not been spared the blame either. Loss of forest cover continues unabated leading to massive soil erosion. Encroachment of the forests for human settlement and agricultural activities has continued, sometimes with the support of politicians.

Recommendations

We recommend that the macro and sectoral policies that affect environmental management be reviewed in order to tease out tensions, contradictions and duplications to make them effective. Currently the four main sectoral policies covering agriculture, lands, local government and environment have major contradictions which have allowed loopholes to be exploited by opportunists and destroyers of the environment. This review should entrench the environmental law in the constitution as an organic law which should override any other law/policy that may be in conflict. One opportunity to do this is the impending constitutional review. The bill to review the constitution is already being discussed in Parliament. Table 4.2 provides more recommendations for policy interventions, highlighting the issue, intervention and who is responsible for implementation.

The specific policies/laws should also be revisited with an aim of stringent but civilized implementation. Involvement of stakeholders and intersectoral collaboration in formulation and implementation of policies gives them a sense of ownership and commitment to them. Public awareness and Environmental Education at all levels of the community should be encouraged. Every local authority (or a group of small but close local authorities) should be required by law to have and operate an engineered landfill for final disposal of solid and hazardous wastes. If waste management will continue to be contracted to private operators, then there should be standards to be adhered to so as to limit further littering and mitigate adverse effects on the scavenger communities.

Furthermore, policy makers and implementers could be taken on study tours to selected model authorities that have in a way succeeded. For example, certain southern African countries have managed to establish and run successful cleansing services that could be emulated and even improved on. Their policies formulations and implementation could serve as an example. Zimbabwe, in spite of economic hardships has established engineered landfills in all main cities. Unfortunately, due to the political quagmire some of the systems cannot be maintained. Botswana has maintained some of the best managed systems to date, and Tanzania is currently studying ways of improvements.

Table 4.2: Policy interventions

Issue	Intervention	Responsibility
Lack of legal visibility of Environmental protection and management in Kenya's supreme law	NBI to support Environmental groups to Lobby/Advocate for the entrenchment of Environmental protection and management in the new constitution NBI to support NEMA to prepare a position paper proposing the process and procedure to entrench environment in the constitution	NEMA, NBI and Civil Society. NBI to provide financial support
Lack of harmony in statutes supporting environment	A comprehensive study be conducted to analyze all environment statutes to harmonize them	NEMA within the support of NBI and UNEP
No national environmental Policy	Work on the establishment of a national environmental policy should be accelerated and completed before the new constitution is finalized to ensure environment issues are captured	NEMA with the support of NBI and
Inadequate funding to local authorities to manage solid waste and other pollutants	The new policy and laws to provide a clear framework for funding environmental management	Ministry of Local Government and Natural Resources and Environment
NEMA is weak and poorly funded	The NEMA Act to be entrenched in the constitution and the law be amended for NEMA to raise funds by charging an environmental management levy from users thus public sector, private sector, etc.	Minister of Natural Resources and Environment
Investors do not always conduct environmental assessments and those who do are not sufficient	Penalties for not conducting and environmental assessment be made stiff in the new law	NEMA and Ministry of Trade and Industry, Agriculture and Water Resources, NBI to support this initiative too
Environmental monitoring on water quality is not sufficient and rigorous	Regularize water quality monitoring in the basin and publish results to create awareness Identify environmental threats at sub basin and district levels with participation of beneficiary communities Identify sections of the river system that do not meet the desired water quality standards and any contamination and black spots along the river system and further estimate pollution load carried by the main river streams and tributaries regularly. Generate data for general research on water and provide information to advice on the effectiveness of pollution control measures in place, and for decision making at operational and policy levels	NEMA, Ministry of Water and NBI
Lack of awareness on non point pollution and pesticide pollution	Conduct symposia at local basin level, and national level to raise awareness	NBI, Civil society and NEMA

References

Agenda 21, Earth Summit (1992) Rio Declaration on Environment and Development, Rio de Janeiro, Brazil, 3 to 14 June 1992, United Nations.

Angwenyi, A. (2006) National Legislation and Domestication of International Environmental Law

Gichuki, J., C. Ezekiel and F.M. Wanda (2006) Implication of a fisheries management plan for Lake Victoria: Status of the Lake Victoria Environment Trends and impact to fish stocks Project No. 8ACP ROR 029

GOK (Government of Kenya) (1992) The constitution of Kenya, (revised edition), Nairobi, Govt Printers, available at: http://kenya.rcbowen.com/constitution/ (accessed 13 August 2006)

GOK (Government of Kenya) (1999) Environmental Management and Coordination Act, Nairobi, Govt. Printers.

GOK (Government of Kenya) (1977) Local Government Act. Nairobi, Govt. Printers.

GOK (Government of Kenya) (1972) Public Health Act. Nairobi, Govt. Printers.

GOK (Government of Kenya) (2003), Environmental Impact Assessment and Auditing Regulation 2002, Nairobi, Government Printers..

GOK (Government of Kenya) (2004), Investment Programme for the Economic Recovery Strategy for Wealth and Employment Creation 2003-2007, Nairobi, revised March 2004), GOK.

Han, J.S., E.S.MiyashitaY-y. Lin and A. Rao (1999) Storm water filtration of a municipal detention pond. In: Kenaf Properties, Processing, and Products; Mississippi State University, Ag & Bio Engineering, 1999, pp471-484.

Jarvie, H.P, C. Neal and P.J.A. Withers (2006) Sewage-effluent phosphorus: A great risk to river eutrophication than agricultural phosphorus? Science of the total Environment 360(1-3): 246-253.

National Environment Management Authority (NEMA) (2002), Environmental Impact Assessment and Audit Administration and Review Manual, 2002, NEMA web site, available at: www.nema.go.ke (accessed January 2006),

National Environment Management Authority (NEMA) (2006), Draft Environmental Impact Assessment and Audit Administration and Review Manual, NEMA, Nairobi, February

Njuguna, M. (2006), A great lake on its death bed", The Daily Nation, 11 October, available at: www.nationmedia.com/dailynation/printpage.aspnewsid=85224, Vol. 2006.

Pearce, G.R. (1998) Agrochemical pollution risks associated with irrigation in Developing Countries: A Guide. Report OD 141, HR Walliford/DFID

Ramsar Convention on Wetlands (1971) Ramsar Convention Secretariat, Switzerland

The Constitution of Kenya (2008) Section 71; The right of life and clean healthy environment.

The Environmental Management and Coordination Act (1999) The Kenya Gazette, Environmental Management Act, 2000.

The Water`Act (2002) Kenya Gazette, Water Act, 2002.

RWANDA

IMPACT OF MACRO POLICIES ON SOIL

By Rukazambuga Ntirushwa Daniel

Introduction

In Rwanda, land constitutes a resource of inestimable value in Rwanda. It occupies a first-rate place in the national economy since farming employs more than 90% of the working population and contributes about 93% of exports. Due to high population pressure, the farmers are using the land on steep slopes which are not recommended for farming.

Until 2005, the country did not have land policy to guide in sustainable utilization. Agricultural activities and land tenure system were guided by bits pieces of law. These were of less importance as customary land tenure system dominated the management and utilization of land. The Government concern on problem of erosion started in 1930 and became compulsory in 1947. However, these efforts were more forceful after independence in 1962. The community regarded the trench making as drudgery and was not willing to invest any more energy in maintaining the erosion control structures, till 1970's when the Government realised the danger of not controlling erosion, and revived the activity. The erosion problem in Rwanda is a function of high population pressure, steep landscape, high rainfall and poor development of alternative source of income forcing large proportion of the community to depend on natural resources services (food, fuel, income, etc) for their livelihood.

The absence of macro and sectoral policies might have contributed more to the soil erosion problem. The existing macro and sectoral policies and laws in many sectors have no clear guiding principles. Most laws that have been enacted such as the soil conservation law of 30 March 1982 have not been re-enforced to-date.

However, currently, the Government of Rwanda is putting much effort in formulation of policies and strategies, and is guided by Vision 2020 in long term and EDPRS in medium term. Decentralized policy is now in place and monitoring and evaluation of execution through *imihigo* is functional. Other sectoral policies such as land, environment, forestry, agriculture, water, industries, investment are also in place and functional. These policies have a common goal of increasing national economic growth, which will also depend on increased agricultural productivity which in turn, depends on good soil utilization, conservation and erosion control.

Soil erosion in Rwanda

The research on erosion needs further development because, to-date, there is no comprehensive study covering all agro-ecological zones and looking at watershed level. The available information should be expanded and research into soil erosion be extend, from the top of the hill where the erosion starts down to the river to assess the related sediments. The research into erosion should develop system thinking in addition to single plot in single locality. This will explain the basis of having sediments in Nyabarongo River throughout the year. How much does soil erosion problem contribute to sediment load in Nyabarongo River and how much comes from coltan washing and stone queries. Rwanda's relief presents varieties, composed mainly in the east by lowlands; in the centre by hills and in the west by high mountains; the altitude increases westward and varies between 1000 and 4500masl.

Extent and severity of soil erosion

Rwanda is a mountainous country with high rainfall pattern (annual rainfall ranges between 783 mm and 2058 mm) that makes the country's numerous hillsides extremely vulnerable to erosion. Large part of the country is prone to soil erosion risks as indicated in Table 5.1 below. Only 23.4 % of the country has small risks, 37.5% need protection measures and 39.1% are high to very high erosion risk.

Table 5.1 : Distribution of soils according to slope and erosion risk classes

Soil erosion risk class.	Very High	High	Average		Weak	Very weak
Surface (Ha)	357,529	436,563	763,005		340,376	136,625
% of Soils	17.6	21.5	37.5	16.7	6.7	

Source: PSTA 2004

The land shortage has necessitated the occupation and development of land which is unsuitable for agriculture. Crops are planted on slopes and occupy up to more than 80% of land known as marginal (land above 60% slope which should be left for forestry only), resulting in soil erosion due to cultivation on excessively steep slopes (>60%). Lack of water management and conservation coupled with excessive exploitation of these resources, make soils in Rwanda prone to continuous degradation and erosion. Where it becomes necessary to use these sites, it is recommended to use terraces. However, terraces are expensive to make, takes time per house to construct, reduce land size and produce low yield during the first two years, but doubles yield in the following years when sufficient quantities of manure are applied on them. Due to misuse of land and cultivation on steep slopes without protection, land losses are considerable and are estimated between 0 and 557 tonnes/ha/year. The soil load varies according to the gradient of the slope and type of crop

planted and management. It is generally accepted that for slopes between 2 to 5% farming practices are enough to address the effect of soil erosion. For slopes up to 25%, anti erosion measures (hedges, trenches) become necessary. Slopes which are above 25% need heavy works such as terracing. Terracing recommended and the conservation of cultivated lands becomes more difficult on slopes above 35%. Beyond 65% any cultivation should be avoided. The area should be protected.

The transboundary concern is the soil load carried by running water and rivers. For example, Nyabarongo River carries solid load of between 51 kg/s at Nyabarongo near Kigali, to 44 kg/s at Nyabarongo near Kanzenze, and 26 kg/s at Akagera near Rusumo falls. The variation gap of these losses varies between 33 and 288 kg of dry matter per second. (Environ. Policy, 2004)

The government concern on soil erosion started in 1930's when the population was still very small (69 people/km2) and by 1947, it became a colonial order to control erosion using trenches. This was a top down order which was accompanied by punishment. To date the community has not adopted it as their sole responsibility to-date. At independence, especially during the first republic government, the erosion control measures were abandoned as drudgery till in 1970's. However, the population growth continued and exerted enormous pressure on natural resources, in particular on arable land and forests, and it became necessary to resume soil conservation measures. By 1982, a law on soil conservation and erosion control was enacted. This pressure is reflected in the increased demand for natural resources (land, water, energy (fuel wood), foodstuffs, etc), land clearing for agricultural and animal production purposes, building of houses, modification and destruction of biodiversity habitats, and deforestation in general. Consequently, soil erosion is accelerated in most cultivated areas without protection measures as indicated above.

Land relief, population and resources imbalance

The imbalance between the population and natural resources which have been degrading over decades, have led to the cultivation of marginal areas, the erosion and unplanned farming. Rwanda's soils are fragile and therefore vulnerable and very sensitive to erosion. The country is characterised by an uneven relief and steep slopes. The rainfall is very high and bimodal and ranges from 900mm/year in the eastern part to 2500mm/year in the highlands. These high rainfalls expose steep-sloped soils to water erosion because of fragile nature of soils from poor sandstone parent rock in many parts of the country. Usable land (for settlement, livestock pastures, infrastructure development etc) is estimated at 52% of total surface area of the country.

Population density of about 309 inhab./km2 for physical density and more than 410 inhab./km2 for physiological density in absence of alternative source of income lead to excessive overcrowding of the population on land, leading to use of marginal areas and increased soil erosion without policy and strategy on compulsory soil conservation measures. As a result of the high population pressure, the available land per house hold is about 0.6 ha. According to 2002 Census, the distribution of households per available land is shown in Table 5.2:

Table 5.2 : The plot size categories and proportion of households for each category in Rwanda according to population 2002 census

Plot size (ha)	Households % of population
0.00 - 0.50	54%
0.50 - 0.75	14%
0.75 - 1.00	11%
1.00 - 2.00	16%
2.00 - 3.00	3%
>3.00	2%

Source: *2002 Census*

The reduction of cultivated areas per family is widespread in the whole country, with 54% of population having an average size of less than 0.50 per household in some parts. However, according to FAO, the critical threshold below which a farmer cannot meet his basic food needs through agriculture alone is about 0.75 or 0.90 ha. Basing on FAO and the 2002, Census, 68% of Rwandan population is unable to meet basic food needs. This situation contributes to the exhaustion of land resources and accelerated soil erosion and deterioration.

This land shortage has necessitated the occupation and development of land which is unsuitable for agriculture. Crops are planted on slopes and occupy up to more than 80% of the marginal land. Cultivation on excessively steep slopes without any techniques for erosion control or soil and water management and conservation, together with their excessive exploitation, make soils in Rwanda prone to erosion and continuous degradation. Land losses are considerable and are estimated between 0 and 557 tonnes/ha/year. The methods and techniques used for soil conservation and erosion control have given priority to soil protection at the expense of the improvement and restoration of soil fertility, making them less attractive to farmers in the absence of fertility amendment measures and source of manures. This inadequacy of modern farming techniques for land development and rational management of land resources leads to frightening erosion.

While forests and natural reserves in Rwanda are subjected to high human pressure and the rate of deforestation is very high, the decentralised decision making will ultimately develop community level strategy of forestation and management. The massive deforestation due to population pressure, combined with the abandonment and destruction of erosion control systems, greatly contribute to the degradation of the bare land on steep slopes and hills making it prone to severe soil erosion. Additionally, the exploitation of mines and quarries carried out in the different parts of the country affects soils on hills and

contributes to increased erosion and sediments in Nyabarongo River and its tributaries.

Effect of structural adjustment programme and job loses

Rwandese government signed the structural adjustment programme (SAP) in 1990. Under SAP package included:

(i) devaluation of the Rwandan Franc by 40% in November 1990 and a further 15% in June 1992;

(ii) control on recruitment and salaries in the state sector;

(iii) increase in user fees for health, education and other services;

(Iv) reduced subsidies to coffee producers;

(v) the phased removal of protectionist trade restrictions;

(vi) privatisation of some state enterprises;

(vii) increased taxes in some sectors to help reduce the budget deficit; and

(viii) a social 'safety net' programme to cushion the impact of adjustment on the poorest. The SAP led to social unrest and did not achieve its goals. In addition due to war and genocide 1994, its influence on soil erosion cannot be emphasized.

Nevertheless, the effect of SAP on soil erosion may not be under rated because the retrenched Government employees and controls on salaries increased pressure on dependence on natural resources, which in turn might have influenced soil erosion, though there is no clear direct linkage.

Macro/sectoral policies

Influence of Macro policies on soil erosion

The macro policies have a significant role to play in national economic growth and development, which in turn influence the use of natural resources. Rwanda is guided by vision 2020 in long term and EDPRS in medium term for national development.

Both vision 2020 and EDPRS identifies agriculture as a major contributor to economic growth and national development. This places more emphasis on proper land management and soil erosion control as an essential activity. The two policies direct all activities in soil conservation and erosion control. In addition, there is decentralized policy which enables grassroots participation in decision making and enhances adoption and ownership. It is anticipated that the three policies will play key roles in the erosion control.

Influence of sectoral policies on soil erosion

In general, the current policy situation in Rwanda is good and progressive. The sectoral policies which did not exist in the past are now in place. During the last five years, the country has developed various sectoral policies which include environment policy, land policy, forestry policy, water and sanitation policy, agricultural policy, industrial policy, and investment policy, among others. All these policies clearly identify focus areas in keeping with national priorities for economic growth, and poverty reduction. Soil conservation is also indicated as a key factor in all of the policies.

All these policies focus on rural development and importance of increased agriculture productivity in economic growth, proper land use and adoption of erosion control measures for soil and fertility conservation as integral part of all strategies. However, as pointed out by one political analyst, adequate policy is only one of the several important components that need attention:

The principal cause of policy failure, both in agriculture, land and environment and the rest of the economy has been the assumption that change of policy and its supporting legislation will be adequate to ensure a successful outcome of the reforms. Without adequate attention given to the acceptance of the reforms by the stakeholders, the organisational requirements for the reform execution, and the time needed to implement reforms

It is for this reason that the GOR is giving power to local authorities and grass root structures to make decisions through decentralization, and make it known to the public through performance based contract *imihigo*. Therefore, besides policy development, there is a great need to give attention to policy acceptance, execution mechanism and implementation time framework, and reliable monitoring and evaluation of execution.

Land tenure system, legal and institution frameworks

According to Rwanda national land policy, *land tenure may be considered as methods and procedures of land acquisition and appropriation. It is, in other words, a combination of regulations that determine modes of access, exploitation, and control of land and its renewable natural resources. It is therefore a relationship between humans or social groups, and land or its underlying resources. Land tenure has a multi-disciplinary dimension that includes social, technical, economic, institutional, legal and political aspects. The debates on the land issue stand to include space and nature, methods of land appropriation, the role of the government*, among others.

Currently, the land tenure system in Rwanda is supported by a dual legal system namely acquisition according to customary law or conceptions, and acquisition according to the written law. As during the colonial period, the customary law still dominates. Land tenure system during pre-colonial was 100% customary. During the colonial period very little change occurred. A large proportion of arable land continued to be under traditional system which is still being used in rural area to date. As compared to the colonial period, the situation after independence (in 1962) till 1994 did not change much as 90% of the country's arable land was still governed by customary law. The written law still applied to a very small number of persons, especially in urban entities, trading centres, as well as institutions like religious communities, GOR institutions.

Under customary law (which governs almost all the rural land), the land belongs to the family. It is passed on from one generation to the other from son-to-grandson inheritance. The written law governs land under urban administrative entities and some rural lands belonging to

institutions like churches, non governmental organisations and government agencies. This statutory law establishes rights of land tenure to individuals such as short term lease, long term lease and title deeds (particularly in towns). The written land law applies to a very small number of people trading centres, as well as religious communities.

During the pre-colonial period, the customary law was characterised by collective ownership of land, and was based on the complementary links between agriculture and livestock. This system facilitated economic production, stability and harmony in production. As the socio-political and administrative structure became stronger and better organised, so did the land resources become more vitally important. The land rights were respected and transmitted from generation to generation according to tradition and custom. The colonial rulers found this system in place, and added a new method of land administration governed by written law, as a dualism model on the duplicity of the king's powers, and those of the colonial power. The colonial rulers applied indirect rule and channelled their commands through the King. The colonial government introduced the written law into the "*Codes and Laws of Rwanda*". They imposed this legal structure to protect the interests of colonialists and any other foreigners who desired a plot of land in Rwanda.

During 1st and 2nd Republic after independence, the situation did not change much, 90% of the country's arable land remained governed by customary law. The government of the time recognised the very important role played by the commune in the administration of land. Through the 'Loi Communale' of 23/1/63, the conservation of rights concerning registered land under customary law is the responsibility of the commune. The period after independence may be looked into during three decades following independence, the 1960's, 70's and 80's. The 1960's saw suppression of the "*Ibikingi"* system, declaring land to be state property, and repossess land which had belonged to the 1959 Tutsi refugees, in order to acquire additional land. The 1970-1980 decade, was an intensive internal migration from the densely populated areas in the North, South and West in search for vacant land. The Government attempted to transform the existing housing system into grouped homesteads, known as the "paysannat". The purpose was to enforce an even distribution of plots.

The decree No. 09/76 of 04/03/76 concerning the purchase and sale of customary rights on land, or the Right of Soil Occupation gives the right to purchase and to sale the customary property land on condition of having the permission of the Minister in charge of lands and the obligation to remain with an area of 2 ha minimum. The buyer may also justify that he does not have a land of at least 2 ha.

At the beginning of the 1980s, the "new" land no longer existed, and serious problems began to emerge; the reduction of soil fertility as well as land for cultivation, family conflicts stemming from land expropriation and scarcity. The average surface area of a family's cultivation plot was reduced to 1.2 ha in 1984 from 2 ha in 1960.

After the Tutsi genocide in 1994, the return of 1959 Tutsi refugees gave rise to some serious land problems. The land shortage problems added to already existing problems such as excessive parcelling of plots, deforestation, and the increased degeneration of the soil. Under this tenure system, and population pressure, soil conservation and erosion control was not effective.

This situation resulted in the development of a national land policy of 2005 that takes into account the evolution of the land situation and, and brings radical changes to ensure proper land management and land administration. *According to national land policy and land law of 2005, every Rwandan has a right to land*.

Policy on population growth in relationship to economical growth

The absence of population policy and dependence on natural resources for income generation are the major source of land crisis and poor soil conservation and soil erosion in Rwanda. The Rwandan population estimated at 1,595,400 during 1934, rose to 8.2 million during the year 2002.

The high population pressure led to reduction in plot size per family with some having an average area of about 0.5 ha per household. This resulted into poor land management and without flexible erosion control measures. In addition, most soils are fragile, and therefore very vulnerable and sensitive to erosion. Moreover, the country is characterized by hilly terrain, with a physiographic pattern of steep hills. Thus Rwanda gets its name - "Land of thousands Hills" from the hilly terrain, high altitudes and rainfall. The eastern part of the country is lowlands and receives an annual rainfall that is less than 1,000 mm per year, while the higher altitudes of the northwest receive an average of 1,800 mm per year, with a maximum of 2,500 mm. This high rainfall makes the slopes vulnerable to soil erosion.

Financial, material and human resources

Bad management and poor utilization of land resources and erosion control are also products of the lack of human, material, and financial resources. A good land administration requires skilled and motivated staff, as well as an enormous amount of material and financial resources. Currently, there are inadequate personnel and resources. Studies on soil erosion are carried out by postgraduate students for academic purposes and lack continuation. Case studies carried out in one locality are never scaled up to look at the whole system and watershed in general. A lot of data is missing to enable land manager make informed decision. For example there is no data on the amount of soil eroded from the slope deposited in the valley bottom or carried by river as sediments. Similarly the variation of amount of sediments in rivers during the year, taking into consideration the rain and dry season variability. Though the study along Nyabarongo indicated variation at different points, it did not show the seasonal variation at these points.

Forestry policy and natural reserves

Rwandan forests are subject to human pressure. Due to the clearing of forests for cultivation purposes, between 1958 and 1978 the Nyungwe Mountain Forest's surface area was reduced from 114,125 ha to 97,138 ha, i.e. a loss of

approximately 17,000 ha in a space of 22 years. This was, in other words, a deterioration of 15% of the forest's surface area. This huge forest had already been undergoing a slow destruction due to a steady stripping off of fuel substances for commercial purposes, as well as the poaching of buffaloes and elephants. Currently, the surface area of the Nyungwe Mountain Forest is estimated at 90,000 ha. In 2000, the government declared the forest a National Park.

One should also note that the surface area of the Akagera National Park was reduced from 331,000 ha during 1956 to 255,000 ha in 1992. Today, the reserve has a surface area of 90,000 ha, i.e. a third of its original surface area, since two thirds of the park was ceded by the Government in 1997, for the resettlement of old refugees returning from countries of Asylum. The move was in respect of the Arusha Peace Accord of 1993.

Given that this region is semi-arid because of the prolonged drought in the east, north-east, and south-east of the country which are occupied by large-scale pastoralists, overgrazing is serious. Consequently soil erosion and general land degradation that leads to progressive desertification is being felt in the semi-arid valleys of the park, as well as the outlying areas. In 1997, over 30,000 cows died due to lack of water during the prolonged dry season. In 2000, 22 hippos died from the drought.

Remedial Government policies and actions Development of Natural resource management (NRM) policies

One of Rwanda's areas of focus to alleviate poverty is economic growth, in which the agricultural sector is expected to be a major contributor (EDPRS 2007). This objective cannot be achieved without strong soil conservation measures and re-enforcement of soil erosion control.

The major problem facing Rwanda with regard to the management and protection of natural resources is the imbalance between population and natural resources. In general human activities on natural resources have had negative consequences the environment in general and soil erosion in particular. It is in this way that population pressure on land results in deforestation on hillside for growing food and reduction in recharge of water table, silting up of lakes and rivers, and the destruction of biodiversity. Due to these interactive growing environmental problems, the Government of Rwanda felt it necessary to develop policies and laws in the field of management and protection of environment, water resources, land, forestry, mining with a view to ensuring sustainable use of natural resources and protection of vital ecosystems for present and future generations.

National Environmental Policy (NEP) and Law

The National Environmental Policy and Law were born out of the concern that the environmental degradation had continued to worsen as a result of population pressure, serious erosion, pressure on natural resources, massive deforestation, pollution in its various forms, lack of a strong and coherent political, institutional and legal framework and, in a particular way, as a result of the 1994 war and Tutsi genocide. Therefore, the Government of Rwanda realised that it was necessary and urgent to provide the country with an environment policy capable of improving man's well-being, with a view to guaranteeing sustainable utilisation of natural resources and the protection of vital ecosystems for present and future generations. It sets out overall and specific objectives as well as fundamental principles for improved management of the environment, both at the central and local levels, in accordance with the current policy of decentralisation and good governance in the country.

The NEP sets out institutional and legal reforms with a view to providing the country with a coherent and harmonious framework for coordination of sectoral and cross-cutting policies; and also lays a solid foundation for the establishment of a legal framework for improved management of the environment, as well as the right principles for the participation of the population in general, and women and the youth in particular. It contains policy and strategic options with regard to population, land-use management, management and utilisation of natural resources and other socio-economic sectors, as well as the necessary arrangements for the implementation of the policy. It offers a framework for the reconciliation of the three pillars of sustainable development, namely environment, social and economic issues. It is thus in line with the policy for poverty reduction while ensuring the quality of life and environment.

The overall objective of the Environmental Policy is the improvement of man's well-being, the judicious utilisation of natural resources and the protection and rational management of ecosystems for a sustainable and fair development.

The NEP objectives, in particular objectives i, iii and iv above cannot be met without soil conservation and erosion control techniques. Soil erosion is one of major environmental problems in the country and should be priority in all developmental activities. Therefore NEP will re-enforce land policy in conservation of soil and related programmes.

National land policy (NLP) and Law

The National Land Policy adopted by Government of Rwanda (GOR) in February 2004 and a land law enacted on 14th July 2005 as law number 08/2005 consist of a package of changes that have to address the issues of land management and conservation in the country. Rwanda has never had a land policy before. However, it enacted land law in 1976 which was not put into use. Thus the country had never even had an effective land law, apart from a few scattered land regulations, most of which date back to the colonial period, and which strengthen the duality between the written law (very restrictive and confining) and the customary law (widely practised, but with a tendency to cause insecurity, instability and precariousness of land tenure, in general).

The Rwandan Government, therefore, found it imperative and absolutely necessary to arm itself with a national land policy that would enable the population to enjoy a safer and more stable form of land tenure, and bring about a proper and well- planned utilisation of land while ensuring a healthy and efficient land management and administration.

Therefore, the overall objective of the national land policy is

to establish a land system that is secure for all Rwandans, land reforms that are necessary for good management, and proper use of national land resources for a harmonious and sustainable development that ensures protection of the environment. In the absence of land policy, farmers were not able to invest their capital in soil erosion control measures irrespective of the forceful means applied since 1930's and soil conservation law of 1982 which has not been applied, although recognised by land law of 2005.

The land policy document attempts to analyze land-related problems; in order to find solutions that are adaptable to the scope of existing problems. Without claiming to solve all the land-related problems with miracle solutions, the document could be regarded as the most complete, and realistic to date. The presence of *land law and national land policy will ensure secure ownership of land and stimulate good land management, erosion control, increased agricultural productivity important in national economic growth, development and poverty reduction. Therefore the land reform as interpreted from the land law and land policy may stimulate rapid economic growth and enable investing in soil conservation and erosion technologies.* The need to stimulate economic growth is a prerequisite to poverty reduction according to EDPRS and Vision 2020. Therefore the land policy and land law are critically important for the country as basis for soil conservation and erosion control.

National Forestry Policy (NFP)

Among essential natural resources, forests play an important role in soil conservation, erosion control and community livelihood in general and preservation of ecological balance. This role of forests is particularly important in Rwanda inasmuch as they contribute greatly to watershed protection against erosion, thus making agriculture viable, and covers the daily basic needs of wood for more than 96% of the population. Furthermore, forests generate direct monetary income (revenues) for households; public entities and the country in general thus contribute to poverty alleviation. In this sense, forests are considered as a capital.

However, since 1960's (last 40 years), the natural forests areas have declined by 65% and a tree species diversity highly reduce and at the verge of disappearing. As a result forest cover remaining till 2004 was only 19% of the total land area of the country as compared to 26% in 1993, and will continue to decline because of the population pressure. The decline of forestry without mitigation measures is a result of lack of forest policy which would have guided the proper utilization of forestry service in a sustainable way. The development of forest policy is important in order to achieve vision 2020 objective of increasing protection against erosion from current 20% to 80% in 2010 and 90% by 2020. The overall objective of the national forest policy is to make forestry one of the bedrocks of the economy and of national ecological balance. This will ensure proper use of techniques of natural protection and erosion control in particular.

Irrespective of the aforementioned importance, Rwanda has not had any forest policy. The earliest and latest attempt to have a forestry policy was made in 1993, which was neither completed nor implemented. Forestry activities were therefore based on working plans and methodological texts, which overlooked major objectives and guiding principles that normally characterize a good forestry policy.

The objectives and strategies of the current forestry policy would enable the government to face the challenging situation of a continuous wood shortage, deterioration of soil, and soil loss due to erosion. The present forest policy addresses all issues, targets ecological and economic welfare of the existing woodlands, research, institutional capacity building and personnel in particular, including number and quality of forestry personnel. It is important to link forestry with rural development. Reforestation will be encouraged to ensure that there is a balance between firewood, timber, environmental and soil protection and erosion control.

National Agricultural Policy (NAP) and strategy

The National Agricultural Policy and Strategic Plan for Agriculture Transformation (SPAT) emphasize clearly on the fact that soil conservation and erosion control are top priorities in order to ensure sustainable production systems. The Government both at central and local level has launched a sensitization programme towards enhanced community mobilization for erosion control and this was particularly reflected in the “Performance Contracts” signed between the President of the Republic of Rwanda and District Mayors every year.

Furthermore, the Government has completed the process of establishment of the legal and institutional framework for better and sustainable natural resources management. It is within this context that the Land Law and Environment Law was enacted in 2005 and the Rwanda Environment Management Authority (REMA) established to ensure the increasing agricultural productivity be done using environmentally friendly technologies.

Since agriculture accounts for over one-third of GDP, it is essential to increase agricultural productivity and ensure that Rwanda meets its growth target under EDPRS period and beyond. The agricultural policy and strategic plan for agricultural transformation are important in achieving EDPRS objectives. However, the increase in productivity will depend on success in protection of land against soil and fertility losses. The area protected against soil erosion during EDPRS (2008-2012) is estimated to rise from 40% (of the agricultural land area) in 2006 to 64% in 2012. The Government will aim at the integration of different methods for reducing erosion, restoring and improving soil fertility, as well as use of technologies acceptable to environmental protection. The erosion control and soils conservation technologies will be included in all packages offered to the producers for sensitization, mobilization, and development of technique such as terraces, mulching, etc. However, under agricultural policy, the fight against erosion is not yet perceived as an intensification parameter.

Among other challenges to be tackled include the implementation of the national agricultural policy; absence of a link between decentralized services and central services of MINAGRI, not understood in the same way by its actors; discrepancy between the research and the transfer of technologies; weakness of the popularization system network; insufficiency of training and information for one part of the population (ubujiji); soil deterioration process and the fertility decrease.

Sustainable development of agriculture cannot reasonably be achieved in the absence of priority and concentration of effort and resources on soil conservation. Therefore, among other things, the agricultural policy emphasises the need to: carry out environment protection and soil conservation through appropriate technologies and methods; build technical capacities for land technicians, decentralized instances and producers in the field of soil preservation; adapt the methods of fighting against soil deterioration to the environment's physical and chemical conditions; integration of different methods for erosion control, restoring and improving the soil fertility; collection of rain water and use it on farm to meet crop water requirements.

National Decentralization policy (NDP)

Rwanda has adopted territorial reform from 2006, and there are now four provincial administrations; the Kigali City, 30 districts, 416 sectors; and 2,148 cells. Each District and each sector should have extension officers; there are at least 446 agricultural extension officers at the level of district and sectors responsible for technology dissemination in agriculture, livestock and natural resources. This number is large enough to disseminate agricultural and sustainable land management (SLM) technology. Moreover, there is political will and farmers are interested to produce more and satisfy their family needs. In addition, NGOs, and many cooperatives have hired their own extension officers.

The SLM is now a component of performance contract ***Imihigo*** between the district authorities and the Republican President. This is a new approach to ensure that the district commitments are made public through signing the above contract publicly which can be monitored. In this way the leaders become accountable to both the public and the Republican President. The local authority becomes more focused on achievement and community development. Since the development pathway of Rwanda as indicated in the Economic Development and Poverty Reduction Strategy (EDPRS) is through increased economic growth. Agricultural transformation, the SLM and soil is the main focus together with agricultural intensification and transformation.

Result-based management tool *(Imihigo)* is a genuine Rwandese response to address the challenge of reforming local government and managing change. One of the challenges is sustainable land management and erosion control. The *Imihigo* is used in Rwanda to design a series of performance management contracts signed between the republican President and the district mayors on behalf of their constituents. The public engagement is recorded publicly in a written contract that presents a set of development targets backed by specific performance indicators over a period of one year. Therefore, the technologies dissemination of SLM and soil erosion are no longer the role of extension officers alone, instead the political will is very high and the output must be reported at the end of year.

The *Imihigo* approach shares many characteristics with **Results-based Management Tools**. First, each *Imihigo* identifies a set of clear priorities. Second, each *Imihigo* presents a set of specific targets backed by measurable performance indicators. Third, each *Imihigo* undergoes a well-defined process of performance monitoring and evaluation. Fourth, each *Imihigo* constitutes an efficient accountability mechanism and an incentive for local government leaders and their population to implement the decentralization policies and to meet local and national development targets. The SLM technologies and their applications, monitoring indicators for outputs are part of the contract signed in each district. This is why each sector has got an extension officer which includes SLM. The country is losing large quantities of soil and nutrients through erosion. In addition the country is focusing on increased productivity and contribution for economic growth for poverty reduction. It is for this reason that there is great political will to support technology dissemination, including SLM and soil erosion control, which is much needed in Rwanda.

National policy for soil and water conservation and farming system

Since 1930's, the colonial government placed erosion control among the priorities, and by 1960, trenches for erosion control were put on 40% of arable land; likewise in 1988, the 2nd Republic established soil conservation measures on 85% of arable land. However, all these efforts were government initiated and led. Community participation and ownership was absent. Any effort for soil conservation and erosion control should target the community sensitization and adoption without using law enforcement.

The importance of Rwandan Agriculture depends on how the natural resources “specially land” which is the main capital of production, is managed. The national policy for soil conservation and erosion control will have to play an essential role in conservation, maintenance and rational use of essential natural resource. It will be strengthened by strict enforcement of the law no 11/82 of 30 March 1982 governing the soil conservation. It shall also be supported by the land tenure law of 2005. The policy itself is of little importance if it is not substantiated by planning of land use for improvement of social and economic welfare of the population.

Comprehensive industrial policy, strategy and master plan

In general, Rwanda's population of 8 millions is not very high to be a good market for large industry development. The main problem of population is that they depend on land services and for a long period the country has been depending on agriculture and natural resource products without developing alternative source of income, such as industries and their associated services. As a result the population density according to land size has become very high beyond bearable capacity. Hence, the major problem is the lack of policies which create alternative employment.

Policy on Payment for Environmental Services (PES)

Rwanda does not have the payment for environmental services (PES) apart from tourism and payment for entrance fees in the protected areas and visit of mountain Gorillas in the Volcano National Park, and other animals in the protected areas. To-date, the government is still

responsible for NRM services.

Through the environment policy, the country did not have the policy before. It is in the process to establish enabling environment such as creating awareness for environment, establishing land tenure system through land reform, improve infrastructures and establish regulations for the environment. The laws linked to the environment are already established. However, the related regulations are underway, not yet established.

Watershed for many dams for irrigated rice farms in the rehabilitated marshlands and hydropower plants need protection. This can be achieved when clear policy on PES is developed and put in place. Because the watershed may go beyond the administrative area where the dam is built, it may require mapping all areas using GIS and mark possible sources of sediments which may have effect on infrastructures in down stream.

The experience of reduced water in Ntaruka hydropower, which resulted in power shortage in the whole country due to agricultural activities on watershed of Rugezi marshland, is a good lesson for the country to develop PES policy

Institutional framework

The erosion control is multi-sectoral in nature and it involves different ministries and institutions. The implementation of the national policy will necessitate establishment of complete framework for coordination. There is a great need to coordinate the soil conservation and erosion control activities at different levels. Some actors have their own objectives which they should attain. Therefore different actors in soil conservation or erosion control with different objectives should be coordinated to ensure contribution to national objective and continuity. It is important to link different actors and provides synergies among them. It is also essential to learn from past experience.

Sectoral coordination

Currently information on soil conservation, erosion, environment, and forestry, is scattered in different institutions and sectors which initiate and implement their programmes and policies with little or no consultation with others. These institution linked to soil conservation include MINAGRI, MINITER, MINALOC (imihigo), ISAR, NUR, REMA, RADA, UNDP, FAO, among others. .This makes it even more complicated to appreciate inter-sectoral issues and monitor effectiveness of conservation techniques. Possible option to keep this information as database would be the use of National Institute of Statistics. It should be able to gather all data and establish linkages between different institutions, organizations and ministries.

Institutional and human resource capacity

The capacity of execution is not sufficient especially in the area of soil conservation at district level. Obtaining accurate baseline information for realistic monitoring of soil erosion may require capacity building and partnership with other institutions. Therefore there is a need to develop a profile for each district and plan for capacity building. Before any soil conservation and erosion control measures are executed, it requires mapping out different options available and their contribution to crop yield. Without reliable information maps, it is difficult to plan and undertake appropriate protection and management measures, yet this is the basis for sustainable soil conservation. The local authorities should have such maps available and information for dissemination to the community.

Ensuring sustainable funding:

The infrastructures for soil erosion control are expensive, while sectoral budget allocations are usually too meagre to support large scale activities in erosion control and soil conservation. It requires national focus and strategies such as communal work "Umuganda", to support budget allocation. In addition, it needs capacity building for the community and sensitization for infrastructure maintenance without further national expanses.

Summary and Conclusions

Insufficient soil conservation is seen as the main challenge for a sustainable development of Agriculture in Rwanda. Not only does it hamper the long term planning of any development activity but it also threatens the environment. Rwanda has to define new strategies to ensure sustainable development and increase prosperity to its population as indicated in vision 2020 and EDPRS.

Rwanda has good policies which may accelerate the adoption of soil conservation technologies, if farmers involvement and active participation at different phases of execution is observed, in particular at identification and diagnosis of problems, types and causes of soil degradation; experimentations and demonstrations of solutions to be recommended; discussions on options to be chosen for the implementation of tested solution on overall plan. The progressive implementation by farmers with the help from the government will enhance adoption and ensure sustainable soil erosion control. Good policies alone are not enough. Mitigation measures should avoid errors from colonial time of commanding farmers to construct erosion infrastructures using law and orders. The soil conservation and erosion control maps are needed as they will serve in decision making especially when prioritizing fund for interventions, because some provinces are more prone to erosion than others because of nature of landscape and terrain. The National Statistics Institute should develop and keep these maps using collected data from districts.

A strong potential for addressing the soil conservation and erosion control issues lies in decentralized planning and governance process. The decentralization policy (and program), implemented by GoR since 2000, has focused on empowering local communities to participate in political and economic decision making, through bottom-up planning using the community development committees (CDCs). It is the view of the consultant that the CDC structures present a good entry point for mainstreaming soil conservation and erosion control issues, especially if these are well linked with the development local committees at cell, sector and district levels. The CDC should be conversant with execution of new policy and legal framework, like land policy, land law, soil conservation and

References

Andriesse J. P., Van Rosemalen H.A. and Muller A. (1976). On the variability of amorphous materials in Andosols and their relationship to irreversible drying and P-retention.

Geoderma 16: 125-138

Anonimous: l'érosion et la lutte contre l'erosion. Fiche technique.

Annonimous (1986) Description of each soil conservation measure. Page 33- 49, in the Guidelines for Development Agents on Soil Conservation in Ethiopia

Anonimous (1986) Community Forests and Soil Conservation Development Department. Guidelines for Development Agents on Soil Conservation in Ethiopia. Step 3: Description of Each Soil Conservation Measure.

Byiringiro F. and Reardon, T. (1996) Farm productivity in Rwanda: Effects of farm size, erosion and soil conservation investments. Agricultural economics 15: 127-136.

Clay D., Reardon, T. and Kangasniemi, J. (**undated**) Sustainable intensification in highland tropics: Rwanda farmers investments in land conservation and soil fertility. Pp 351-377, in economic development and cultural change. University of Chicago press.

Clay D., Kelly, V. Mpyisi, E.and Reardon, T. (2001) Input use and coservation investments among farm households in Rwanda: Pattern and determinats. Michigan State University, Report. 22 PP.

Clay D. C. and, Reardon, T. (1998) Population and sustainability: Understanding population, environment and development linkage. Michigan State University, 22PP.

Delepierre, G., Prefol, B., (1974) Disponibilite et utilisation des terres au Rwanda. Situation actuelle et perspectives. Ministre du Plan et des Resources Naturelles. PP 45.

Habarurema E. and Steiner K.G. (1997) Soil suitability classification by farmers in Southern Rwanda. Geoderma 75: 75-87.

ICRISAT, (1991) Farmers' participation practices and Soil erosion and Water Conservation programs. Summary proceedings of a Workshop held in ICRISAT Center, India, 19-21 Jun 1991. PP. 54.:

Kelly, V., Murekezi, A., (2000) Fertilizer response and profitability in Rwanda : A sunthesis of findings from MINAGRI studies conducted by Food security research project (FSRP) and the FAO soil fertility Initiatives.

König, D. (1992) L'agriculture écologique agroforestière. Une stratégie intégrée de conservation des sols au Rwanda. Bull. Réseau Erosion 12: 130-139.

König, D. (1991) Contribution des méthodes agroforestières à la lutte antiérosive au Rwanda. Bull. Réseau Erosion 11: 185-191.,

Krieg. M., Preissler. R., (1987). Intensification de la production vivriere . Fiche technique, Terrassement radical. PP. 21.

Kundermann, B. (1993) Impact socio-économique du terrasement radical en milieu paysan. Intensification de la production vivrière, Karago, Giciye, satisye and Kibilira. Pp.152.

Masimann, T., Maillard A., Musy, A., Neyroud, J.A., Ruttimann,M., Weisskopf, P., (1991). Lutte contre l'erosion des sols cultiveés: Mécanismes et causes de l' érosion des sols,-bject de la conservation des sols- estimation du risque d'érosion-Mesures de protection$ à l'échelle d'une exploitation agricole et d'une bassin versant. Guide pour la conservation des sols. Liebefield-Berne. PP.37.

MINAGRI (2006) CAADP implementation in Rwanda. Par I : Review and Stock taking Report on ongoing Development efforts in Rwanda and alignment with CAADP Targets and Principles.

MINAGRI (2004) National Agricultural Policy

MINAGRI (2004) Strategic plan for Agricultural Transformation in Rwanda.

MINAGRI. (1991) Strategie Nationale de conservation des sols, Ministre de l'agriculture, de l'elevage et de Forets. Direction Generale du Genie Rural et de la conservation des sols. PP. 69.

MINECOFIN (2007) Economic Development and Poverty Reduction Strategy

MINECOFIN (2004) Vision 2020, Ministry of Finance and Economic Planning, Kigali, 2004.

MINITER, (2003) National strategy and action plan for the conservation of biodiversity in Rwanda. 81 PP.

Mizoto C. and Chapelle J. (1988) Characterization of some Andepts and Andic soils in Rwanda, central Africa. Geoderma 41: 193-209.

Moeyerson, J. (1991) Ravine formation on steep slopes: forward versus regressive erosion. Some case studies from Rwanda. Catena 18: 309-324

Moeyerson, J. (2003) The topographic threshold of hillslope incisions in southern Rwanda. Catena 50: 381-400.

Moeyersons. J. (1989) La nature de l'érosion des versants au Rwanda. Recherche sur colline de Rwanza (Runyinya-Butare) et observations dans la partie occidentale du pays suivie de quelques reflexions sur la lutte anti-érosive.

Ndayizigiye.F. (1991) Compte rendu de l'atelier sur la recherche en consevation des sols tenu à ISAR de 14 au 16 Novembre, 1991. Document de travail 17. PP. 79.

Ngwabije, R. Ndindabahizi, I., (1991) Evaluation des systèmes d'exploitation agricole pour une regionalisation des techniques de conservation et d'amelioration de la fertilité des sols au Rwanda. Rapport d'une mission de consultation réalisée du 15/9/90 au 15/01/92.

Roose, E. and Ndayizeye, F. (1992) Agroforestry, water, and soil fertility management to fight erosion in tropical mountains of Rwanda. Soil technology 11: 109-119

Schurg, A., (1993). Necessite, forme et acceptation des meusures de protection contre l'erosion dans des sites tropicaux, une etude de cas du Rwanda.

Service des enquetes et des statistiques agricoles (SESA), (1986) Pertes de terres dues a l'erosion. Resultats de l'enquete pilote sur erosion. Rapport descriptif. Ministere de l'agriculture, de l'elevage et Forets. PP. 23.

Shivakot.G.P. and Thapa, B.S. (2005) Farmer' perception of participatory and institutional effectiveness in the management of mid-hill watersheds in Nepal. Environment and Development economics 10. 665-687.

Steiner, K.G., (1992) Development des techniques d'une agriculture durable dans un environment diversifie. Communication présentée à la telier du réseau régional « fertilité et erosion », Gitega, 18-20 November 1992.

Document de travail no 18. pp.

Steiner, K.G., Blanken, J., Uwera, J., Sekayange, L., Ndyanabo, E., (1993) Development participatif des techniques de conservation des sols dans deux zones agro-ecologiques sud du Rwanda. ISAR and GTZ document de travail no 10. pp.30.

Van Den Steen, M.C.M., (1965) Conservation et amelioration des sols au Rwanda.

Zaongo, C., Ndayambaje, J.D., Ndabamenye, T., Mukuralinda, A., Mutagenda, A., Ndayiramiye, L., Rushemuka, P., Uzayisenga, B., and Mukariziga, C., (2002) Impact du terrassement radical sur les propriétés physiques et chimiques des sols de la region de Byumba : Cas de communnes Kibali et Buyoga. Pp 74-86 dans Rapport de la premiere phase du projet : Reseau Africain de la recherche en Agroforesterie pour Afrique orientale et Centrale : Composante Rwanda. Vol. 3. Acquis en materiere de conservation et fertilite des sols. ICRAF et ISAR.

Verdodt, A.and Van Ranst, E. (2005) Environmental assessment tools for multi-scale land resource information system. A case study of Rwanda. Agriculture, ecosystem and environment XXX: XXX-XXX

Yamaoh F.C. Rurleigh J. and Malcolm M.R. (1990) Application of expert systems to study of acidic soils in Rwanda. Agriculture, Ecosystems and Environment 30: 203-218

SUDAN

IMPACT OF MACRO POLICIES ON OIL EXPLORATION AND DEVELOPMENT

By Mirghani Tagelseed Ahamed and Dr Hasan Bashir Nimir

Introduction

Sudan has three main ecological zones: i) the desert and semi desert zone north of 12º N, ii) savannah in the centre of the country and the iii) tropical equatorial zone in the South. The annual rainfall varies from 0 - 2000 mm/year; with over half the country receiving less than 200mm per year. Recent severe climatic changes have caused floods and droughts in many areas of the country (HCENR, 2007). The agricultural sector is the core of Sudan life and the main driving force for its economy even with the emerging oil sector. Sudanese economy is predominately agricultural with 70% of the population deriving their livelihoods in rural areas. Agriculture contributes 46% of the country's GDP and more than 90% of the non-oil export earnings. In addition, it accounts for about two thirds of the employment and supplies about 60% of the raw material needed by the manufacturing sector. The country has some of the most extensive wetlands in Africa. Swamps, floodplains and rain-fed grasslands of the Sudd support a rich animal diversity over 100 mammal species, over 100 species of fish, a wide range of amphibians and reptiles (including a large crocodile population) and 470 bird species. Over 350 plant species that include the endemic Suddia sagitifolia (a swamp grass), have been identified. The swamp habitats cover more than 30,000 square kilometres, while peripheral ecosystems such as seasonally inundated woodlands and grasslands cover a total area some 600 km long. The swamps host the largest population of shoebill (Balaeniceps rex) in the world, aerial surveys in 1979-1982 counted a maximum of 6,407 individuals. Hundreds of thousands of birds also use the Sudd as a stopover during migration. Migratory bird species include the black-crowned crane (Balearica pavonina), the endangered white pelican (Pelecanus onocrotalus) and the white stork (Ciconia ciconia).

Beside its agricultural and hydrocarbon resources, the country has many more valuable natural resources. Its mineral wealth includes significant reserves of uranium, copper, diamonds, gold, iron ore, mica, silver, talc, tungsten, uranium, and zinc (HCENR, 2007; Enour et al., 2007). The Sudanese potential for development is therefore, immense if its resources are fully utilised for the benefit of the country. A fundamental strategy for poverty eradication rests on the country's ability to develop agriculture as the main tool for economic growth. The agricultural sector is envisaged to play a major role in the post-peace period by generating employment opportunities and providing food security for the war affected populations (Bank of Sudan, 2008). There are three major farming systems in the country: (i) irrigated agriculture; (ii) rain-fed semi-mechanized; and (iii) rain-fed traditional agriculture. The pastoralist and agro-pastoralist livelihood systems are integral part of the traditional rain-fed farming system of the low rainfall savannah and semi desert ecological zones of the Sudan. On a global scale, Sudan ranks first in terms of pastoralists population size. Pastoralism involves about 20 per cent of the population and accounts for almost 80 per cent of livestock wealth.

Oil has emerged as major source for economic growth and revenue for the government as reflected in the balance of payments and investment flows (Adam, n.d.).

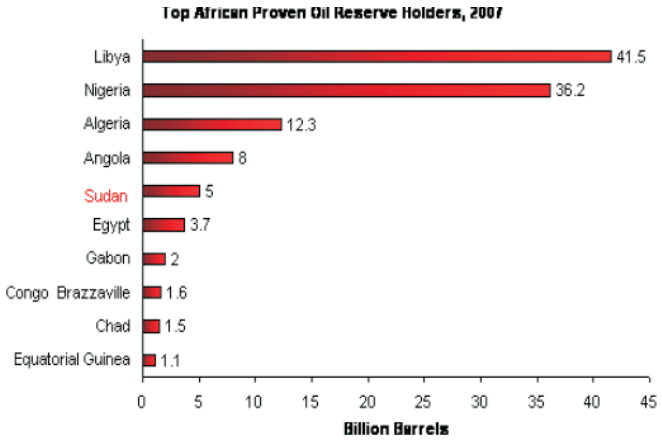
Oil Exploration and Development

Sudan started its oil exploration activities in 1959. In 1975, first discovery was made by Chevron Oil Company in the Red Sea offshore. Due to low oil prices and limited reserves at that time, the discovery turned to be non-commercial. The First commercial discovery was made by Chevron in 1975 in the Abu Gabra in the interior of the country (MEM, 2001).

Table 6.1 : Production rate (1998-2007) in 000 barrel/day

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Rate	12	146	174	211	233	255	325	397	420	488

Source: After BP statistical review of world energy 2006, Ministry of Energy Magazine 3, 2008



Source: *Oil and Gas Journal 2007*

Although Sudan has been a producer of oil and gas for several years it is considered to be vastly under-explored. Most of her producing oil fields are distributed in areas close to the White Nile and/or its tributaries. As of January 2004, Sudan's estimated oil in-place was approximately 5 to 6 billion barrels of oil with proven reserves that exceeds 1.2 billion barrels of oil and 3 trillion cubic foot of natural gas (Government of Sudan, 1998, 2008). Following the 2006 British Petroleum (BP) statistical review of world energy, Sudan has proven oil reserve of 6.4 billion barrels (MEM, 2008a). The country is also rich in natural gas with reserves estimated at 3 trillion cubic feet. Production of oil in 1998 was estimated at approximately 600,000 metric tons or 12,000 barrels per day (bpd). Figures for 1999 were about 7.2 million metric tons or 146,000 bpd. Table 6.2 below shows the growing production rate in the last ten years.

In the past, exploration activities were limited to the central and south central regions. Currently exploration activities are widespread and cover the entire country. It is speculated that vast potential reserves exist in the east, north-west and south parts of the country. This can be verified by the increasing rate of exploration successes in Sudan.

The worldwide success is one discovery well in every ten wells, whereas in Sudan the rate is a success in every three drilled wells. Ministry of Energy speculates that the production of oil to be doubled in the next decade (MEM, 2007, 2008a). Figure 5.1 below shows top African proven oil reserves. Sudan ranks fifth on the continent.

Multi national operating and service companies are presently working in all around the country with Chinese, Malaysian and Indian companies being dominant. Table 6.3 below presents major share holders in different concession blocks around the country. The present refining activities are located in Al-Obied (15000 b/d), Khartoum Refinery (100,000 b/d).

Expansion of refineries in Khartoum and upgrading of Port Sudan will add more than 150 000 bbl/day in the next few years. Expansion in Khartoum Refinery depends on crude from Block 6 that produces more gas oil, petroleum coke, and gasoline for export.

Plans on expansion of Port Sudan Refinery will increase its capacity from the 25000 bbl/day to 100,000 depending on the expected additional production from Blocks 3 and 7. Initial conservative estimates of oil reserves in this block enabled the country to double its oil and product exports to add extra several billion US dollars into the Sudanese economy (Government of Sudan, 1998, 2008).

In addition to expansion in production of gas oil and gasoline (benzene) there will be more production of LPG (about 820 MT/day). Sudan is currently producing about 300 thousands ton of LPG. Average household consumes about 12.5 kg of LPG per month. If all LPG is consumed in the Sudan then the produced LPG suffices more than 2 million families or about one fourth of the Sudanese inhabitants in addition to services and industry. Petroleum coke (petcoke) will be used for electricity. Production of 910 MT/day results in addition of 90 to 110 MW to the national grid at very low fuel cost (MEM, 2008a).

EXTENT AND SEVERITY OF ENVIRONMENTAL IMPACT ON OIL EXPLORATION AND DEVELOPMENT

Impact of oil revenues in Economy

The current development in the oil industry sector is reflected in a positive growth in the national economy. Sudan economic performance has been strong over the past few years. Since the first batch of oil produced in 1999, the country's real GDP has grown by an annual average of 8%. However, inflation has slowed growth dramatically over the past few years, from an average 110 % between 1991 and 1996 to 4.9 % in 2001 and 6.7 % in 2002. Oil exports have grown sharply since 1999, when the export pipeline was completed. This turned the country's trade balance from negative to positive (Bank of Sudan, 2008).

The Nile Basin countries have benefited from Sudan's oil production in several ways. As a result of economy growth, trade between Sudan and other Nile Basin countries has increased substantially. The trade balance between Sudan and Egypt is considerably increasing due to construction materials imports to oil and energy industries (cement and steel). Ethiopia, Uganda and Kenya and to some extend the Democratic Republic of Congo have benefited from Sudan oil production at different levels. Southern Sudan imports from or through Kenya and Uganda almost everything from food to heavy machinery. There is increasing trade and labour traffic between Government of Southern Sudan (GOSS) and Uganda and Kenya. Because of its proximity to refineries and existence of semi-paved roads, Ethiopia has benefited the most by importing a great amount its petroleum products from Sudan at very favourable prices (MEM, 2007).

World Bank report, IMF, CIA and Bank of Sudan statistics indicate a substantial increase in gross domestic product after the start of oil export in 1999. Real GDP

Table 6.2 : Oil operating companies drilling operations

No	Operating Co	Block (area in Sudan)	no of drilling rigs	No of Completion rigs	No of Drilled wells	no of targeted Wells 2007	Production rate 220K to 290K b/d
1	Greater Nile (GNPOC)	1, 2, 4	10	6	300	90	160K to 180K
2	Petrodar Operating (PDOC)	3, 7	8	6	170	85	Bbl/day
3	White Nile PETRONAS (WNPOC)	5a, 5b, 8	2	1	50	50	20 K bbl/day
4	Petroenergy (CNPCIS)	6	4	2	100	50	8 K to 12K
5	Advanced Petroleum (APCO)	C	1	0	4	3 Exploration	Bbl/day
6	SudaPak	9, 11, A	1	0	3	3 Exploration	0
7	Red Sea	13	0	0	0	Sep-07	0
8	Star Petroleum	17	0	0	9	Seismic	0
9	Petroleum of South Africa (Petrosa)	14	0	0	0	Seismic	0
						280	0
		Total	26	15	636		410 to 510 bbl/day

growth percent change average was about 8% compared to only 2 percent for the period before oil discovery. Gross domestic product was 47 billion USD in 2007 compared to only 14 billion in 2001 one year before oil export. Table 6.3 below depicts statistics showing growth of Sudanese economy in the period after oil export (Bank of Sudan, 2008; SEPO, 2002).

Table 6.3 : IMF Selected Economic Indicators

Real Sector	2001	2002	2003	2004	2005	2006	2007
Real GDP growth (% change)	6.1	6.4	5.6	5.2	8.0	11.8	11.2
GDP (mln $)	13,369	15,109	17,680	21,610	27,699	37,442	46,708
GNP per capita	374	425	486	579	790	970	1,182
Inflation (%)	4.9	8.3	7.7	8.4	8.5		
External debt:							
- bln $	20.9	23.6	25.7	26.0	27.7		
- % of GDP	157	156	145	120	100		
- Net international reserves (mln $)	-109	84	290	1,144	1,889		

(**Source:** www.ecosonline.com)

Oil Industry Economical Impact on Other Nile Basin Countries

The trade between Southern Sudan and neighbouring countries grew steadily after the peace accord in the Southern Sudan. Although there were sporadic news of crude oil shipments to Mombassa Refinery and consequently petroleum products to Uganda, however these amounts could not be quantified. There are no statistics for oil exports to Kenya and Uganda. Ethiopia's importation of Sudanese oil (80% of gasoline and 10,000 Ton/ month of petroleum coke) saved the country ten of millions USD in 2007 (Ethiopian Petroleum Enterprise). The imports are expected to increase and will have profound effect on Ethiopian economy in a world affected by energy shortage. Mutual benefits such as electricity exchange between Sudan and Ethiopia will strengthen bilateral relations between the two countries.

Before oil imports from Sudan, half of Ethiopia's export earnings were spent on serving the country's fuel requirements. Ethiopia needs 10,000 tons of benzene monthly and 120,000 tons annually. Currently, Ethiopia imports (mainly from Saudi Arabia and the Gulf states) around 2 million tons of oil costing around $ 221 a year (2006 USD). It is expected that as much as one hundred million USD each year can be saved by Ethiopia in shipping in the oil through Sudan. Of course this is due to lower transportation cost compared to that for oil from other countries and substitute of large quantities of fuel oil by petroleum coke. Price of fuel oil is five times greater than petroleum coke exported from Sudan.

As a result of the presence of international exploration companies in Sudan to boost her oil exploration activities, Ethiopia and Sudan signed a cooperation agreement under which Ethiopia has received 25,000 square meters of land in Sudan for the construction of a fuel depot. The country is also looking at the development of oil and gas as a means of shifting from reliance on hydroelectric power. The current drought has hit water supplies at the hydroelectric plants leading to frequent power cuts in Addis Ababa. The potential of hydroelectric power in Ethiopia is enormous. So far the country only utilizes around 2 % of the potential (MEM, 2008b; SEPO, 2002).

Positive environmental impacts

Sudan oil production increased from 9,000 barrels a day in 1997 to more than 500,000 barrels/day (b/d) in 2008. Consequently, the country refining capacity has increased five fold from 25,000 b/d to about 125000 b/d. This increase led to production of more petroleum products such as LPG and kerosene that have substituted the conventional wood and charcoal fuels. Recent developments in the oil industry sector have led to modern and efficient ways of using hydrocarbon fuels, and less dependency on wood fuels. Wood fuel is mainly used in domestic and commercial sectors for cooking and conventional bakeries. A substantial amount of wood fuel is also consumed in traditional industries, mainly brick and bakeries manufacturing.

Expanding energy service in particular to household sector, by provision of liquefied petroleum gas (LPG) and kerosene is considered as one of the main strategies in wood fuel conservation policy. In addition to decreasing the degree of deforestation, use of petroleum fuels can also free up supplies of dung for use as organic manure for growing trees or agricultural crops in areas where animal dung is used as fuel (Abdelsalam, 1994, 2001).

Negative environmental Impacts

On the other hand, development of the oil industry has negative impacts associated with issues related to disturbance of stability of the ecological systems. Huge construction activities associated with oil development include road and pipelines construction (Adam, n.d.). The most significant of these impacts are new access roads for very heavy equipment and drilling rigs, seismic survey lines and drilling sites. The damage is mainly physical, comprising deforestation and de-vegetation, erosion and watercourse siltation, and disrupted drainage patterns. Extensive damage of this type was observed by a UNEP team (UNEP report, July, 2007) north of the Heglig facility in Southern Kordofan. Inspections of seismic lines in Jonglei state, however, revealed a much lower level of impact (Adam, n.d). In addition to habitat disturbance and destruction, oil exploration activities and oil industry may result in local pollution problems.

Extent of environmental Impact

The development of oil industry in Sudan has affected the

environment surrounding the Nile Basin in different proportions. Most of the oil development activities and/or processing are taking place in the proximity of Niles and their tributaries. If not well managed, the exploration processes can have the greatest impact on the environment of all the phases of oil production. This is due to the large areas affected and the temporary nature of exploration work. Exploration is usually unsuccessful in over 90 percent of cases, and when the results are negative, oil companies abandon the areas surveyed. Unless it is remedied, the environmental legacy of exploration can last for generations (Petrusak et al., 2000).

Pollution

Since the start of oil exploration in Sudan, more than 500 wells were drilled using the drilling mud configuration system. In 2008 more than 200 wells were planned to be drilled mostly in Blocks 1, 2, 4 and 3 and 7. The pollution nature of drilling fluids and chemical additives are well documented in the international drilling heritage. The environmental effect of circulated mud ponds, especially on the flooding seasons has not been quantified. Generally, this may cause enormous damage if not properly treated and securely abandoned after the end of drilling operations. There is no law and independent body to follow-up and enforce proper procedures to deal with mud ponds.

In addition, produced water poses a challenge to the oil and gas industry as it represents the largest volume of waste stream in hydrocarbon production (Gas Research Institute, 1999). Produced water is associated with formation of hydrocarbons. Produced water is divided into two categories either essential for oil and gas production (good water) or in excess of that required for hydrocarbon production (bad water). Water produced in association with crude oil is the largest waste stream in most oil fields. It accounts for up to 95 percent of total wastes. It is composed of natural underground water combined with water injected into the formations from the surface to enhance recovery of the oil in a process called water flooding." In mature fields the amount of this water produced often exceeds the amount of oil (Seven times that of oil in Heglig Field).

This water requires adequate treatment before any usage. Produced water is contaminated with oil and chemicals in different concentrations levels and presents danger to any further usage (SEPO, 2002). The problem is compounded by the disposal of produced water in environmentally sensitive areas that threatens bio-diversity. Bio-remediation would not be adequate for the ever increasing water production. Worldwide experience has demonstrated that using state of the art technologies offers reliable solutions when carefully studied, designed and executed. High success rates are associated with considerable field experience and elaborated research and development efforts (Veil et al., 1999).

The practised disposal method employed in onshore operations is surface and subsurface. In the former produced water is contained in open ponds allowing it to evaporate and leave pollutants (residual waste). The residual waste is dumped afterwards or simply abandoned. The surface disposal poses considerable environmental risks to soil, air and water streams. Disposal of produced water from Muglad Basin created special concern since the field lies in one of the world's major wetlands of rich and diverse ecology (Enour et al., 2007; SEPO, 2002). The wetlands are important not only for their biodiversity, but also as important catchments area of Bahr el Ghazal and other Nile tributaries. In Subsurface disposal method water is injected into shallow aquifers or down-hole injected by sending it back to its origin at an approximate depth of 1500 metres.

A variety of trace elements and hydrocarbon compounds occur in produced waters from oil fields (Wacker et al, 1999). Trace elements, hydrocarbons and radio-nuclides accumulate in the sediments and food chain exposing aquatic birds to environmental risks (Adam, n.d.). Polycyclic aromatic hydrocarbons (PAHs) were reported in the bile metabolites of juvenile waterfowl collected at a wetland (near Cody, Wyoming) that had received oil field produced water (Adam, n.d.). Bone tissue from these birds also contained radium-226. This suggests that birds inhabiting this wetland are being exposed to petroleum hydrocarbons and radium-226. Such exposure may result in sub lethal or lethal effects. Furthermore, the environmental sensitivity plays an important role in impact severity, i.e. in Sudan the operations are carried out in a wetland and semi wetland areas with an international biodiversity importance and adjacent to surface and ground water basins.

Heglig oil field produced water in Sudan commenced in 1999 with an average of 100000 cubic metres per day (SEPO, 2002) This volume is expected to increase substantially due to increase in production volumes and the age of well. Oil well drilling mud pits such as those at Heglig are normally rehabilitated after use (see Figure 6.1); at present, however, there is no oversight body for the oil industry's performance or detailed environmental standards for rehabilitation work.

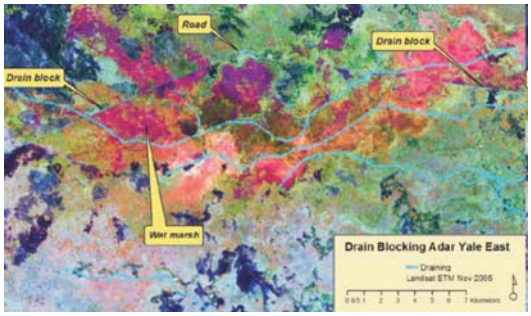
Figure 6.1: Oil well drilling mud pits at Heglig

Impact on natural vegetation and habitat

Discovered oil fields are located on highly sensitive environmental regions. Exploration activities and development of oil fields are affecting the forestry resources base as more natural vegetation lands are cleared for other land uses activities. Figure 6.2 below illustrates

different oil development environmental changes created by roads on Adar Yale East Areas (HCENR, 2007).

Figure 6.2: Satellite Map shows environmental changes due to oil development in Adar Yale East Areas



Historically, exploration activities have taken place in forestry rich areas. The concession of Blocks 1,2 and 4 operated initially by Chevron and followed by GNPOC consortium have affected the forestry in the following ways (Nair & Salam, 2005):

- The initial clearing of land for exploration activities. The number of wells drilled and the field production facilities as well as the central production facilities areas and camps determine the acreage to be cut in each field.
- Safety measures and adjunct to the field's forces barracks where security is a major concern in the past war years enforced more cutting of trees to enable the army to protect this new industry.
- Since new human settlement are attracted by the new industry more villages will be build close to the oil facilities where more jobs are expected and consequently more cutting down of trees will occur for their daily energy needs.

Field visits to Heglig Oil and WNPOC oil fields between June and August 2006 revealed that for each drilled well (whether dry or producing water or oil well) the cutting down of trees extended to a radius of a one kilometre. For Field production facility (3 of them) the trees cut area was about 5-10 km in diameter including the camp and its surroundings. The area is doubled for central production facility in Heglig including air strip for helicopter and small aeroplanes (10-20 sq Km diameters) (Nimir & Salam, 2005).

Macro/Sectoral Policies in relation to Oil Exploration:

In the beginning of oil exploration and development activities in Sudan, Environmental Impact Assessments (EIA) were considered as a requirement (mainly for international companies). Lately, the government is not enforcing this requirement. The situation worsened after replacement of the Canadian Talisman company (who obeyed international good environmental oil field practices) by the Indian ONGC. Because of the limited budgets allocated by companies and approved by government as part of oil cost these studies have many drawbacks. The following negative observations were noted when comparing recent Environmental Impact Assessments performed by some private companies and institutions for oil exploration and development:

- Most of these studies are based on previous studies which are not authentic, or comprehensive. Sometimes there is paucity of information.
- Rarely, if at all none of these EIA's is rejected by the authorized body Higher Council for Environment and Natural Resources (HCENR).
- Most of these studies are performed in a late stage of the project under considerationi.e. after finishing of design phases and starting of implementation of the project. The thing that make even any acceptance of new suggestion or ideas unacceptable by both operating companies and government.
- Environmental pre activities measurements are either demonstrative or completely absent.
- Extremely important EIA components are not completely covered such as exploration and design review these are to be performed by specialists in oil and gas industry. Most studies do not have even a petroleum engineer to perform this task.
- There is no follow-up for the Environmental Management Plan (EMP).
- Absence of monitoring of impacts of the project.

Policies in relation to use of petroleum products

The total amount of wood fuel consumed in the form of final energy in Sudan in 1999 was equivalent to about 6.6 million tons (Abdelsalam, 2001). The largest share of this amount was used for cooking in the household with services sector representing about 95% of this total amount. The pattern of use of wood fuel in the household sector indicated more use of firewood in the rural sector compared to the urban sector, while the situation with charcoal is the reverse. The household survey indicates that the average percentages of population who use firewood in rural and urban sector was 82% and 69% respectively while the percentage for charcoal was 52% and 89% respectively (MEM, 2001). Substituting wood fuel by more efficient petroleum products will conserve a lot of tree cutting and consequently contribute to the environment conservation efforts. For instance, energy from one ton of petroleum is equivalent to burning from 3-4 tons of trees for fuel wood usage.

The major wood fuels consuming industries include the brick making industry with about 52% of wood consumed in the industry sector (equivalent to about 550000 cubic metres annually, followed by the traditional bakeries (36%), oil and soap (8%), lime making industry (3%), and the rest of industries constituting about 1%. The pattern of wood fuels consumption can be altered significantly by pushing the substitution of petroleum fuels in the different wood fuel consuming sectors.

According to the recent National Energy Assessment, Sudan consumed about 11 million tons oil equivalent (toe) in total in form of primary energy. About 71% of this total amount was in the form of wood fuels, while the percentage from petroleum was only 15% (16, Palmer, 1988). Petroleum products consumption as final energy was in the order of 1.7 million metric tons of products with the main

consuming sectors being the transport (52 %), electricity (15 %) and industry (12%). After the production of oil, the consumption pattern started to change. The refining capacity increased four fold compared to that before oil production started (from 25 000 bbl/day to about 100 000 bbl/day). More petroleum products are availed for the local market consumption (British Petroleum, 2007; MEM, 2008a).

Remedial Measures

Produced Water:

The primary technologies available for dealing with produced water generally fall into one of three categories, any combination of which may be employed in a given field (Doran et al., 1999; Veil et al., 1999; Wacker et al., 1999):

1. Conformance control measures. These are modifications to well completions or production patterns designed to reduce the volume of water produced from the formation.

2. Conventional disposal methods. Surface handling and disposal of separated, produced water, either into injectors for enhanced recovery, into disposal wells, through surface discharge, or through beneficial uses (e.g., irrigation).

3. Downhole oil/water or gas/water separation and disposal methods. Subsurface equipment that separates the hydrocarbon and water phases, disposes of the water into a non-productive zone, and produces the relatively water-free hydrocarbon to the surface.

Most operators rely on a combination of technologies from categories one and two. A number of new options have been proposed for reducing the costs or increasing the efficiency of surface water treatment and disposal processes. Some researchers are exploring ways on how to utilise produced water as a replacement for fresh water in remote, dry areas (e.g., see sidebar on recycling modules and modified reverse osmosis). In most cases operators continue to rely on conventional disposal solutions and focus on finding ways to reduce the cost of those operations as much as possible. However, over the past several years the third category, downhole separation and disposal, has seen an increased number of installations and attention.

It is completely feasible to reduce the environmental impact of oil exploration and production to acceptable levels in all but the most ecologically sensitive areas. This however, requires both commitment and substantial investment.

Substituting Use of Petroleum Fuels for fuels wood

Switching to either LPG or kerosene is determined by a combination of factors. They include an increase in income, availability, accessibility, urbanization, price, and decline in supply of biomass. Use of LPG will reduce rate of deforestation and contribute to the social welfare by improving living standards and enhancing the environment by reducing indoor and outdoor pollution (Abdelsalam, 1994; Nimir & Salam, 2005). LPG is well suited for domestic cooking because of its clean burning attribute and practical advantages over traditional fuels. It is highly portable and has a high calorific value by volume and mass. Following these advantages households will prefer LPG to other fuels if their incomes are high enough.

Generally, the growth in consumption of kerosene in Sudan for cooking is less compared to LPG. The success for pushing the use of kerosene will depend on continuous accessibility of the fuel, availability of adequate appliance and stability of the price of both fuel and stove (Abdelsalam, 2001). Kerosene offers the least cost and practical solution for cooking particularly for the rural population. Problems seem to be less related to its transport and distribution, and efforts should be directed more towards accessibility to stove.

The shift towards modern fuels will be more pronounced in urban areas. The consumer behaviour will be mainly affected by availability of energy resources, and the socio-economic characteristics of the households (mainly income) and the policy interventions. The total quantity of kerosene dispatched to the different consuming sectors in 1999 amounted to 7196 tons and 28000 tons of LPG. The amounts were mainly imported by that time since local production had not started. The dispatch for the year 2003 (which was mainly provided from local production) was 15465 tons and 118176 tons for kerosene and LPG respectively, indicating an increase of almost more than 4 times of annual quantities of LPG supplied.

The degree of urbanisation is an important factor determining accessibility of population to fuels, whether wood fuel or modern fuels. The size of the urban areas is expected to have an effect on both the price that people have to pay for a fuel and its availability for the local population. One reason that city size has such effects is that small cities often are in more remote areas that require transport of modern fuels. Consequently higher transport costs may cause the price of modern fuels to be higher. In addition, smaller cities also obviously have smaller markets, so that the distributor of modern fuels may not be interested in targeting those areas for sales. The lack of fuel alternatives in the market place may influence the other prices in the market place. Another factor is that biomass often is more readily available around the boundaries of small cities (Abdelsalam, 1994; Nimir & Salam, 2005).

Produced Water

In Sudan three to nine water barrels are produced with each barrel of oil produced. This depends on the artificial lift method used and depletion rate of the reservoir. Evaporation ponds are the only way to discharge the produced water. In the ponds oil is initially skimmed and the oil is used for road spraying to decrease dust and the water is left to evaporate. Several Evaporation ponds (usually three) are used for gradual purification of water from oil. The process has a draw back since it fails to purify the associated water from any harmful water soluble materials and chemicals (SEPO, 2002).

A new pilot project is underway in Heglig where artificial wetlands are created by giving reed beds near the ponds. The water from the evaporation ponds is also utilized in the irrigation of trees/ and grass which can withstand this contaminated water. Other suggested ideas are to completely isolate such plantations and to use the trees for wood industry. This solution is also not risk free since birds and micro organisms will certainly have access to the said isolated plants and consequently to other animals and human beings through these birds (HCENR, 2007).

Figure 6.3 below shows one of produced water evaporation ponds at Heglig Central Production Facility. The water level as it can be seen is high and a small flood in the rainy season will make this water mix with the flood water and extend its risk to a larger area. On the other hand the contamination of underground water is very possible.

Figure 6.3: Oil Wastewater Evaporation pond at Heglig Central Production Facility (Source: HCENR, 2007)

Figure 6.4: Experimental reed bed for the treatment of oil wastewater at Heglig (Source: HCENR, 2007)

Substitution of Petroleum Fuels for fuels wood

Marketing of modern fuels:

Government policy will have a significant role to play in affecting the marketing of modern fuels. This in particular will be by:

- Increasing investments and expanding availability in those areas which are at a lower stage in the transition.
- Subsidizing or taxing fuels, accordingly subsidizing modern fuels should target those areas which are in lower level in the transition.
- Removing barriers to market entry for private sector to invest in distribution of petroleum fuels for use in household sector.
- Subsidizing of initial costs of equipments (stoves and cylinders) for use of LPG & kerosene.
- Providing micro-credit financing arrangement to finance purchase of stoves and financing income generating activities.
- Promoting awareness among household on comparative advantage of using of modern fuels.

The use of modern fuels in brick making industry (the major wood fuel consuming industry) is very limited. Fuel oil is used in modern brick making factories where Hoffman's kilns are used. Present production from such factories does not exceed 2 % of the total annual brick production of Sudan. Generally, production of bricks is continuously increasing due to increase of urbanization, and the trend of shifting from rural built houses to brick houses with increase in income.

FNC/FAO project study estimated annual wood fuel demand by the industry to be about 550,000 cubic metres for the year 1994. Later, estimates by Ministry of Energy and Mining for the year 1999 were approximately 700000 cubic metres. If no policy measures are taken, the impact on the forestry resources in the coming 5 10 years will be substantial. Alternative firing techniques with fuel oil were suggested in the report. Use of LPG in firing traditional kilns has been tried and encouraging results were obtained. Firing of traditional kilns with LPG has also been tried, but still is at experimental stage.

The number of modern bakeries using petroleum fuels is increasing. The total number in the entire Sudan in 1980 was estimated to be 16 only. The number increased to 650 in 1994. The 1999 National Energy Assessment estimated that total number of bakeries operating on petroleum fuels to be 750. Traditional bakeries can also be modified slightly to operate on gas oil. Subsequently, many traditional bakery owners are modifying their bakeries. Previous projection indicated that the consumption of wood fuels in traditional bakeries, which was about 300000 tons in 1994, will reach about 500000 tons by the year 2010. However, if some policy interventions are introduced including a shift to modern fuels, the demand on wood fuels can be reduced significantly. It was estimated that in 1994 about 68% of baking in Sudan was done in traditional bakeries. Lowering this percentage by only 2% can result in about 100000 tons savings in total quantities of wood consumed in this industry.

Generally policy interventions in the industry sector should include:

- Taxing wood fuel used by traditional industries.
- Incentive for industries to shift to modern fuels, this will include tax reduction or exemption for imported equipment.
- Financial arrangements and credit facilities.

Sustainable management of forestry resources:

The Forest National Corporation is the government authority directly involved in control over trade of wood fuels and other forestry products while Sudanese Petroleum Corporation is controlling dispatch of petroleum products. The Forestry Authority is mandated with protection and sustainable management of existing forestry resources. In addition to the policies, acts and legislation related to the management of forestry resources, several ministerial decrees and resolutions have been issued to address the issue of deforestation. This has resulted in a general improvement in forest management and tree protection. Examples of ministerial decrees and resolutions are briefly highlighted.

Ministerial Resolution No. 268/1991

Following this resolution the State has an obligation to combat drought and desertification, and ensure reforestation of Sudan by:

- Supporting all the national and popular activity in the field of planting trees and expand the same to enable the people of Sudan benefit directly and indirectly from forest resources.
- Celebrating a Tree National Day on the 3rd of August of every year
- Integrating environmental education in the entire school curriculum and at all the stages

Council of Minister Decree No. 40, 1997

This decree approved the economic sector proposals on the management and division of forests resources within the federal government system. The decree placed forests protecting trans-water movement and important federal structures and those located on the desert fringes under the management of Forest National Corporation (FNC). It stipulates that division of royalties from outside reserved forests is to be on the basis of 40% for FNC, 40% for the States and 20% for the Central Reservation Fund. However, Federal Ministry of Agriculture and Forestry (FMAF) in a letter to State Governors changed the percentage to 25%, 25% and 50% respectively. This was attributed to the increased role of FNC in the rehabilitation of forests, afforestation, reservation and extension services. The Council of Ministers Decree confirmed that federal forests are to be under FNC management, but at the same time, delegated its administration to Federal State Ministers of Agriculture.

Ministerial Decree No. 23, 2001 of the Federal Minister of Agriculture and Forestry

Following this decree the Federal Minister of Agriculture and Forestry delegated to State Ministers of Agriculture, Animal wealth and Irrigation (SMAAWI) specific powers, regarding FNC-State Administration (FNC-SA). This is to give the states more authority for controlling, planning, implementing, follow up and better use of their natural resources. The delegated functions include:

- General supervision of the implementation of programmes and plans on forestry affairs
- Vetting of monthly reports and making comments regarding implementation of forestry works in the state
- Making necessary arrangements for the protection of forests in consultation with the state director of FNC
- Supervising and ensuring implementation of forests legislation in coordination with concerned institutions in the state
- Supervising the implementation of the Memorandum of Understanding signed between FNC and the states
- Ensuring that division of royalties is done within the agreed percentages.

Memorandum of Understanding between FNC and States

A Memorandum of Understanding exists between FNC Ministry of Agriculture and Animal Wealth and Irrigation (Sennar State) regarding Division of Authority and Forestry Wealth of the State. This is an example of several MOUs signed between FNC and a number of SMAAWI. The Sennar State Memorandum of Understanding establishes a unified administration of the forestry sector in the state with the aim of raising efficiency and rationalizing financial and administrative performance.

A unified administration of the forestry sector in the state is achieved through the appointment an FNC-State Director (FNC-SD) who is entrusted with the responsibility of both federal and state forestry activities. An Assistant Director for State Forestry Affairs (ADSFA) assists the Director (FNC-SA). For each Federal and State forestry activity, a separate organizational and position structures are to be established in accordance with work loads. While the federal organizational structure is to be under the supervision of FNC-SD, the state entity is placed under the supervision an Assistant Director for Forestry State Affairs (ADSFA).

Ministerial Resolution No. (8) Of 2001

This resolution that came into force in 2001 controls dealings in the Genetic Resources of the Species of the Trees, and Forestry Bushes and the Information about them. The resolution prohibits the exchange or transaction in plant genetic resources of national economic importance (e.g., Acacia senegal Hashab). The collection, keeping and conducting research on genetic resources requires the approval of the Forests National Corporation. The resolution further, prohibits the exchange of information on genetic resources with foreign bodies and the importation of any genetic resources to the country, without approval from the Forests National Corporation.

Ministerial Resolution No. 13/2001

This resolution that draws on the Republican Decree No. 12 of 2001, transfers the functions of the General Administration of Natural Resources and Land use, to the Forests National Corporation. Accordingly, the Forests National Corporation has re-organised its administrative organizational chart to adopt new functions and qualified personnel.

Resolution No 40/2001

The resolution implements the recommendation of the Economic Sector in its session No (1) /2001 that banned the use of wood and charcoal in all commercial places. The use of wood was to be replaced with gas, as from the 1st of January 2002. The Economic Sector is delegated to take the measures required to facilitate the obtaining of gas and cylinders at cheap expenses.

Ministerial Resolution No 50/2001

The resolution is about the mechanism for obtaining the approval of agricultural lands disposition committee. Following the resolution, approval from the Agricultural Lands Disposition Committee (agricultural, forests, surveying and lands) as required before one commences the clearing of any agricultural project. The approval is subject to devoting the percentages of lands to forests, as

provided for under Section 20 of the forests Act 1989. The Agricultural Lands Disposition committee is expected to make field survey prior to the issue of any cleaning permit as well as regular routine survey.

Ministerial Resolution No 51/2001

This resolution banned the approval of agricultural projects in national forests zones. bans all approvals or planning of new mechanized agricultural projects in the national forests zones or the attached areas.

Resolution 628 Attachment of Forests

Resolution 638 empowers the Chairman of the National Salvation Revolution Command Council and Prime Minister, to attach forests based on the advice from the Minister of Agriculture and Natural Resources and Animal Resources and the Forest Act 1989.

References

Abdelsalam A. (1994). Assessment of Use Pattern and Forecasting of Demand of Fuel wood by Traditional Bakeries. Khartoum: Forest National Corporation / Food Agricultural Organisation.

Abdelsalam, A. (2001). Evaluation & forecasting Trends Pattern of Energy Demand for Cooking in Household Sector. Khartoum: National Council for Research.

Adam, M.A. (n.d.). Research on Conflict and Poverty in Sudan. Cairo: FAO Regional Office.

Bank of Sudan. (2008). Accessed from http://www.cbos.gov.sd/arabic/period/q1_07/Tab_1.pdf

British Petroleum (PB). (2007). Statistical Review of World Energy.

Doran, G.F.; Williams, K.L.; Drago, J.A.; Huang, S.S. & Leong, Y.C. (1999). Pilot Study to Convert Field Oil Wastewater to Drinking Water or Reuse Quality. Paper presented at SPE International Thermal Operations and Heavy Oil Symposium, Bakersfield, CA, March 17-19, 1999.

Enour, A. et al. (2007). Sudan Forestry Sector Review.

Gas Research Institute. (1999). Technology Assessment and Economic Evaluation of Downhole Gas/Water Separation and Disposal Tool. Report, Radian International.

Government of Sudan. (1998). Sudan Updated Energy Assessment.

Government of Sudan. (2008). Sudan Country Analysis Accessed from www.eia.doe.gov/

HCENR (Higher Council for Environment and Natural Resources). (2007). Report. Khartoum: National Plan for Environmental Management..

Karrar A. B., & Ahmed A. E.(2006). Brief overview of Sudan Economy and Future Prospects for Agricultural Development. Report

MEM (Ministry of Energy & Mining). (2001). Report. Khartoum: National Energy Assessment.

MEM (Ministry of Energy & Mining). (2007). Oil and Gas Journal, Issue No. 4, Publications of Sudanese Ministry of Energy and Mining.

MEM (Ministry of Energy & Mining). (2008a). Oil and Gas Journal, Issue No. 1, Publications of Sudanese Ministry of Energy and Mining.

MEM (Ministry of Energy & Mining). (2008b). Oil and Gas Journal, Issue No. 3, Publications of Sudanese Ministry of Energy and Mining.

Nimir, H. & Salam, A. (2005). Effects of Oil Exploration and Production on Forestry. Paper presented to Sudanese Forestry Corporation.

Palmer, P.D. (1988). Issues and Options in Fuel wood Conservation, with Special Attention to Africa. The Economic Development Institute of the World Bank.

Petrusak, R.L.,Freeman, B.D. & Smith, G.E. (2000). Baseline Characterization of U.S. Exploration and Production Wastes and Waste Management. SPE paper 63097 presented at the SPE Annual Technical Conference and Exhibition, Dallas, TX, October 1-4, 2000.

SEPO (Sudanese Environmental Protection Organization) (2002) Base Line Environmental Study of Diffra Oil Field Khartoum: Greater Nile Petroleum Oil Company.

Veil, J.A., Langhus, B.G. & Belieu, S. (1999). Feasibility Evaluation of Downhole Oil/Water Separation (DOWS) Technology. Accessed at http://www.ead.anl.gov/pub/dsp_detail.cfm?PubID=31

Wacker, H.J., Parker; R.M., Stuebinger, L., Harding; R. & Watson; B. (1999). Test Proves Out Triple-Action Pump in Downhole Separation. Oil & Gas Journal, Oct. 4, pp. 49 - 55.

TANZANIA

IMPACT OF MACRO POLICIES ON DEFORESTATION

Dr Oswald Mashindano

Introduction

Approximately 41 percent of the total land in Tanzania is covered by forest (Meghji 2003). This is about 38.8 million hectares. The main vegetation types include Afro alpine heath and moor land, forests, woodlands and grasslands, bush lands and thickets, swamps, mangroves and plantation forests. About 13 million hectares of the total forest area has been gazetted as forest reserves. Over 80,000 hectares of the gazetted area is under plantation forestry and about 1.6 million hectares are under water catchment management (Kahyara et al. 2001). The forests have social, economic and environmental importance not only for Tanzania but for the World at large. The forests have various species of plants and animals that make Tanzania one of the richest and attractive countries in terms of biodiversity features in the World. For example, Tanzania has Africa's largest number of mammals, third Africa's largest number of birds (with 1,035 species), second for plants with 10,000 species, fourth for amphibians (123 species) and fourth for reptiles with 245 species. Most of these are found in the country's forests (Kahyarara *et al.* 2001). Tanzania has an agrarian economy with peasant farming that is susceptible to rainfall availability, soil erosion and desertification being dominant. About 6 percent of the total land in Tanzania is used for peasant farming.

Forests play an essential role in the maintenance of the hydrological balance and soil protection. They maintain rainfall pattern and preventing water run off thus, ensuring appropriate hydrology which is necessary for sustainable water sheds. This is important not only for agricultural development in Tanzania, but also for fishing and marine transport. The forests are also important for recycling and fixing of carbon dioxide. For many years agro forestry has been promoted in Tanzania as one of the farming system that has a role and function in nitrogen fixation and provision of natural mulch as well.

There is an important synergy between forest and other economic activities such as tourism, wildlife and trade. Tanzanian forests are important in the growth of sectors like tourism through block hunting and wildlife development. They offer food and habitat for wildlife particularly in the designated four World Heritage sites of the Kilimanjaro and Serengeti National Parks, the Ngorongoro Crater and the Selous Game Reserves. Forests and woodlands in Tanzania provide 91% of the domestic energy source whereas oil fuel, electricity and coal provide 7, 1.6 and 0.4 percents respectively (Mashindano 1998; Kahyarara *et al.* 2001; Meghji 2003). Following the World Health Organization (WHO) estimates, over 60% of rural population in Tanzania depends on medicinal plants from the forests (Kahyarara et al; Mascarenhas 2004). The forest also provides construction materials in terms of timber, building poles, ropes, roofing materials etc.

More than 1.5 million people are employed in the forest sector. Employment is through forest industries, forest plantations, government forest administration and self-employment in forest related activities. The real contribution is underestimated due to unrecorded labour in the collection of wood fuels and other forest-based products consumed by households. Export earnings from the forest sector accounts for over 10% of the total export. Forest products are among the three important foreign exchange earners and the highest contributors to the non traditional exports. It should be noted that a huge amount of exports from forest industry has not been recorded thereby heavily underestimating the actual contribution made by forest sector in the country (see for example Milledge, 2008).

Tanzania Development Vision 2025 (TDV 2025)

Tanzania National Development Vision 2025 (TDV 2025) envisages that by 2025 the country should have eradicated abject poverty, improved the quality of life and created a strong, diversified, resilient and competitive economy. The Vision aims at achieving three key targets: (i) *high quality livelihood*, (ii) *good governance and the rule of law* and (iii) *strong and competitive economy*.

(1) *High Quality Livelihood* the Vision aims to realize the following important goals:

- Food self-sufficiency and food security
- Universal primary education
- Gender equality and the empowerment of women
- Access to quality primary health care for all
- Access to quality reproductive health services for all individuals of appropriate ages
- Reduction in infant and maternal mortality rates by three-quarters of current levels
- Universal access to safe water
- Life expectancy comparable to the level attained by middle income countries
- Absence of abject poverty

(2) *Good Governance and the Rule of Law* it is envisioned that by 2025 the Tanzanian society should be characterized by:

- Desirable moral and cultural uprightness
- Strong adherence to and respect for the rule of law

- Absence of corruption and other vices
- A learning society which is confident and that learns from its own development experience and that of others and owns and determines its own development agenda

(3) Strong and competitive economy it is envisioned that by 2025 Tanzania will be having:

- A diversified and semi industrialized economy
- A stable macroeconomic situation manifested by a low inflation economy and basic macroeconomic balances
- A growth rate of 8 percent per annum or more
- An adequate level of physical infrastructure needed to cope with the requirements of all sectors
- An active and competitive edge in the regional and world markets

The main message of Vision 2025 in respect to poverty eradication is echoed in the National Poverty Eradication Strategy (NPES, 1998). The Strategy reiterates the Government's intention and commitment since independence of addressing ignorance, diseases and poverty. The existing policy framework places strong emphasis on the participation of various stakeholders in fighting these issues with a view to realizing sustainable development for the people. It is in this context that the Government continues to carry out the necessary policy reforms and improve the investment climate in the country to allow key players in the private sector to participate effectively in national development.

The National Strategy for Growth and Reduction of Poverty

The National Strategy for Growth and Reduction of Poverty (NSGRP) popularly known as MKUKUTA is a medium term strategy informed by Vision 2025 and aims to achieve the Millennium Development Goals (MDGs). The Tanzania Development Vision 2025 and the National Poverty Eradication Strategy set long term targets with MKUKUTA translating them into medium term goals for implementation. MKUKUTA has an increased focus on growth and governance and is a tool for mobilizing efforts and resources towards its outcomes. The Strategy is strongly outcome focused and aims to foster greater collaboration among all sectors and stakeholders. It identifies three clusters of broad outcomes:

(a) Growth and reduction of income poverty

(b) Improvement of quality of life and social well-being

(c) Good governance

Each cluster has a set of goals and targets. To achieve each target interventions and actions are identified. There is a strong relationship between the clusters and all are equally important. Equitable growth leads to higher incomes thus reducing income poverty. Higher incomes enable households to improve human capabilities through better education, health, nutrition and shelter. Human capability in turn is critical for long-term growth. Growth enables the government to collect revenue for provision of services. On the other hand good governance provides conditions for growth, well-being and poverty reduction.

Clearly, the targets set in the National Policy framework are quite ambitious. The government recognizes the importance of participation of various sectors and stakeholders to achieve the specified goals. The most important element is the participation of the private sector both in the productive sectors as well as service delivery. In this respect the government continues to improve the investment climate, and to encourage a sense of partnership with the private sector. The Tanzanian Government has updated various policies, strategies, programs and standards to create space for effective participation and contribution of all sectors and stakeholders in sustainable development.

Policy Environment Nexus: The Analytical Framework

Macro and sectoral policies have potential impact in altering the economic incentives that govern resource use and conservation in a country. The linkage between policy variables and the natural environment in the Nile Basin is well demonstrated in Figure 7.1. The policy-environmental nexus provides a suitable analytical framework for linking macro policies and natural environment to underscore both positive and negative impacts.

A decrease in public spending (fiscal policy) through reductions in subsides, extension services, drought relief, food aid and general welfare programs may intensify poverty in an area leading to unsustainable resource management and farming of marginal land. Any fiscal policy through taxation or government spending can affect farmers' demand for resources such as land, labour, energy, fertilizer and farm credit thus, disrupting the resource base.

Monetary policies influence the interest rate since money supply is inversely related to the interest rate. When the interest rate is altered investment demand tends to change thereby affecting aggregate demand as well as equilibrium national output. In the agricultural sector or fishing industry, for example, a declining interest rate tends to stimulate investments and subsequently disrupt the natural resource balance.

The downward adjustment of the exchange rate (devaluation) may redirect expenditure away from foreign imports and encourage exports. Devaluation increases both the domestic prices for exports and imports. This new set of prices may have an impact on resource allocation and indirectly affect management of the natural resources. Since it attracts exports, overexploitation of resources is likely to occur. This is exactly what happens in the timber and logging industry of Tanzania.

Trade liberation tends to direct its attention at removing restrictions (import tariffs, quotas or export taxes) to foreign trade. Trade liberalization has an impact on the environment through changes in the relative prices of imported and exported goods. Its consequences are similar to those of devaluation. Removal of price controls is likely to stimulate production of the respective commodities.

In agriculture, environmental impact of macro policy change depends on soil erosion protection characteristics of the crop in consideration. Legal and institutional reforms

Table 7.1 :Linkage between Macro policies and the Environment: An Illustration

Sn	Policy	Intermediate Policy Variable	Environmental Impact
1	Fiscal	· Government Expenditure · Taxes · Subsidies	· Agricultural extension services · Resource management · Demand for resources · Input effect: fertilizer, pesticides energy, credit · Output effect: depending on crop characteristics
2	Monetary	· Credit · Interest Rate	· Demand for agricultural inputs · Demand for investments and resources
3	Exchange Rate	· Devaluation	· Import effect: Increase input prices · Output effect: Increase export crops depending on Crop characteristics and farming practices
4	Trade	· Import and Export Taxes · Trade Controls	· Same effect as devaluation · Same effect as trade taxes
5	Pricing	· Price Controls · Subsidies · Taxes	· Impact on output response, depending on crop Characteristics and farming practices · Demand and use of inputs · Demand for agricultural resources
6	Institutional Reforms	· Land · Financial · Research and Extension	· Farm investment effects · Investment in resource management · Agricultural extension services
7	Investment	· Training · Valuation · Technology · Public Infrastructure	· Human investment in agricultural extension and Resource management · Evaluation of environmental costs and benefits · New agricultural technologies · Access to natural resources

Source: Adopted from the World Bank in Mashindano (1998)

are critical elements in any environment management programme. Lack of a clearly defined property rights, for example, may encourage individual herders to over-stock cattle causing overgrazing, bush encroachment, erosion and desertification.

Severity and extend of Deforestation

Tanzania is one of the Sub Saharan countries which face a serious problem of deforestation and forest degradation (URT 1998c, URT 202c). Literature reveals a number of causes of deforestation in the country. The effects of deforestation include alteration the ecology of the area, loss of timber and other non-wood forest products, degradation of the natural environment and water shortages. Human activities are the root cause of deforestation in the country. These activities include timber logging; pit sawing, charcoal burning, firewood and pole collection, harvesting of non-timber forest products such as honey and animals, cultivation and grazing in the forest lands (Kahyarara, 2008). Kahyarara (2002) summarizes the activities into two forms of utilization: i) utilization by local communities largely for subsistence purposes, and ii) utilization by outsiders mainly for commercial purposes. Easy access to the forest reserves in the country enables traders and farmers to unlawfully cut down trees. Migration of people from other ethnic groups, increased demand for farmland, unclear (undefined) forest entry and exit points, poverty, poor farming practices, population growth are some of the driving forces for deforestation frequently cited in the literature (for example, Mashindano 1998; Kahyarara et al 2001; Kahyarara 2008). Establishment of settlements in forest lands, forest fires and outbreaks of pests and diseases also cause deforestation.

On the other hand Kulindwa *et al.* (2001), ESRF (2005), URT (2005b) argue that to a larger extent deforestation and forest degradation are related to policy changes in the country. The macro and sectoral policy changes in Tanzania have influenced deforestation and the quality of forest reserves. Macro and sectoral policies such as fiscal and monetary policy reforms have attracted more players in the trade industry. Trade liberalization which entails adjustment of policy instruments such as taxation, interest rates, domestic export prices and devaluation has stimulated production and exports of forest products. The forest sector has been liberalized along with other economic sectors. The public, natural resources experts, government leaders and politicians have recently raised concern over uncontrolled utilization of the forest resources in the country. The benefits envisaged from the trade liberalization policy measures seem to be reversed by the consequences of uncontrolled utilization of forest resources. Environmental impacts of trade liberalization to the forest sector include increased rate of forest product extraction that accelerates deforestation. Increased deforestation due to *timber logging*, *forest fires* and *fuel wood and pole collection* has already resulted into adverse impacts in the country

Timber Logging

Improper, haphazard and uncontrolled logging in Tanzania which has been flourishing overtime has led to unnecessary clearing of forests, damages to the residual trees and ground cover. Timber logging has accelerated soil erosion and caused soil compaction thus hampering natural regeneration. Much damage has been done to both logged as well as the remaining trees due to poor felling and bucking techniques. Subsequently, the country has lost valuable timber due to low utilization of merchantable timber.

Following trade liberation in the forest sector, Tanzania has been trading in timber and timber products with China, UAE

and India being the major importers. Table 7.2 below presents primary destinations of Tanzanian timber products.

Table 7.2 : Timber Export from Tanzania

Sn	Products	Species	Qty	Units	Primary Destination
		Swartizia			
		Madagascariensis	846.73	m^3	· China (100%)
		Tectona grandis	8930.3		· UAE and India (99%)
					· China (76%)
					· Taiwan (7%)
					· UAE (6%)
1	Logs	Various hard			
		Woods	4282.39	m^3	· Thailand (3%)
	Sawn wood, billets	Softwood	19671.49	m^3	· UAE (76%)
2	And chips	Sandalwood	116.51	Tons	· South Africa (8%)
3	Dalbergia				· India (100%)
	Melanoxylon				· India
	carvings and other				· USA
	Finished				· United Kingdom
	Products				· China
					· Germany
					· Italy
					· Kenya
			10310.29	Kgs	· South Africa
			77.05	m^3	
			5513	pcs	

Source: URT (Forest and Beekeeping Division) 2006a

According to a study on *Forest Revenues and Governance in Logging in Tanzania i.e. The Traffic Research Report* (Milledge et al 2008), Tanzania has for many years been losing huge amount of revenues due to illegal and unrecorded trade in timber and logging. Findings of the study show that in mid 2004, Tanzania collected only 4 percent of the actual timber harvested.

This trend has revealed a drastic decline between revenue collected in 2001 and that of 2004. There is a serious governance weakness in forestry despite having good policies and the legal framework. Huge amount of timber has been harvested illegally in the country but legalized at a later stage by either granting a transit pass or an export permit using fraudulently acquired documentation.

Table 7.3 below compares total exports from Tanzania to the world with total Chinese imports from Tanzania alone.

A huge discrepancy depicted in Table 7.3 clearly demonstrates the prevalence of illegal exports of timber that culminate into massive losses of revenue. This presents a huge lost opportunity for economic growth and self-reliance of Tanzania. If the losses are properly addressed, the country can generate enough revenue to meet priority targets as spelt out in the National Strategy for Growth and Reduction of Poverty (NSGRP) and the Millennium Development Goals (MDGs). Unrealised revenues are a threat to the sustainability of the forest resource and therefore, sustainable development in Tanzania.

Table 7.3 :The Scale of Distortion of Logging Trade Records (cm^3)

Sn	Tanzania Total Export to the World		China Imports from Tanzania Alone	
1	2002/03	4,920	2003	45,432
2	2003/04	8,529	2004	41,699
3	2004/05	5,867	2005	21,374

Source: Milledge et al 2008

Table 7.4 :Export of Forest Products by Values (USD)

Sn	Forest Products	Unit	2002/03	2003/04	2004/05	2005/06
1	Tree logs	m3	4920.0	8529.0	5867.5	5117.1
2	Timber (Rough sawn)	m3	5539.9	8162.0	87918.3	24859.3
3	Ebony Timber	m3	79.1	231.0	65.2	2269.2
4	Floor Boards	m3	657.9	251.0	75.1	107.7
5	Wood carvings/sculptures	Kg	246034.0	72043.0	6655.0	45296.9
6	Rail gauges	m3	2233.4	2769.0	272.1	19.9
7	Sandals Tree	Tons	195.1	350.0	4964.0	398555.5
8	Furniture	Pieces	3634.0	734.0	-	6504.0
9	Tannin	Tons	295.0	98.0	114.0	0.0
10	Mimosa Bark	Tons	265.0	157.0	15.7	304.0
11	Terminalia bark	Bags			1180.0	0.0
12	Tree Seeds	Kg	100.0	38.0	-	1150.0
13	Bees Wax	Tons	537.0	243.0	288.0	330.6
14	Honey	Tons	647.0	800.0	465.2	315.8
15	Tree's Glue	Kg	10.0	-	-	0.0
16	Poles	Pieces	-	904.1	8791.8	85000.0
17	**Total**		**265,147.3**	**953,09.1**	**116,671.9**	**569,829.9**

Source: URT (2007d)

Estimated nationwide losses of revenue due to under-collection of timber royalties from natural forests is reportedly equivalent to *more than twice* the entire income of the Ministry of Natural Resources and Tourism (MNRT) in 2004/2005.

During this period MNRT revenues constituted 16% GDP (approximately US $ 1.8 bill), however, Table 7.4 shows that the total value of exported forest products in the same year was US$ 116,672.

Forest Fires and Harvesting of Non Timber Forest Products

Generally, forest fires cause loss of forests and habitats to animals. A study by Kahyara *et al.* (2001) for example, found that in Arusha region about 5,000 ha or 2% of the reserved forests are destroyed by fire every year. The situation worsens during long drought spells like the 1996/97 drought in which about 3,700 ha of Meru forest reserve were destroyed by fire. In the 1983 drought more than 5,600 ha of plantation forests were destroyed by fire in Sao-Hill forest plantations in the southern part of Tanzania. In Mamboya forest reserve, Kilosa district about 1% of the forest is destroyed every year by fire.

Forest fires are largely motivated by illegal harvesting of forest products such as honey, beeswax, medicinal herbs, hunting, game, fruits, gums, and collection of firewood. These activities have grown in response to favourable market prices resulting from liberalization and/or reforms in the trade sector.

Fuel Wood and Pole Collection

About 90 percent of the population in Tanzania depends on firewood and charcoal as the main source of energy (Meghji, 2003). Almost 92 percent of the rural population use firewood. Charcoal, which requires about 3 to 4 m^3 of firewood to make 1 m^3, is preferred in urban areas because of its high calorific value. Although the estimated annual fuel wood demand in Tanzania is about 45 million m^3, the current forests can only supply about 19 million m^3 on a sustainable basis. In order to meet fuel wood demands, some forests especially those close to towns have been heavily exploited. Evidence from the previous studies shows that in Arusha region where firewood and charcoal demand is about 506,878 m^3, about 15,000 ha of forests are deforested every year (Kahyarara *et al.* 2001).

According to Kahyarara *et al.* (2002), deforestation in the coastal belt of Tanzania has reached a critical point. Close to half of the Kazimzumbwi forest has been degraded over the past few decades and over 20,000 ha of the Pongwe forest have been lost through unmanaged activities such as charcoal making. Some porches of forests in the areas surrounding Dar-es-Salaam and Coast regions are also under threat.

Most of the poles for simple house construction and scaffolds for major construction works are cut indiscriminately from the forests in the neighbourhood of big towns and settlements. Nearly all of the harvested poles are young trees that are yet to produce seeds for regeneration. In consequence, harvesting of these trees not only deprives the country of good quality sawn timber but also interferes with the natural regeneration or species diversification in these forests.

Reforms of the Local Government Authorities (LGAs)

As mentioned earlier, the local government reforms in Tanzania are aimed at devolving political, administrative and fiscal powers from central government to local government authorities. This process is expected to enhance opportunities for citizen's participation and to improve transparency and accountability in local authorities. In terms of forest management the changes in local government policies have made some positive impacts. With more powers and resources most LGAs in Tanzania have improved forest management through increased surveillance and/or monitoring. The LGAs in Tanzania are now instrumental in overseeing community based initiatives related to forestry. This has improved benefit sharing among key stakeholders in relevant forest reserves as well as sustainable forest management.

Forest resources need sustainable management for the benefit of the present and future generations. For a long time forests in Tanzania have been managed without full participation of the local communities. Recognizing the critical role played by local communities in improving forest management, Participatory Forest Management (PFM) has been given high priority both in the National Forest Policy, and the National Forest Programme (NFP). PFM is part of an overall rural development strategy intended to improve rural livelihoods, protect forest resources and promote equitable distribution of benefits. Over the past ten years a range of projects have been testing PFM in many parts of the country and have made generally good progress (see Table 7.5).

Table 7.5 :Estimates of Adoption and Spread of PFM in Tanzania since 1999

Year	Community Based Forest Management (CBFM)		Joint Forest Management (JFM)	
	Forest area under CBFM (ha)	Number of villages With CBFM	Forest area under JFM (ha)	No. of villages with JFM
1999	323,219	544	25,335	11
2002	1,085,306	845	1,175,550	525
2006	2,060,608	1,102	1,612,246	719

Source: URT (2007d)

Table 7.6 :Trend of Forest Sector Revenue Collection

Year	Average exchange Rate USD/TZS	Average exchange rate USD/TZS	Revenue in mill USD	Proportional increase (USD)%
2001/02	921	921	4.4	0
2002/03	1002	1002	5.2	18%
2003/04	1064	1064	5.4	3%
2004/05	1109	1109	5.3	-2%
2005/06	1165	1165	8.68	64%

Source: URT (Forest and Beekeeping Division) 2006a

As illustrated in Table 7.4, over 1,800 out of 10 000 villages are currently practising PFM in Tanzania. More than 441 881 ha are under Community Based Forest Management (CBFM) while 396 330 ha are planned or under Joint Forest Management (JFM). Between 2001/2002 and 2005/2006 revenue generation from PFM has been increasing overtime. The PFM generated a total of USD 4.4 billion and

8.7 billion in 2001/02 and 2005/06 respectively (see Table 7.6).

With devolution of power, roles and responsibilities of managing forest resources to the low level of governance and recognition of indigenous knowledge in managing forests, scaling up of PFM implementation has a bright future. Focusing both on conservation and economic incentives for communities will secure the sustainability of the programme.

Other Dimensions of the Impact

Following Kahyarara *et al.* (2001) environmental impacts of policy reforms such as trade liberalization on the forest sector have been observed in seven major areas. These are:

The greenhouse effect

Both consumption and production processes of forest products have resulted into increased atmospheric carbon dioxide particularly through burning forest products for fuel or as a result of uncontrolled fire during the process of production.

Changes in the hydrological cycles

Dedeforestation and forest degradation in the country has led to disruption of the hydrological balance. A study by ESRF (2005) shows that overtime, protected areas of Livingstone Mountains have been encroached by farmers from the Lake Nyasa (Wanyasa) on one hand, and others from Matengo Highlands (Wamatengo).

Farmers on the two sides are encroaching marginal areas and water catchment areas in expansion of their farming lands. Vegetation has gradually been removed and rivers and streams are drying up threatening the future of Lake Nyasa and many other rivers which depend largely on forest covered along Livingstone Mountain.

Impacts on soils and agricultural land

Farming in areas near the forests has been done up to the slopes of the mountains which are steep in nature. With increasing deforestation, soil is exposed to erosion especially of important nutrients. The Matengo highlands particularly along Livingstone Mountains have for a number of years suffered from this tragedy which prompted the Vice Presidents Office Division of Environment to pass some regulations prohibiting settlements around the mountains.

Impact on forest productivity

Increased harvest of forest resources result into a sharp decline of forest products in a given area. This in turn leads to falling productivity of the forests. Specifically this trend is reflected in declining availability of some tree species and general biological diversity in Tanzanian forests. Kahyarara et al (2001) have mentioned a number of lost tree species, some of which are endemic.

(e) Social migration and Invasion of the forests for search of productive land

Decline in productivity of agricultural sector, and increased activities in and around the forests tend to cause social migration and invasion of forest for search of productive land. As noted earlier, a number of migration and settlements have been taking place in areas such as Mbinga (Livingstone Mountains) and Kazimzumbwi forest reserve.

Health problems to the society

Increased human health problems are among the social impacts accelerated by the fast expansion of economic activities in the forest sector. Actors in the forests are increasingly contaminating most of the water sources near or within the forests. For example, the two rivers of Minaki and Mzumbwi in the Pugu and Kazimzumbwi forests have traditionally been known for bringing safe water directly to over 10,000 people. However, due to contamination water from these rivers is no longer safe.

Social Organization Impacts of Trade Liberalization in the forest sector of Tanzania

Milledge (2008) has analysed social organization impacts of the trade liberalization on the forest sector of Tanzania. The purpose was to check the way social networking has been influenced by trade liberalization measures. The findings reveal a high degree of networking amongst different stakeholders in the forest sector. The stakeholders included senior central government forestry officials, senior local forestry, local traders, prominent Tanzanian exporters etc.

Macro Policies/ Sectoral Policies

The National Environmental Policy

The recognition of deteriorating trend of the environment led to the 1972 UN Conference on the Human Environment in Stockholm. Since then, there has been a wide acknowledgement on the importance of addressing environmental issues (see for example Barry Dalal-Clayton and Bass Stephen, 2002). The World Conservation Strategy (1980) and the subsequent World Commission on Environment and Development (the Brundtland Commission) (1987) were developed as a response to an increasing recognition of the strong link existing between environment and development.

Agenda 21 and the conventions signed during the Earth Summit held in Rio de Janeiro in 1992 were the subsequent processes in the series of international events related to the environment. Following the Earth Summit Tanzania formulated and adopted a National Environmental Policy in 1997.

The overall objectives of the National Environmental Policy is to provide a framework for making fundamental changes needed to include environmental considerations into the mainstream decision-making processes in the country (URT 1997). The policy seeks to provide guidelines and plans in determining priorities.

It also aims to provide for monitoring and regular review of policies, plans and programmes. The policy further provides for sectoral and cross-sectoral policy analysis in order to achieve compatibility among sectors and interest groups and exploit synergies among them.

The current study is therefore, a response to the National Environmental Policy's requirement that policies, plans and

programmes need to be regularly monitored and reviewed.

The National Forestry Policy

The National Forestry Policy was adopted by the Government in 1998 forms the basis for development in the forest sector. The policy recognises that ownership of land and natural resources, access and the right to use these resources are of fundamental for enhancing sustainable development. Equally important is sound management of those resources to ensure greater benefits to society and sustainable preservation.

As mentioned earlier Tanzania has abundant forest reserves. The country has 33.5 million hectares of forests and woodlands that translates into 46 percent of the country's total land area. However, the management of these resources is poor. Deforestation is estimated to range from 130,000 to 500,000 hectares per year. The root causes for deforestation are clearing for agriculture, overgrazing, wildfires, charcoal burning and over-exploitation of wood resources.

The National Forest Policy seeks to ameliorate the negative impacts of deforestation arising from encroachment and over-utilisation. Its main policy statements are:

- To enable sustainable management of forests and public lands. This entails developing clear ownership of all forests and assigning management responsibility to villages, private individuals or Government authorities.
- To establish a legal framework for the promotion of private and community-based ownership of forests.
- To develop management plans for biodiversity conservation, protection of water catchment areas and preservation of soil fertility.
- To enhance the capacity of local governments to manage forest resources and strengthen the co-ordination mechanism between the local and central government.
- To strengthen the forest management extension services through skills upgrading in order to facilitate better management of farm and community forests.

National Trade Policy of 2003

The 2003 Tanzanian Trade Policy Vision is: *"... to transform the economy from a supply constrained one into a competitive export-led entity responsive to enhanced domestic integration and wider participation in the global economy through national trade liberalization".* The role of the trade sector in eradicating poverty in Tanzania will be attained through a structural transformation of the economy and enhanced productivity. This is expected to contribute to the process of international competitiveness and lead to rapid economic growth.

Trade is not an end in itself but a means for achieving a higher welfare to society. The function of the trade sector is to integrate the Tanzanian economy into the global economy. This entails structural transformation of the national economy and product/market diversification. To sustain an economic growth rate above the 7% as envisioned in the National Development Vision 2025, the country is expected to develop a modern export-led economy. High volumes of exports are necessary to achieve the goals of Vision 2025. The mission of the trade sector is therefore to: *"...stimulate the development and growth of trade through enhancing competitiveness aiming at rapid socio-economic development."*

The main goal of the trade policy is to raise efficiency and widen linkages in domestic production and build a diversified competitive export sector with a view to stimulating higher rates of growth and development. The following five specific objectives emanate from and reflect this goal.

- To stimulate a process of trade development as the means of triggering higher performance and capacity to withstand intensifying competition within the domestic market. This includes the establishment of improved physical market-place infrastructure and stimulating dissemination of market information and increasing access to the market.
- To transform Tanzanian economy towards an integrated, diversified and competitive entity capable of participating effectively in the Multilateral Trade Systems (MTS).
- To stimulate and encourage value-adding activities on primary exports in order to increase national earnings and income flows.
- To stimulate investment flows into export-oriented areas in which Tanzania has comparative advantages. This is a strategy for introducing technology and innovation into production systems towards realising economic competitiveness.
- To attain and maintain long-term current account balance and balance of payments through effective utilization of complementarities in regional and international trading arrangements. This will ultimately enhance income generation and the people's earning power at the grass-roots thereby reducing poverty levels in the country.

Unlike sector economic policies trade policy a cross cutting collection of strategies that address the goal of achieving a high rate of economic growth. The trade policy seeks to address a range of economy-wide constraints. There is a wide package of policy instruments that Tanzania applies in line with international obligations to address economic constraints. They include:

Tariff -based instruments such as Tariffs, Taxation and Duty Draw-Back (DDB) Schemes.

Non-Tariff Measures Quotas, Import Licensing and Registration, Pre-shipment Inspection (PSI) and Customs Valuation, Local Content Requirements, Standards, State Trading Operations, Government Procurement and Administrative Barriers.

Trade Defence Mechanisms Subsidies, Safeguards, Antidumping and Rules of Origin (RoO).

Trade Development Policy Instruments Investment Code and Rules, EPZs, Export Promotion Measures and Export Facilitation Measures.

International Trade Policy Instruments Bilateral Cooperation Initiatives, RTAs and WTO Agreements.

The application of each group of trade policy instrument calls for the identification of underlying constraints and challenges, a specific objective for each and adoption of an appropriate and consistent strategy for its implementation. The treatment of trade policy instruments adopted in National Trade Policy reflects the fact that the nation has been implementing the recommended trade policy in the course of economic reforms initiated in mid-1980s. Chapter five presents the impacts of implementing trade policy instruments in Tanzania.

The National Energy Policy 2003

The National Energy Policy of 2003 recognizes the critical importance of adequate supply of sufficient and cost-effective energy in accelerating development. The main policy statements enshrined in the National Energy Policy includes the following:

- Ensuring sufficient energy supply to meet the increasing demand in the economy
- Encouraging energy efficiency
- Facilitating agro-processing centres with appropriate energy alternatives with emphasis on electrification in order to promote small-scale industry, employment creation and economic growth
- Creating an enabling environment for governmental institutions and private sector engaged in the research, development and distribution of energy products in the country

The strategy of the Ministry of Energy and Minerals for implementing the Policy is to triple the generation of electricity in the next twenty years. This involves encouraging the private sector to generate, transmit and distribute electricity and other sources of energy such as solar and wind in a sustainable manner.

National Water Policy of 2002

The National Water Policy of 2002 is the first revision of the 1991 National Water Policy. The revision was made following a series of changes in the Water Sector that required the government to shift from the role of provider to facilitator in the sector. These changes, which took place after the 1991 launch of Water Policy, emphasize the active participation of new players such as local communities, the private sector and the local government. The changes were a response to Agenda 21 that requires all nations to protect the natural resources including water, and conservation of the ecosystems. The 1991 Water Policy had put the Central Government as a sole investor, implementer and manager of all water related projects. This conflicted with emerging changes in the management of water resources.

The 1991 Water Policy was revised in 2002 with an aim of developing a comprehensive framework for sustainable development and management of water resources. This provided an effective legal and institutional framework for managing water resources in the country. The 2002 policy aims at ensuring that all beneficiaries participate fully in planning, construction, operation, maintenance and management of community based domestic water supply schemes. In addition, the policy addresses cross sectoral interests in water, watershed management and integrated and participatory approaches for water resources planning, development and management.

The National Water Sector Development Strategy (NWSDS) and subsequent Water Sector Development Programme (WSDP) are also in place. NWSDS was finalized in 2006 and endorsed by the Cabinet in March 2008. The strategy informed the WSDP that was implemented in 2007/08. The National Water Sector Development Strategy highlights major problems of the sector, possible causes, possible effects and comprehensive solutions (strategies for sector development). It also captures fully the components like resource requirements, performance indicators and draws out a well-defined National-wide strategic implementation framework.

Land Policy of 1995

The Tanzanian land policy dates back even before independence in 1961. The 1923 Land Ordinance provided a legal framework for facilitating imperial interests. The 1963 Freehold Titles and Government Leases Act was the first attempt to reverse colonial policy on land issues. Further policies were initiated until the recent adoption of the National Land Policy in 1995. The main focus of the policy is not only to guide the allocation, ownership and use of land but also to help resolve recurring land conflict problems in the country. The overall objectives of the Land Policy of 1995 are to:

- Promote an equitable distribution of and access to land for all citizens.
- Ensure that existing rights in land especially customary rights of small holders (i.e. peasants and herdsmen) are recognized, clarified, and secured in law.
- Set ceilings on land ownership, which will later be translated, into statutory ceilings to prevent or avoid the phenomenon of land concentration (i.e. land grabbing).
- Ensure that land is put to its most productive use to promote rapid social and economic development of the country.
- Modify and streamline the existing land management system and improve the efficiency of land delivery systems.
- Streamline the institutional arrangement in land administration and land disputes adjudication and also make them more transparent.
- Promote sound land information management.
- Protect land resources from degradation for sustainable development.

Community Development Policy

The Government stresses that Donors, NGOs and other stakeholders should support community efforts to develop themselves in line with the Community Development Policy. The policy puts emphasis on collaboration and strengthening people's capability to be self reliant as an essential ingredient in community development interventions. The government further recognizes that although people are responsible for their own development, there are times when external contributions

are needed in order to complement and reinforce their efforts. In this regard, the government continues to create a sense of partnership with various stakeholders that include private investors operating within communities. The government expects private investors to feel part of the communities that they operate in, before complementing community efforts in development. The implementation of Community Development Policy has resulted in programmes such as the Community Based Forest Management (CBFM) and Joint Forest Management (JFM) among others Agriculture Policy of 1997

In this review agriculture includes livestock. The current agriculture policy is a result of a comprehensive review of past policies and strategies that have shaped the social and economic development of the country in the past two decades. It takes into account the changed role of government with regard to provision of goods and services. The policy is based on economic reforms to direct the economic system towards a free market economy with increased role for private sector participation. In this regard, the Government is explicit about disengaging itself from commercial activities and direct production functions. The policy seeks to ensure that the direction and nature of agriculture sector development meets social objectives, provides adequate public goods, and builds competitive agricultural and livestock markets. All these are to be accomplished by taking into account environmental and development concerns in the agriculture sector.

The ultimate goal of the policy is the improvement of the well being of the majority smallholder farmers and livestock keepers who produce only a small surplus. The policy sets national food security as the primary objective. It aims at improving national standards of nutrition by increasing output, food quality and availability. In order to achieve this objective, production growth rates of food crops and livestock production are targeted at least 4 percent and 5 percent per annum respectively. Food crop production is to be increased through productivity and area expansion and livestock growth through encouraging private sector based initiatives in the industry.

The main objectives of the Agriculture Policy of 1997 are to:

- Ensure food security for the nation, including improving national standards of nutrition
- Improve standards of living in rural areas
- Increase foreign exchange earning
- Produce and supply raw materials and expand the role of the agricultural sector as a market for industrial outputs
- Develop and introducing new technologies for land and labour productivity
- Promote integrated and sustainable use and management of natural resources
- Develop human resources for transforming agriculture and livestock
- Provide support services for enhancing agriculture
- Promote access of women and youth to land, credit, education and information

Table 7.7 : Human Development Indices

Human Development Indicators	1960	1970	1980	1987	1996	1999	2002	2004
Life expectancy at birth (in years)	41	45	52	53	52	na	51	na
Infant mortality (per thousand Live births)	146	na	120	107	88	99	95	68
Literacy rate (%)	na	33	na	90	na	na	69	na

Source: Ndulu B (1994) and URT (2005) and URT (2007a)

Table 7.8 : Economic Development Indicators (1966 2002)

Sn	Economic variable	1966-1970	1971-1975	1976-1980	1981-1985	1986-1992	1993-1997	1998-2002
1	Real GDP growth rate (%)[a]	3.9	3.8	2.8	0.7	4.1	3	5
2	Gross Capital Formation/GDP	24.2	26.8	28.0	18.1	24.6	23	20
3	Gross Domestic Savings/GDP	17.1	12.9	15.3	10.5	5.1	5	9
4	Current Account Balance (millions of US$)[b]	(4.7)	(157.7)	(256.9)	(241.9)	(231.6)	(374.4)	(450.8)
5	Current Account Balance/GDP (%)	(1.3)	(7.7)	(6.4)	(5.8)	(13.3)	(15)	(8)
6	Recurrent Budget Balance/GDP	0.3	0.8	(0.4)	(4.1)	(4.8)	(6)	(7)
7	Overall fiscal balance/GDP (excluding Loans, grants, and import support)	(5.3)	(8.8)	(12.6)	(11.5)	(10.9)	(11)	(11.42)
8	Overall fiscal balance/GDP (including External finance)	(3.7)	(4.8)	(7.1)	(8.2)	(3.0)	(5.2)	(6.68)
9	Inflation	2.8	13.7	13.7	30.2	26.2	25	10

Notes:
[a]With exception of 1986-92, (which is 7 years), the rest are (5 years) annual average growth rates.
[b]The current account balances are also annual averages. They include receipts and payments for the merchandise exports and imports respectively, as well as receipts and payments for exports and imports of other goods and services respectively.
Sources:Ndulu B. (1994); Musonda F. (1992) and BoT (2002)

The agricultural policy is implemented through the Agricultural Sector Development Strategy (ASDS) and the subsequent Agricultural Sector Development Programme that were adopted in 2001.

Macro policy in Tanzania

Since independence in 1961, Tanzania has been committed to fighting poverty and improving the livelihood of its

people. In the first five years following independence, the country made steady progress in economic growth and in meeting the basic needs of its citizens (see Table 7.7).

Tanzania made a major economic and political change in 1976 by adopting a socialist model of development as outlined in the Arusha Declaration. This ideological shift was characterized by a central government that controlled key areas of the economy. A series of economic crises during the 1970s almost led to economic collapse and put under threat achievements made in the initial period after independence. Macroeconomic imbalances aggravated the predicament even further. The imbalances were manifested through budgetary deficits, balance-of-payments deficits, growing debt burden, increasing inflationary pressures, and weakening productive sectors, among others. The capacity of the country to sustain delivery of basic social services came under enormous strain. From the early 1980s to date, Tanzania has been undertaking macro-economic and sectoral specific policy reforms as a long-term strategy for economic growth. Table 7.8 below shows economic development indicators of the country since 1966.

Economic Crisis and Policy Reforms

Economic crises in the early 1980s reversed social progress that was achieved soon after independence. This led to a public outcry in the fall of education, health services and many other social services rendered by the government. As a response to the economic crisis, a shift from a state controlled economy towards economic liberalization was made. Macro-economic policy reforms associated with this shift brought about fundamental changes in the way the country's economy was managed. The reforms sought to create a more stable macro-economic environment. In parallel with macro-economic reforms, the government also carried out structural reforms. Structural reforms focused on realigning the incentive structure towards increased exports, efficient use of scarce foreign exchange, liberalizing markets and reducing the involvement of the public sector in commercial activities.

In summary, macro policy reforms in Tanzania have mainly revolved around fiscal and monetary reforms, public sector reforms, anti-corruption measures (including institutional reforms and Law enforcement), constitutional matters and political and electoral processes. Public sector reforms include public sector restructuring and privatisation, public finance and financial sector, civil service reforms and decentralisation of governance (Local Government Reforms).

Some of these reforms are briefly reviewed to provide a clear understanding of the Tanzanian macro-policy framework.

Fiscal and Monetary Policy Reforms

Tanzania follows prudent fiscal and monetary policies consistent with her poverty reduction priorities. Fiscal discipline that is defined in terms of recurrent deficit targets is a major policy objective. Following pressure from international money lenders (e.g. International Monetary Fund), the government started to tighten fiscal policy since mid 1995. A tightened fiscal policy aims at raising revenue and reducing spending in selected areas, allowing private service delivery, restructuring government spending so as to increase spending in priority and/or critical areas and enforcing accountability and adherence to financial rules and budgetary ceilings. The Government target is to maintain fiscal deficit before grants fall to below 10 percent of GDP.

Fiscal policy also focuses on domestic resource mobilisation through tax policy reforms, strengthening tax administration and improving expenditure management. The set targets of revenue collection are expected to come from streamlining income tax, reducing tax exemptions and improving tax administration (particularly customs). On expenditure, the Government projected an improvement from 19.8 percent of GDP in 2002/03 to over 25 percent in 2006/07. This was necessitated by substantial increase in resources required to finance priority spending under the Poverty Reduction Strategy and a higher wage bill resulting from civil service reform.

Other reforms aimed at reducing rent seeking opportunities have been the introduction of Value Added Tax (VAT) and the introduction of tax payer identification numbers (TIN). In an effort to strengthen planning and budgeting process, financial control and accountability and enhance dialogue the Government introduced Public Expenditure Review (PER) process starting 1995/96. The PER process is instrumental for managing public resources and MTEF processes, and for giving policy and strategic guidance. The MTEFs are now covering all central ministries and departments and the performance Management System is gradually being applied to an increasing number of central ministries departments and agencies.

Concurrent with reforms aimed at containing the fiscal gap, the government started monetary and financial sector reforms in early 1990s. The reforms are to facilitate the attainment of macroeconomic stability, support structural adjustment in the real economy and provide effective support to the economy by financial deepening and diversification. The argument underlying the reforms is that with economic liberalization, an autonomous central bank can lead to more predictable monetary and exchange rate policies. Granting greater autonomy to the central bank is one of the important ways a government may use to signal investors that macroeconomic policy would be prudent and sound. Prior to these reforms (before 1993), Tanzania faced challenges of regulating money supply while at the same time pursuing expansionary fiscal policies. Unsustainability of the accommodating monetary policy led to huge inflation rates, high domestic debt and seigniorage tax on the part of Tanzanians.

The Bank of Tanzania (BOT) is committed to a prudent conduct of monetary policy that is capable of maintaining core inflation below 5 percent. The Bank uses indirect instruments to influence the level of money supply. The main instrument is the Open Market Operations (OMO) in which the Central Bank sells or buys Government securities, e.g. Treasury Bills, in order to influence the monetary base. Other indirect instruments include Foreign Exchange Market Operations (FEMO), the Discount Rate, Statutory Minimum Reserves (SMR), and Moral suasion.

Civil Service and Parastatal Sector Reforms

Civil service reforms started with the Civil Service Reform Programme (1993-1998). The reforms were mainly concerned with the rationalisation of government functions including downsizing government functions through disengagement from productive activities. The reforms sought to:

- Create semi autonomous agencies
- Rationalise employment through improved record management and staff reduction
- Address efficiency and accountability through process re-engineering
- Introduce modern technologies.
- Undertake pay reforms to address pay inadequacy. Pay inadequacy not only led to proliferation of individual allowances but also to laxity and corruption in the public service (Warioba, 1996).

The above measures have led to redefinition of government roles, privatisation or elimination of non-core activities, major retrenchments and promotion of public-private partnerships in service delivery. Furthermore, the civil service has developed a code of conduct, appointments and promotions are more transparent and competitive and wages and benefits are being improved to reduce the need for additional income. Procurement, distribution, revenue collection and customs procedures have been rationalised to improve transparency and accountability in the public sector.

The Public Service Reform Programme (2000-2011) which succeeded the Civil Service Reform Programme in 2000 is being implemented in three phases: i) Installation of Performance Management Systems (2000-2005), ii) Instituting Performance Management Culture (2005-2008) and iii) Instituting Quality Improvement Cycles (2008-2011). Notably, installation of Performance Management Systems in Central Ministries Departments and Agencies is aimed at improving quality, efficiency and effectiveness of service and performance throughout the public service on a continuous and sustainable basis. Local Government Reforms

As part of the emerging concerns for good governance as a prerequisite for sound development management, donor agencies are popularising and promoting the devolution of power to sub national governments (decentralisation). Decentralisation is expected to enhance opportunities for participation by placing more power and resources at a closer and easily influenced level of government. It is viewed as a first step towards creating regular and predictable opportunities for citizen's participation and local authorities' transparency and accountability in service delivery. This is expected to lead to improvement in the quality and availability of services provided by local government authorities.

The most recent decentralisation initiative (since 2000) in Tanzania aims at devolving political, administrative and fiscal powers from the central government to local government authorities. The initiative follows the principle of decentralisation-by-devolution (D-by-D). However, this is being implemented at a rather slow pace and with some difficulty (Egli and Zürcher, 2007).

In the implementation of the Civil Service Reform Programme, issues of decentralisation of governance and reform of Local Government Authorities (LGAs) were covered as components of the programme. However, they were later separated into a reform programme in its own right due to its importance and the complexities involved. The Local Government Reform agenda was started in 1996 with effective implementation commencing in 1999. A ministry for overseeing matters pertaining to the local government reform programme (PMO-RALG) was later established in 1998.

Investigation and Anti-Corruption Measures

Investigation and anti-corruption measures are an integral part of ensuring accountability. Corruption in the public or private sectors results in the misuse of scarce resources and greatly affects the entire economy. In the areas supported by external assistance, corruption can devalue the reputation and efforts of international development agencies. Combating corruption is therefore, a central objective of good governance.

In the past decade, the Tanzanian government has been committed to fighting corruption. Measures that are being taken to address the issue of corruption include:

- Investigating the root cause and extent of corruption. For example, through the presidential commission (Warioba Commission) against corruption (PCAC), an in-depth diagnostic study on the causes and extent of corruption in Tanzania was carried out in 1996.
- Involving all stakeholders in brainstorming, formulating and proposing the basic structures and content of the strategy, the National Anti Corruption Strategy and Action Plan (NACSAP) to combat corruption in the country.
- Enhancing political will in the fights against corruption.
- Developing sector specific action plans against corruption, setting up of priority areas to attack corruption and institutionalising a coordinating, evaluation and monitoring unit.
- Mainstreaming the fight against corruption with the ongoing reforms in the country.
- Developing and building capacities of institutions (oversight bodies) that are directly charged with the responsibility to combat corruption.

The Prevention of Corruption Bureau (PCB) and the office of the Controller and Auditor General (CAG) were recently restructured and given more powers and autonomy to fight corruption in Tanzania.

Financial Sector Reforms

Since 1986 Tanzania has undertaken financial sector reforms that have resulted in a diverse financial system and significant changes in financial and monetary indicators. The financial system comprises 21 banks, nine non-bank financial institutions, pension funds, two of which invest in financial assets, 14 insurance companies, 63 foreign

exchange bureaus, about 650 savings and credit cooperatives (SACCOs), several other micro-finance institutions (MFIs) and a stock exchange. Foreign equity participation accounts for about two-thirds of banking system capitalization and 57 percent of total banking assets are in banks majority owned by foreign banks.

Trade Policies and Institutions

The East African Community (EAC)

Reforms of trade policies have taken mainly place in the context of regional agreements, including SADC and EAC. Tanzania is a member of EAC (Kenya, Uganda and Tanzania). There are several existing commitments under the EAC five-year development strategy (2001-2005) that have had impact on the macroeconomic stability. There is a move to establish an East African Community Customs Union. The Customs Union Protocol focuses on the elimination of internal tariffs, application of rules of origin and the establishment of a three band structure of the common external tariff (with a minimum of 0 percent, a middle rate of 10 percent and a maximum rate of 25 percent) in respect of all products imported into East African Community. Tanzania adopted the Common External Tariff (CET) of the East African Community (EAC) in January 2005, lowering its average tariff from 13.8 to 12.3 percent. The lowering of the maximum tariff of the CET from the current 25 percent to 20 percent, as expected to happen in 5 years in accordance with the Customs Union Protocol, should help correct some of the dispersion of protection. On the export side, the main issue on the export side pertains to export taxes. International experience has shown that export taxes and bans have generally failed to achieve industrial development objectives, led to informal trade, and frequently hurt small-holders who receive lower prices as a result.

Tanzania joined the EAC customs union in January 2005. This entails making extra efforts to realign EAC agreements with those required under SADC. Moreover, the implementation of the EAC Investment Strategy which places high priority on infrastructure development should foster macroeconomic stability in the country. In particular, efforts that are underway to implement an EAC Power Master Plan and Road Network Project should improve these countries' infrastructure with positive impact on macroeconomic stability.

(b) New Partnership for African Development (NEPAD)

Tanzania is among African Union (AU) members that are committed to NEPAD's resolve to eliminate poverty and boost economic development on the continent. In addition, Tanzania is among the 15 African Union members that have signed the memorandum of understanding which opens up the country for assessment by the NEPAD Africa Peer Review Mechanism (APRM). The peer review mechanism is supposed to ensure transparency, good governance, respect of human rights and economic efficiency all with high impact on macroeconomic stability.

(c) African Growth and Opportunity Act (AGOA)

AGOA is a programme approved by the American Congress in 2000 to grant Sub-Saharan African countries an opportunity to access the US market on duty and quota free basis. Although Tanzania has not yet taken up the opportunity conferred by AGOA (partly due to supply side constraints), efforts are underway to rectify this situation. Measures that have been taken include keeping stakeholders informed on AGOA, provision of incentives to investors intending to produce for AGOA and the establishment of Export Processing Zones (EPZ) to encourage production for the export market, including AGOA. These measures have important bearing on macroeconomic stability, especially on the country's balance of trade as they take off.

Infrastructure: Energy and Transport Sub Sectors

The establishment of the executive agency TANROADS with responsibility for the trunk road network has been a major step forward for the transport sector. However, a clear separation of responsibility between the Ministry of Infrastructure Development, TANROADS and districts has not yet been implemented. This hampers effective road maintenance and development activities. The current formulation of a new Road Act provides an opportunity to establish a more appropriate policy and institutional framework and provide the basis for accelerated infrastructure development.

Detailed work on the restructuring of the power sector has been carried out but the implementation of the restructuring has been delayed.

Private Sector Development

Public Institutions Interface with the Private Sector is yet to be appreciated. Excessive red tape and government interference in private sector activities are one of the main constraints to private sector development in Tanzania. The government has started reviewing regulations focusing on removing obstacles and re-organizing government priorities. In practical terms this calls for:

- Harmonizing local government taxation to remove excessive tax burden on private enterprise
- Streamlining of work permit procedures
- Reviewing and amending licensing legislation to reduce the cost of business establishment and continuation
- Reviewing and revising export-import procedures to reduce time costs and corruption-related costs
- Designing and implementing a program for enhancing access to commercial courts by SMEs. Tanzania has reformed the legal framework for regulatory institutions that are currently being established.

Labour Market Policy Framework

The National Employment Policy unveiled in April 1997 is Tanzania's labour market policy. Its main task is to facilitate wage and non-wage employment of the labour-force. Out of a total population of about 34 million people, 14 million constitute the labour force of ages 15-64 years. Over 30 percent of the labour force is either unemployed or underemployed. The Poverty and Human Development Report (2003) confirmed that there are about 700,000 new job seekers annually in Tanzania, but the economy can only generate about 40,000 new jobs.

The labour policy has several strategies for reducing unemployment, increasing per capita incomes of

employees and facilitating the eradication of poverty. Among these are:

- Modernising industry and trade to increase its capacity for wage employment from the current (2004) level of 17% to 25% by 2007. This is to be achieved through emphasis on the use of science and technology, promoting industrial development and creating a more conducive environment for attracting private investment in industry and trade.
- Modernising agriculture through the use of appropriate technologies in order to increase the productivity of its labour force. Currently, agriculture employs nearly 80% of the country's labour force.
- To provide training and re-training of the labour force in order to improve its productivity and its competitiveness regionally and globally. In this regard, the country's education system from primary to tertiary levels is to be re-structured and made more relevant to solve domestic development problems and be more prepared for the challenges entailed by globalisation.
- To encourage self-employment in both rural and urban areas through facilitation of access to credit, business development and removal of bottlenecks especially those related to licensing and taxation.
- To promote youth and other disadvantaged labour force (women, persons with disabilities) through strengthening vocational training, expanding services for commercial training and creating a special fund for the purposes of covering costs and providing loans for self-employment activities.
- To provide technical skills and counselling to retrenched employees so that they can be re-employed elsewhere or become self-employed.

The labour policy recognises the important contribution of foreign experts in building the capacity of Tanzanians in fostering the development process. Investors can now employ five experts without permit. Additional employment of experts requires approval by the Ministry of Home Affairs or the Ministry of Labour and Youth Development. Where the skills required are available locally, priority is accorded to the local staff. In order to reduce 'brain drain' the civil service wages are to be made more attractive and competitive under the on-going civil service reform programme.

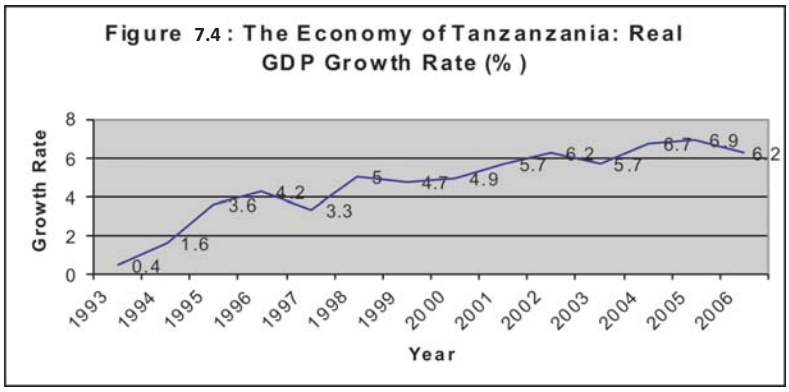
In terms of implementation of the policy, a National Employment Council (NEC) has been established under the chairmanship of the Office of the Vice President. The Ministry of Labour and Youth Development is responsible for co-ordination and facilitation aimed at creating a better environment for implementation of the labour policy. The Government has reviewed labour laws to ensure that they are more responsive to private sector needs and offer appropriate incentives for investors to create more jobs in the economy.

The new labour laws are in place already. The labour law reform was carried out with developmental objectives in mind. The reform sought to generally put in place policies and laws and regulatory structures that can promote good governance, poverty reduction, sound labour relations, labour productivity, job creation and employment promotion.

Macro policy changes and the environment macroeconomic performance

Judging from the various development strategies and policies Tanzania has implemented since independence, the country has been committed to fighting poverty and improving the well-being of her people. The economic performance was satisfactory during the first five years of independence in terms of both economic growth as well as meeting the basic needs of its citizens (see Limbu and Mashindano, 2001). Afterwards the country's economic management entailed some evident weaknesses which led to the late 1970s and early 1980s economic crisis.

Figure 7.4 : The Economy of Tanzanzania: Real GDP Growth Rate (%)



Despite evident weaknesses, Tanzania has progressed significantly in re-establishing macroeconomic stability with a steady GDP growth, falling inflation, falling interest rates, a stable exchange rate and falling government deficits (Kweka 2006). The average real GDP growth for example shows an upward trend from 3 percent in 1977 to 6.9 percent in 2005 before making a moderate decline to 6.5 percent in 2006 (See Figure 7.1).

Sound macro economic management has successfully brought down inflation from 35 percent in 1994 to approximately 4 percent in January 2005. The recent rise to about 9 percent is attributed to prolonged drought and the oil crisis that is currently sweeping the world. The impressive macroeconomic records and performance have led to an increase in the amount of aid and the number of donors operating in the country. Tanzania is among the major aid recipient in Africa. As pointed out earlier, to a larger extent this was possible due to the policies and development agenda pursued in the country.

SADC Macroeconomic Convergence Programme

The performance of Macroeconomic Indicators in Tanzania have been assessed using the SADC macroeconomic

Table 7.9 : Key Macroeconomic Convergence Stability Targets

Numeric Values of Target Indicators	2008	2012	2018
Core inflation	9%	5%	3%
Budget deficit as a percentage of GDP	5%	3%	1%
External debt as a percentage of GDP	60%	60%	60%
Current account deficit as a percentage of GDP	9%	9%	3%
Growth rate	7%	7%	7%
External reserves (import cover in months)	3	6	6
Central bank credit to Government	10%	5%	5%
Domestic savings	25%	30%	35%

Source: Mashindano *et al.* (2007)

Table 7.10: Other macroeconomic targets and variables

Indicator	Target
Central bank credit to Government	Less than 10% of previous year's tax revenue by 2008 and less than 5% by 2015
Increase in domestic investment level	At least 30%
Gradual interconnection of payments and clearing system in SADC	By 2008
Finalise the legal and regulatory framework for dual And cross listing of the regional stock exchange	By 2008
Liberalise exchange controls	
Liberalisation of Current account transactions between Member States	By 2006 and the capital account by 2010

Source: Mashindano et al (2007)

convergence programme where all the member countries are required to meet the targets set for 2008, 2012 and 2018. The main targets for macroeconomic convergence have been presented in Table 7.9 and Table 7.10 for reference.

Tanzania's macroeconomic stability indicators are within SADC target stability programme for inflation, budget deficit and current account deficit. Public debt is higher than target value and real growth is below target value (See Appendix 2). Other important indicators not included in the SADC MOU such as real growth and investment show improvement. However, the performance is far below that required to meet Tanzania's Development Vision 2025 or Millennium Development Goals 2015 for accelerated development and poverty alleviation.

Inflation

SADC macroeconomic convergence for inflation is to achieve a single digit level by 2008. Tanzania has sustained this level of convergence since 1999 (see Appendix 2).

Budget Deficit as a Ratio of GDP

The SADC macroeconomic convergence programme proposes a fiscal deficit to GDP ratio target of less than 5.0% to be attained between 2004 and 2008. As Appendix 2 indicates, fiscal deficit is within the SADC convergence programme if donor grants are included. However, exclusion of donor grants worsens fiscal deficit, which rises from 8.1% of GDP in 2003 to 9.9% in 2004. Greater mobilisation of domestic resources including reforming the tax policy and administration are essential if Tanzania is to attain convergence by 2008.

Ratio of Public and Publicly Guaranteed Debt to GDP

SADC macroeconomic convergence for public and publicly guaranteed debt is 60% of GDP. Tanzania's 2004 level for this variable was 81.4% of GDP (Appendix 1). Even after taking into account full debt relief under the Enhanced HIPC Initiative, Tanzania has a considerable task of achieving convergence in the future. However, external debt sustainability analysis conducted by the IMF at the HIPC Completion Point shows that Tanzania's external debt is sustainable in the medium term.

Current Account as a Percentage of GDP

SADC macroeconomic convergence target for this variable is set at a single digit level of 3% to 9% of GDP. Tanzania's balance of payments on current account for 2004 was 5.3% of GDP, which is within target stability programme. The deficit has improved from about 11.0% of GDP in 1998 to 5.3% in 2004. This is partly due to better performance in attracting foreign direct investment and improved exports related to minerals and non-traditional exports.

Other Macroeconomic Indicators

Other macroeconomic indicators not included in the SADC Memorandum of Understanding (MOU) include economic growth rates, foreign exchange reserves, central bank credit to Government, domestic savings rates and domestic investment rates. These indicators are briefly explained.

- ***Economic Growth Rates***

  Millennium Development Goal target for real growth is 7% to enable countries reduce poverty. Tanzania's Vision 2025 targets growth between 8-10% to achieve its development goals, including progressive reduction in poverty. As Appendix 2 indicates, real growth improved from 5.7% in 2003 to 6.7% in 2004. Tanzania is posed to achieve its growth targets if further improvements are made in macroeconomic management, fiscal management and attracting greater developmental-oriented foreign direct investment.

- ***Foreign Exchange Reserves***

  Tanzania has progressively improved its foreign

exchange reserves from about 2.4 months of imports in 1996 to nearly 8 months of imports in 2004. The good performance is attributed to improvements in the overall balance of payments. All main accounts improved during this period (current account, capital and financial accounts). If that level of reserves is maintained, these are considered adequate to cover Tanzania's requirements for imports of goods and services.

- ***Central Bank Credit to Government***

  Increasing external financing of the Government budget has enabled Tanzania to avoid recourse to domestic bank borrowing to finance its deficit. As Appendix 2 indicates, the net Bank of Tanzania credit to the Government has been maintained at less than 0.7% since 1997. The IMF Article IV Consultation Report for 2004 observes that the low net domestic financing is appropriate "in light of the comfortable domestic debt position".

- ***Domestic Savings Rates***

  The SADC RISDP has set domestic savings rates numerical target values of 25% of GDP by 2008, 30% by 2012 and 35% by 2018. As shown above, Tanzania's 2004 domestic savings rate was only 16.7% of GDP - about 8.3% below the 2008 target. The data for savings is obtained from World Bank reports and therefore comparable with other SADC countries because of the similar methodology used.

- ***Domestic Investment Rates***

  The SADC RISDP considers an investment to GDP ratio of at least 30% to be essential for achieving desired growth and attaining Millennium Goals of reducing poverty by half by 2015. As Appendix 2 shows, Tanzania's 2004 investment rate was only 19.9% of GDP about half of what is required under RISDP. The data is obtained from World Bank reports that are comparable with other SADC countries. The low investment rate is not consistent with levels required to reduce poverty and calls for Tanzania to improve further not only macroeconomic stability but also put in place a better environment for attracting greater foreign direct investment.

Conclusion and recommendations

According to the projections based on the 2000/01 Household Budget Survey, Tanzania is endowed with a variety of natural resources most of which have not been exploited fully. The natural resources include wildlife, minerals, water bodies, fish, land and forests. The potential and opportunities of these resources have not yet benefited the Tanzanian people despite the fact that massive exploitation is taking place. For instance, more than 30 foreign large scale companies are engaged in the mining sector. In fisheries, statistics show that more than 150 big foreign ships are harvesting fish in territorial water of Tanzania. Most of these ships undertake fishing illegally. Likewise, in the forest sector massive harvesting of the forest products particularly timber is taking place illegally.

The growing rate of exploitation of natural resources taking place in Tanzania is a response of economic agents and actors to the ongoing macroeconomic policy reforms and sectoral policy changes. As stated earlier, most of the forest products from Tanzania are exported to China, UAE and India. However, other destinations which also take significant share include Taiwan, Thailand, South Africa, Kenya, Europe (Germany, United Kingdom, and Italy) and USA.

Massive losses of revenue due to illegal logging are a huge lost opportunity for economic growth and self-reliance in Tanzania. Unrealised revenues are an evident threat to the sustainability of the forest resource and therefore sustainable development. Generally, poor governance, corrupt practices and low capacity to monitor logging have contributed to the losses.

On the other hand, a notable achievement has been made in terms of awareness creation and promotion of participatory forest management through Local Government Reform Programme (LGRP) and Forest Management Programmes, The general public is more aware today on their rights and obligations over their resource base than it used to be two decades back. Participatory Forest Management (PFM) uptake however is still very low.

Recommendations

In spite of negative impacts associated with implementation of macro and sectoral policies on deforestation, appropriate policy reforms can be made to minimize the impacts. Although trade liberalization policies in the forest sector have paved way for the establishment of a level ground play market, liberalization forces cannot guarantee sustainability in the forest sector.

Inevitably, immediate firm and strategic interventions are required to address the ailing conditions and malpractices in the forest sector. There is need to mobilize efforts to address forestry governance targeting transparency and accountability at all levels and all the activities in the sector. The issue of property rights, resource ownership and licensing procedure need to be clarified to adequately inform the respective personnel and the public at large.

Since the PFM uptake is still very low, efforts should be scaled up to promote Participatory Forest Management (PFM) through Community Based Forest Management (CBFM) and Joint Forest Management (JFM). For this to happen the Local Government Authorities (LGAs) must be empowered in terms of financial resources and competent human resources.

Resources need to strategically be scaled up towards capacity building of the Local Government Authorities to facilitate the ongoing decentralization process. At present, the LGas mandate to initiate and therefore implement its plans and strategies is limited. For example, the LGAs have limited power over companies investing in forestry largely because they are not part of the approval process, and therefore investors feel they don't have any obligation to the local authorities. All the major decisions are made by the Central Government. The gap between local authorities and investors has tended to deny the latter the power to

monitor and control the forest activities.

Similarly, the local authorities are not aware of the revenue collections from hunting blocks which are operating in their jurisdictions, because they don't have any mechanism in place to monitor such collections. LGAs need to demand more autonomy to be able to execute investment promotional duty adequately.

The current institutional framework for the forest sector encourages duplication of efforts and potential conflicts among key players. The institutional problems have significantly contributed to the problems observed in the sector. While in most cases the responsibility is referred to the central government, there are other institutions mainly the local government which also has interest in the forest sector but with varying objectives and restricted mandate. This institutional structure makes monitoring of the sector difficult especially when it comes to sustainable forest management.

References

Dalal-Clayton B. and S. Bass (2002): **Sustainable Development Strategies**, A Resource Book, Earthscan, London

BoT (Bank of Tanzania) (2002): Economic Bulletin for the Quarter Ending March, 2006, Vol XXXVII No. 5, Dar-es-Salaam

Egli, W and Zürcher, D (2007): The role of Civil Society in Decentralisation and Alleviating Poverty: An Exploratory case study from Tanzania, CIS Working Paper No 29, Swiss Federal Institute of Technology, Zurich

ESRF (Economic and Social Research Foundation) (2005): Moving Out of Poverty: Understanding Freedom, Democracy and Growth from the Bottom Up, A Draft Report Prepared for the Poverty Reduction and Economic Management Unit of the World bank, Dar-es-Salaam

ESRF (Economic and Social Research Foundation) (2006): African Peer Review Mechanism (APRM): Economic Governance and Management in Tanzania, A Report Submitted to the APRM Secretariat, Ministry of Planning, Economy and Empowerment, Dar-es-Salaam, Tanzania

ESRF (Economic and Social Research Foundation) (2008): Assessment of Tanzania Development Vision (TDV) 2025; The Report Presented at a Meeting of Permanent Secretaries of the Government of the United Republic of Tanzania on 24th January 2008, Mkapa Hall, Mbeya

ESRF (Economic and Social Research Foundation) (2008): Songosongo Island Social Economic Survey; The Report Submitted to PanAfrican Energy Tanzania Ltd (PAT) and Songas, ESRF, Dar-es-Salaam

Kahyarara G, W. Mbowe and O. Kimweri (2002): Poverty and Deforestation around the Gazetted Forests of the Coastal Belt of Tanzania, Research Report No 02.3, REPOA, Dar-es-Salaam

Kahyarara G, G. Nyamwihura, E. Mlelwa, R. Msuya and I Mchallo (2001): Country Draft Report on Environmental Impacts of Trade Liberalization in the Tanzania Forestry Sector, A draft report submitted to the Centre for Environmental Economics and Development Research, UNEP

Kulindwa K, O. Mashindano, F. Shechambo and H. Sosovele (2001a): Mining for Sustainable Development in Tanzania, Dar-es-Salaam: Dar-es-Salaam University Press

Kulindwa K, H. Sosovele and O. Mashindano (2001b): Tourism Growth for Sustainable Development in Tanzania, Dar-es-Salaam: Dar-es-Salaam University Press

Kweka J P (2006): The 2005 Poverty Status Report on MKUKUTA Cluster 1: Growth too Little for Poverty or Poverty too much for Growth? A Report Submitted to REPOA for the Research and Analysis Working Group (R&AWG), Dar-es-Salaam

Limbu F and Mashindano O (2001): "The Agricultural Sector and Poverty in Tanzania: The Impact and Future of the Reform Process" , in Mbelle A., Mjema, G and Kilindo, A. (eds); The Nyerere Legacy and Economic Policy Making in Tanzania, Dar-es-Salaam University Press, DSM

Mascarenhas, Adolfo (2004): Knowledge, Indigenous Knowledge, Peace and Development, Vol 3, Issue 1Sabinet Online Ltd

Mashindano, O. (2003): "Understanding Policy Analysis: Concept and Tools", A Paper Presented at a Training Workshop on Policy Analysis for Sustainable Development, Jambiani, Zanzibar.

Mashindano O. (1998): Constraints to Agricultural Sustainability in Tanzania: An Economic Analysis of the Case of Ruvuma Region, a Ph D Thesis, University of Dar-es-Salaam

Mashindano O., Rweyemamu D and Ngowi D (2007): Deepening Integration in SADC: Tanzania Torn between EAC and SADC; Economic and Social Research Foundation (ESRF) and Friedrich Ebert Stiftung (FES), Dar-es-Salaam

Mashindano O, Msambichaka L and Mwamba N (2006): Agriculture in Tanzania: Opportunities and Challenges of Globalization, A Paper presented to the Annual Agricultural and Livestock Training Conference organized by the Ministry of Agriculture, Food Security and Cooperatives (MAFC) at Ukiriguru Training Institute, Mwanze Region

Milledge S, I. Gelvas and A. Ahrends (2008): Forest Revenues and Governance in Logging in Tanzania, Key findings of a TRAFFIC Research Report presented at the ESRF Policy Dialogue Seminar, ESRF, Dar-es-Salaam

Musonda, F. (1992): Development Strategy and Manufactured Exports in Tanzania, Lund Economic Studies No. 52, CITY: Department of Economics, University of Lund, Sweden

Ndulu B. (1994): Tanzania's Economic Development, in Msambichaka et al, Development Challenges and Strategies for Tanzania: An Agenda for the 21st Century, Dar-es-Salaam: Dar-es-Salaam University Press

United Nations (1992): Agenda 21: Programme of Action for Sustainable Development, Rio Declaration on Environment and Development, Statement of Forest Principles, New York, United Nations Organization

URT (United Republic of Tanzania) (1994): TANZANIA: National Environmental Action Plan (NEAP): A First Step, Ministry of Tourism, Natural Resources and Environment, Dar-es-Salaam

URT (United Republic of Tanzania) (2008): Speech by the Minister for Finance Hon. Mustafa Haidi Mkulo (MP) Introducing to the National Assembly the Estimates of Government Revenue and Expenditure for the Financial year 2008/09 2010/11, Dar-es-Salaam

URT (United Republic of Tanzania) (2006): Agricultural Sector Review (ASR): Performance, Issues and Options: Main Report Vol II, October 2006, Ministry of Agriculture, Food Security and Cooperatives, Dar-es-Salaam

URT (United Republic of Tanzania) (2007a): Poverty and Human Development Report 2005, Mkuki na Nyota Publishers, Dar-es-Salaam, Tanzania

URT (United Republic of Tanzania) (2002a): Household Budget Survey 200/01, Ministry of Planning, Economy and Empowerment, Dar-es-Salaam, Tanzania

URT (United Republic of Tanzania) (1998a) "A Local Government Reform Policy Paper": President's Office, Regional Administration and Local Government, Dar es Salaam

URT (United Republic of Tanzania) (1998b) The National Poverty Eradication Strategy: Vice President's Office, Dar es Salaam

References

URT (United Republic of Tanzania) (2002b): National Water Policy, 2002: Ministry of Water and Livestock Development, Dar es Salaam

URT (United Republic of Tanzania) (2005a): National Strategy for Growth and Reduction of Poverty (NSGRP): Vice President's Office, Poverty Eradication Department, Dar es Salaam

URT (United Republic of Tanzania) (2006a): Participatory Forestry Management in Tanzania: Facts and Figures, Extension and Publicity Unit, Forestry and Beekeeping Division, Ministry of Natural Resources and Tourism.

URT (United Republic of Tanzania) (1997b): "National Agricultural and Livestock Policy, 1997", Ministry of Agriculture and Food Security (MAFS), Dar-es-Salaam.

URT (United Republic of Tanzania) (1995): "The National Land Policy, 1995", Ministry of Lands and Human Settlements (MLHS), Dar-es-Salaam.

URT (United Republic of Tanzania) (2003): "The National Energy Policy of 2003", Ministry of Energy and Minerals (MEM), Dar-es-Salaam.

URT (United Republic of Tanzania) (1997c): "The National Employment Policy of 1997". Ministry of Labour, Dar-es-Salaam.

URT (United Republic of Tanzania) (1998c): "The National Forestry Policy of 1998", Ministry of Natural Resources and Tourism, Dar-es-Salaam.

URT (United Republic of Tanzania) (2002c): "The National Environmental Policy of 2002", Vice President's Office, Dar-es-Salaam.

URT (United Republic of Tanzania) (2001a): "Agricultural Sector Development Strategy (ASDS)", Ministry of Agriculture and Food Security (MAFS), Dar-es-Salaam.

URT (United Republic of Tanzania) (2001b): "Agricultural Sector Development Programme (ASDP)", Ministry of Agriculture and Food Security (MAFS), Dar-es-Salaam.

URT (United Republic of Tanzania) (1983): "The Agricultura Policy of Tanzania", Ministry of Agriculture and Food Security (MAFS), Dar-es-Salaam.

URT (United Republic of Tanzania) (2005b): Tanzania: Diagnostic Trade Integration Study, Vol 2, Ministry of Industry, Trade and Marketing, Dar-es-Salaam

URT (United Republic of Tanzania) (2002d): "OECD/DAC Developing Country Dialogues on National Strategies for Sustainable Development", Status Review Workshop Report, President's Office Planning and Privatization (PO-PP), Dar-es-Salaam.

(URT) United Republic of Tanzania (2007d): **National Forest and Beekeeping Programme Joint Sector Review Report**, Ministry of Natural Resource and Tourism, Forest and Beekeeping Division, **Dar-es-Salaam**

WCED (World Commission on Environment and Development) (1987): Our Common Future, New York, Oxford University Press

UGANDA

THE IMPACT OF MACRO POLICIES ON DEFORESTATION

By Emmanuel Kasimbazi

Introduction

According to the National Forestry Authority (NFA), forests and woodlands cover a total of approximately 4.9 million hectares, about 24% of the total land area of Uganda. Of the total forest area, 70% is on private land, while 30% is in the Permanent Forest Estate (PFE) as some form of protected area, such as Forest Reserves (central and local), National Parks and Wildlife Reserves. Of the PFE's 1,881,000 ha, 1,145,000 ha (60.9%), is managed by the National Forestry Authority (NFA) as central forest reserves, 5,000 ha (0.3%) are controlled by Local Governments (LG) as local forest reserves and 731,000 ha (38.8%) are managed by the Uganda Wildlife Authority (UWA). Within the PFE currently 78% (1,468,000 ha) is under forests and woodland, while the rest is mainly grassland. Of UWA's protected areas, only 39% is covered with forests or woodlands, and it is only these that are counted as part of the PFE, whereas all the NFA's reserves (of which 64% is forest) are included due to different classification methods. Of the protected areas under forest, the NFA manages 50% (737,000 ha), and UWA manages the remaining 50% (731,000 ha). Most private forests are woodlands. The largest part of the Tropical High Forest (38%) is held under private and customary tenure.

Uganda has two types of forests namely; natural forests and planted forests. Natural forests are categorised into tropical moist forests (TMFs) which cover approximately 320,000 hectares, the Savannah Woodland/Bushland forests (SWFs) covering approximately 521,000 hectares and other types including the wetlands, grasslands and built up areas covering approximately 329,000 hectares. The natural forests have a total of approximately 1,170,000 hectares. The second type of forests is the planted forests covering approximately 30,000 hectares.

The forest estate in Uganda in both protected forest areas and on private land is increasingly shrinking as a result of deforestation yet forests are the backbone in the three pillars of sustainable development namely, the economy, society and the environment. The Food and Agricultural Organisation (FAO) in 2000 estimated the deforestation rate in Uganda to be about 0.9% per year based on the change in the amount of bush land and woodlands from 1990 to 1995. According to the Ministry of Agriculture and the World Bank, the rate of land clearance range from 70,000 ha to 200,000 ha. These figures imply annual deforestation rates of between 1% and 3%, respectively.

The main hydrological feature of Uganda is the extensive interconnected system of the Equatorial lakes forming the upper part of the White Nile. Lake Victoria which drains a total area of 190,000 square kilometres in Rwanda, Burundi, Tanzania, Kenya and the entire southern part of Uganda, has its outlet close to Jinja passing the Owen Falls Dam, the water flow through the Victoria Nile into Lake Kyoga subsequently into the northern end of Lake Albert. The other branch of the Lake system that is Lake George and Lake Edward is connected via the Semliki River which flows into Lake Albert in the Southern end. From Lake Albert the Albert Nile flows towards the Sudan. Thus the whole Ugandan territory is situated entirely within the Nile Basin. Therefore deforestation in Uganda would affect the Nile Basin system.

A number of factors underlie the deforestation trends in Uganda. The Uganda government has been advocating for economic development independent of other policies that would ensure its sustainability. There has generally been a failure on the part of the government to reconcile the vision for Uganda's forests within the context of its economic development efforts. Sustainable development requires that all macro policies be considered in all development aspects. This approach will create a conducive environment for the protection of natural resources such as forests.

THE MAJOR CAUSES OF DEFORESTATION IN UGANDA

Increases in Human Needs

Deforestation is influenced by the increase in human needs. The population growth in Uganda is estimated at 3.3 per cent which leads to an increase in the demand for land, food and energy. About 90% of the total population who live in rural areas directly depend on agriculture and this leads to encroachment on forest land for agriculture. This population also depends on firewood for their energy needs, and a big fraction of the urban dwellers depend on charcoal. In general, about 92% of Uganda's source of energy is wood fuel which means that more pressure will be put on forestry resources. Seasonal burning for fresh pasture in the rangelands of Karamoja/Teso, Mbarara/Ntungamo, and Masindi/Nakasongora areas is also another factor contributing to deforestation in these areas.

Flawed policy and legal framework

Deforestation can also be attributed to inadequate policy and legislation. Some policies and laws do not promote conservation of forestry resources. There are policy deficiencies relating to the private sector and the local communities over land tenure, access rights and responsibilities for resources management.

Most of the pieces of legislation are technically unrealistic and prescribe activities, procedures and institutional arrangements which are not matched by adequate financial and human resources in government and civil society. These pieces of legislation are perceived as unfair and socially

unacceptable. For instance they fail to provide adequate forest fire control measures that cause the seasonal burning for fresh pasture in the rangelands of Karamoja/Teso, Mbarara/Ntungamo, and Masindi/Nakasongora areas. In some cases, the laws are inconsistent or conflicting with other bodies of legislation. This causes uncoordinated and poor implementation of these laws. This is combined with lack of public participation in law design and forest-related decision-making processes leading to long-term adverse social, economic and environmental impacts, including increased levels of illegal forest operations.

There are legislative provisions that exceed national capacities for implementation. For example, at the district level there is only one forestry officer and ranger. Some provisions exceed what is necessary to achieve reasonable and legitimate objectives. Provisions also exceed what is socially acceptable.

Poor implementation/enforcement capacity

Many forest laws are not utilized or are under-utilized due to lack of political will, weak institutional capacity, corruption, overall disregard for the rule of law and so on. Uganda still lacks the necessary human, financial and managerial capacity to effectively ensure forestry law compliance. This gap leads to a greater inclination to engage in forestry illegal activities, as the probability of being detected and punished is low.

Urbanization and Industrial Growth

Urbanization and industrial growth are also putting pressure on forestry resources. Many urban and peri-urban reserves are under threat of being degazetted. The increasing demand for industrial land has led to the degazetting of nearly 10,000 ha, which will result in a permanent net reduction of the forest estate unless alternative non-forested areas are identified and developed. The most affected forest reserves are those close to the urban and industrial centers, for example Namanve forest near Kampala, butamira forest and Mabira forest

Lack of information about the forest resource and illegal operations

Successful strategies to improve law enforcement rely on a solid knowledge of the resource base and its utilization, which Uganda does not possess. Forest inventories and forest management plans are either inadequate or non-existent. Many forests are located in remote and inaccessible areas, making monitoring difficult. The Ugandan government and institutions responsible for managing forests often make uninformed decisions when granting timber harvesting licences without adequate knowledge of the forest resource's sustainable yield. Without adequate data, it is difficult to judge the extent of illegal timber harvesting.

Lack of accurate information also makes it difficult to identify and monitor the occurrence and evolution of illegal acts. Forestry officers have little knowledge of how to gather and preserve evidence against illegal operators and judicial officers are seldom familiar with forest related crimes which makes it difficult to prosecute forest offenders. Even when information is available, it is often not used efficiently and/or shared among the relevant government agencies and stakeholders.

Corruption and lack of transparency

Many deforestation activities are associated with corruption. Corruption is a complex social, political and economic phenomenon. Corruption in the forest sector involves acts such as payment of bribes to government officials and politicians for preferential treatment. For example, award of a procurement contract, or timber licences; financial extortion by officials from operators to artificially legalize illegal operations like transportation permits, harvesting licences, forest land use conversion; official decisions that favour certain groups for instance when allocating timber harvesting licences with the tacit understanding that the group will eventually repay the favour. Persons engaged in timber harvesting evade complying with laws with relative impunity due to the protection by powerful patrons in government.

Wars and Violence

Wars and violence place a major direct and indirect burden upon forest resources. Military warfare in Uganda has contributed much to deforestation. Uganda has had a turbulent history and sometimes guerrilla groups launch their attacks from forests and woodlands. This has led to poor management of forests and in the past, clearance of some forest in search of rebels. To-date rebels have occupied Rwenzori Mountains in Uganda since 1997. This has prevented any meaningful conservation activity.

Severity and extent of deforestation in Uganda

According to the NFA, deforestation is eminent in Uganda considering the reduction of forest cover from the pre-colonial days to present. Forest clearance for agriculture in south-western Uganda montane forests is thought to have begun some 2,200 years ago with arrival of Bantu-speaking peoples who had iron-smelting technology. These ethnic groups encountered the Batwa (pygmies) people, who traded forest products for food, a scenario that initiated accelerated deforestation. In the last 100 years, Uganda's forests have faced severe pressures mainly from agricultural conversion as a result of population increase, urban demand for charcoal, over grazing, uncontrolled timber harvesting and policy failures.

The forestry cover has shrunk from 45% in 1890 to the present 20.3 % of the total land area in Uganda. The country lost an average of 86,400 hectares of forest or 2.1 percent of its forest cover per year between 2000 and 2005. On a generational time scale, Uganda lost 26.3 percent of its forest cover (1.3 million hectares) between 1990 and 2005 and deforestation continues today at a rate of 2.2 percent per year. The annual cost of deforestation in Uganda has been conservatively estimated at US$ 3.8 5.7 million per year.

Uganda could lose all its forest cover in 50 years if the current rate of destruction is not reversed, thereby upsetting the ecosystem and exposing the country to

further environmental degradation. Forests and trees have been cut at rates that exceed sustainable levels; characterized by the prevention of forest regeneration by grazing and fires. Many urban and peri-urban forest reserves are also under threat of degazettement for industrial development and housing.

In south western Uganda, the results of deforestation mapping show that the highest level of deforestation is located in the northern part of the protected area network, around Bugoma, Budongo, and Kagombé forests. The greatest amount of forest loss for Bugoma is located 2 and 3 km from the protected area limit and is associated with large-scale farming. Kalinzu has the least disturbance in terms of conversion to agricultural land, but forest degradation associated with mechanized logging is evident. The majority of forest loss is located immediately outside of the protected area, indicating that deforestation is approaching protected areas. However, the uncertainty as to the protected area boundaries indicates that deforestation could be occurring inside the protected areas.

The trend of deforestation has a number of implications on Uganda and the Nile Basin. Deforestation has adversely affected biological diversity. Uganda is home to more than 5,000 plant species, 345 species of mammals, and 1,015 types of birds. The animal species are threatened due to loss of wildlife habitats and degradation of watershed areas is leading to deterioration of the quality of life and reduction of the options for development. The gorillas of the Bwindi Impenetrable National Park are under threat of extinction through habitat loss and disease brought about by the increasing proximity of humans resulting from the opening up of roads in forests, hunting and tourism. Loss of habitat combined with an increase in diseases is potentially disastrous for such a small population of gorillas.

The current rate of deforestation is causing environmental-related problems in some parts of Uganda. Regions that used to be cold and malaria-free have experienced rising temperatures, providing conditions for the spread of disease. Areas like the southwest in Kabale, which had been cold, are losing 0.3^{o}C of their minimum temperature every 10 years.

Deforestation affects the amount of water in the soil and groundwater. Shrinking forest cover lessens the landscape's capacity to intercept, retain and transport precipitation. Instead of trapping precipitation, which then percolates to groundwater systems, deforested areas become sources of surface water runoff, which moves much faster than subsurface flows. That quicker transport of surface water can translate into flash flooding and more localized floods than would occur with the forest cover.

Other effects of deforestation include: increased soil erosion and loss of soil fertility especially in areas of Kabale, Mbale and Moroto; and wood deficiency leading to increased dependency on costly imports. Deficiency in fuel wood also forces people to walk further and spend longer in search of wood to meet their daily requirements.

To other Nile Basin countries, the effects of deforestation in Uganda can also be seen. Forests play an important part in the greater natural cycles that make and affect the weather and that clean the air in our atmosphere. They keep the hydrological cycle healthy by putting water back into the atmosphere through transpiration, making clouds and rain. They also capture carbon dioxide produced by the burning of fossil fuels from the atmosphere, replacing it with oxygen and thus reducing the risk of global warming. The massive deforestation in Uganda means that these important functions cannot be carried out. The result is less rain, higher temperatures, and more severe weather patterns in the Nile Basin region. This too affects the water levels of the Nile due to increased evaporation as a result of high temperatures and low rainfall.

Macro and Sectoral Policies and legal framework

Vision 2025

Uganda has enshrined her vision for development within the first quarter of the 21st Century in a document popularly known as the Vision 2025. The Government Vision 2025 is a long-term national development perspective, which aims at achieving a Uganda with *"prosperous people, harmonious nation and beautiful country."* Vision 2025 embodies three elements of national development which are: sustainability, conservation and regeneration of both man-made and natural capital. One strategic issue recognized in this vision is how to ensure that resource use and development activities sustain and enhance environmental quality. The Vision has a section on forestry resources and it identifies deforestation as one of the key issues in forest management which is a major form of land degradation. The identified causes of deforestation are conversion of forestry land for agricultural purposes as a result of both population increase and commercial agricultural expansion, urban demand for charcoal and policy failures.

The National Environment Action Plan for Uganda (NEAP) (1995)

NEAP provides a framework for addressing environmental problems as well as a strategy for integrating environmental concerns into the national socio-economic planning and development processes. It presents practical solutions and options in the areas of policy, legislation, institutional reforms and new investments with the view of promoting sustainable social-economic development by changing people's ways of utilizing and conserving natural resources. It recognizes that soil erosion and land degradation are highly pronounced particularly in the highland areas and increased soil erosion is largely due to deforestation in the water sheds and inappropriate farming methods which do not follow soil erosion control measures. It also recognised that deforestation is widely spread in the country and it is caused by encroachment, energy demands and pit sawing. This Plan was the background to the development of the current environmental policies and laws in Uganda.

One major weakness of this plan is that it does not recognize industrial development as a cause of deforestation as a result it never addressed it and yet it has been a recent cause of deforestation.

Poverty Eradication Action Plan (PEAP) (2004/5-2007/8)

The PEAP provides an over-arching framework to guide public action to eradicate poverty. The PEAP is grouped under five pillars namely: economic management,

production, competitiveness and incomes; security, conflict-resolution and disaster-management; good governance; and human development. The PEAP recognizes that there are serious signs of declining soil fertility and deforestation in Uganda. It provides that to meet these challenges, Government will develop a sector-wide approach for the Environment and Natural Resources (ENR) sector.

The PEAP provides that there is an urgent need to reduce deforestation, since distances walked to fetch fuel wood are increasing and the number of trees is shrinking causing negative impacts on women's time, and posing serious threat to the livelihoods of some poor forest residents. It suggests that the National Forest Authority should encourage private participation in forestry while protecting central forest reserves. It also recommends that district and community forests need to be supported. It further recommends that the district forest services need to be supported to promote pilot community forest initiatives.

This Plan recognizes important aspects of controlling deforestation both at local and national levels in the forestry sector. However, limited financial resources especially at the district levels have hampered the implementation of this plan. Therefore whereas PEAP recognised the urgent need to reduce deforestation, it may not have achieved its objective due to the above identified limitation.

Uganda Forestry Nature Conservation Master Plan (2002)

This is a sectoral plan for forestry development in Uganda. Its vision is to achieve a sufficiently forested, ecologically stable and economically prosperous Uganda. The goal of the plan is to have an integrated forest sector that achieves sustainable increase in economic, social and environmental benefits from forests and trees by all the people of Uganda, especially the poor and vulnerable. The Master Plan provides a framework for implementing the Forestry Policy. It describes the long term vision for the forest sector and the reforms needed in its leading institutions. It also includes an investment program based on a series of activities and measurable outputs. It is a rolling plan that is regularly reviewed to fit into the Medium Term Expenditure Framework (MTEF) and the budget cycle of the Ministry of Finance, Planning and Economic Development.

The Plan provides that the forests and trees provide agricultural support and environmental services in ways that are taken for granted or poorly understood. It states that a regular supply of clean water and soil fertilization are major services provided by forests and trees which are especially important to the poor, as they cannot afford alternatives such as piped water or fertilizers.

It recognizes that the forest cover in Uganda has halved during the past century and currently is shrinking at a rate of 55,000 ha per year. It provides that the combined effects of deforestation and high consumption result in an accelerating imbalance between national demand and supply of forest products. It further provides that Uganda moved into a net national wood fuel deficit in the year 2000 and that this decline will particularly affect the poorest Ugandans who are least able to respond to shortages, choose alternative livelihoods or accommodate the loss of natural assets and safety nets.

The plan outlines the major factors leading to the loss of forest cover and forest degradation to include conversion of forests into agricultural and grazing land; and over harvesting forests for firewood, charcoal, timber and non-wood forest products. It highlights market failures or institutional failures as the major causes of these factors.

The plan requires, among other things, legal provisions requiring local communities to receive benefits or revenue derives from conservation of forests. The Plan also requires enactment of legislation to control pollution, pesticide and arboricid use and charcoal burning in natural forests. These requirements have not been expressly incorporated into the Forestry and Tree Planting Act for effective control of deforestation.

Environment and Natural Resources Sector Investment Plan (2007)

This is a strategic document which seeks to provide a framework for investment in environment and natural resources. It provides a sound basis for integration into a sector wide planning framework to facilitate, mobilize and allocate funds in priority areas of the environment. It identifies the contribution of the forestry sector to the economy and its key constraints. Some of the constraints identified include: insecure and poor awareness of land and tree tenure regulations, insufficient high quality tree seeds and planting stock of appropriate species, lack of accessible technical advice, culture and gender constrains, insufficient mechanisms for control of problem animals, insufficient processing technology, poor market structure, lack of private sector support and inequitable distribution of forest reserves benefits to local stakeholders. Some of the targets of the plan include security of land tenure or ownership, sustainable harnessing or use of natural resources so as to improve the ability of forests and trees to yield increases in economic, social and environmental benefits for all people especially the poor and vulnerable now and in future generations.

The plan provides investment and resource requirements which include financing through private sector such as debt for nature swap, carbon credits which are fundamental for controlling deforestation. This plan provides a budget for the support of ENR investment plan to the year 2018. However, it does not specify the sources of the money to invest in ENR

Plan for Modernization of Agriculture (PMA)

The Plan for Modernisation of Agriculture (PMA) is a holistic, strategic framework for eradicating poverty through multi-sectoral interventions enabling the people to improve their livelihoods in a sustainable manner. It is an outcome-focused set of principles upon which sectoral and inter-sectoral policies and investment plans can be developed at both the central and local Government levels. The mission of the PMA is *"eradicating poverty by transforming subsistence agriculture to commercial agriculture".* The Plan provides that the government's main objective in the modernisation of agriculture include: soil fertility management, water conservation and environmental protection; formulation of a land use policy and implementation of the land Act; and development of

technologies for soil fertility management, water conservation and Environmental protection. It recommends the establishment of NAADS which is intended to among other things enhance the traditional advice on productivity by enhancing technologies and soil conservation, knowledge and skills development. The plan provides that Natural resources must be used and managed in a manner that ensures their availability to both present and future generations. It identifies key natural resources to include land, water, forestry, wetlands and environment. It recognizes that Agro-forestry will be among the mainstream activities of the agricultural advisory services and agricultural education curricula.

The provisions of this plan were incorporated in the NAADS programme, however PMA has not been effective due to less effective supervision and lack of coordination with all stakeholders.

The National Agricultural Advisory Services (NAADS) Programme

This programme was formed from the need to empower farmers particularly the poor and women to demand and control agricultural extension services. The mission of NAADS is to increase farmers' access to information, knowledge and technology for profitable agricultural production. NAADS also addresses poverty eradication, gender and sustainable natural resource management. It is envisioned to become a decentralized, farmers owned and private sector serviced extension system contributing to the realization of the agricultural sector development objectives. NAADS is part of the PMA. The National Environment Management Policy for Uganda (1994) mandates MAAIF to promote farming systems and land-use practices that conserve and enhance land productivity in an environmentally sustainable manner.

NAADS was established by the National Agricultural Advisory Services Act of 2001 with the main objective of promoting food security, nutrition and household incomes through increased productivity and market oriented farming and empowering all farmers to access and utilise contracted agricultural advisory services through promoting farmer groups to develop capacity to manage farming enterprises.

The major functions of the NAADS are to contribute to the modernisation of agricultural sector in order to increase total factor productivity of both land and labour for the benefit of the farmers. NAADS has increased the attention paid to environmental concerns in agricultural extension, research and training work.

One of the guiding principles of NAADS is to the manage natural resource productivity. In light of this principle, specific roles of NAADS include integrating environmental concerns in agricultural extension, research and training; mitigating the negative impacts of agriculture on the environment and forest resources; and mitigating the impact of agrochemicals (fertilizers, pesticides) on environment.

The NAADS programme can be an avenue for agro forestry and integration of forestry protection in agricultural extension. The main challenge of implementing the NAADS Program has been supervision and lack of coordination with stakeholders of the NAADS activities. Further, there has been limited expertise at sub county procurement committees which are supposed to award contracts to farmer groups. These challenges would obviously not assist in using NAADS to control agro forestry projects.

Uganda's Medium-Term Expenditure Framework (MTEF)

The Government of Uganda has been operating a Medium-Term Expenditure Framework (MTEF) since 1997/1998. The MTEF is a three-year rolling plan that sets out past performance, the budget for the current financial year, and the projected resources for the following two years. The MTEF guides all public expenditure decisions, including the use of resources committed by donors, so that consistency with Government priorities can be ensured. Under the MTEF, resources are allocated according to Government priorities and on the basis of sectoral Budget Framework Papers (BFP) and Local Government Budget Framework Papers (LG-BFP). The BFPs, which are increasingly being developed using a sector-wide approach to planning (SWAP), set out sectoral priorities, sector resource requirements, and the sectors' comprehensive development plans.

Sectoral BFPs are evaluated by the Poverty Eradication Working Group (PEWG), which scrutinizes the extent to which sectoral plans address key poverty relevant issues, such as geographical inequality and empowerment. The PEWG is also mandated to scrutinize sectoral BFPs regarding the extent to which they address environmental considerations. In order to take forward this mandate, the PEWG developed draft guidelines for integrating environmental concerns into BFPs used by BFP sector working groups starting with the 2003/04-budget cycle. This framework could be used to increase the budget for managing natural resources such as forests which would be an avenue for controlling deforestation. However the funds allocated for natural resources management are very low in the National Budget.

Uganda's Sector Wide Action Plans (SWAPs)

A Sector Wide Approach Plan is where all significant sector investments are channeled towards the same objectives following a consistent strategy that is guided by a consolidated investment plan. These Plans are harmonized sub-sector statements of development intentions in a particular sector. The SWAP allows development partners to contribute to a national programme of development instead of piecemeal project specific development. They also increase donor coordination and reduce the likelihood of overlapping and duplication of initiatives.

SWAPs by their sector-wide nature enhance synergies across sectors as much as possible and minimize conflicts and duplication of effort. SWAPs are designed to develop a comprehensive, nationwide framework of objectives and priorities, according to which all public expenditures to a sector can be channeled and allocated.

SWAPS are useful in mainstreaming priority areas for natural resources management such as forests. The main challenge facing SWAPS is the change of membership of the SWAP committees which may affect consistency in dealing with urgent issues such as deforestation.

Policy Framework

The National Environment Management Policy for Uganda (NEMP) (1994)

The National Environment Management Policy (NEMP) is an output of the National Environment Action Plan (NEAP) process. The overall policy goal is to establish sustainable social and economic development, which maintains or enhances environmental quality and resource productivity on a long- term basis that meets the needs of the present generations without compromising the ability of future generations to meet their own needs.

This policy sets out the objectives and key principles of environment management, providing a broad framework for harmonization of sectoral and cross- sectoral policy objectives. It was on the basis of the policy that a comprehensive environmental legal and institutional framework was designed. The policy created new capacity building needs in environmental planning, information generation and dissemination, and the use of environmental tools in managing the environment. The policy also set the agenda for decentralized environmental management in Uganda. The principles of the policy were incorporated in the National Environment Act.

The policy recognizes that although Uganda is endowed with a rich diversity of forestry resources, these resources are highly threatened by over-exploitation and inadequate implementation of policies and laws. The objectives of the policy in relation to forestry resources are: to manage sustainable forest resources in protected areas, public and private land; and to promote increased production by the private sector and the communities.

The guiding principles of the policy are: Uganda's forests provide a wide range of environmental services and values such as the amelioration of climate, stabilization of soils etc., which are critical to national development; the role of the Forestry Department should continue to be supervisory and regulatory; local community involvement in the planning and management of Protected Areas and in the sharing of benefits derived from these is crucial for the conservation of the forest resources; multi-sectoral collaboration is necessary in both the classification and management of all levels of protection in the Protected Area system; and private forestry should be encouraged by appropriate incentives, extension services, marketing assistance and increased security of land and tree tenure. These principles have been incorporated in the National Environment Act and the National Forestry and Tree Planting Act.

There are still some gaps in implementing the Policy as far as deforestation is concerned: The major ones include:

- Whereas a substantial number of people are willing to take on agro forestry, the seedlings are still too expensive. If the seedlings are distributed for free or at subsided cost to the local communities, private forestry would be encouraged.
- The policy also emphasizes local community participation in the management of the forestry resources. However, it is noted that individuals at the local community level often lack technical information and skills relevant in the management of forestry resources and there are frequently few or no local institutions through which they can participate actively in decision-making about forest resource management.

The Uganda Forestry Policy

The objective of the Uganda Forestry Policy is to establish an integrated forest sector that achieves sustainable increases in the economic, social and environmental benefits from forests and trees by the people of Uganda, especially the poor and vulnerable. The policy provides for the protection of Permanent Forest Estate (PRE) under government trusteeship and the development and sustainable management of natural forest on private land. This is aimed at promoting profitable and productive forests. The policy provides a wider cross section of stakeholders' participation in the management of the forest estate. These include local government, the private sector, local communities and farmers in the conservation and sustainable use of forest biodiversity.

The Forestry Policy is the main policy dealing with forestry management in Uganda. As a result it lays a number of guiding principles in forestry resources management. For instance, that Uganda's forests should be managed to meet the needs of this generation without compromising the rights of future generations; the improvement of livelihoods should be a major goal in all the strategies and actions for the development of the forest sector so as to contribute to poverty eradication; and forest sector development should safeguard the nation's biodiversity and environmental services through effective conservation strategies.

The policy also emphasizes partnerships in governance of forestry resources. New institutional relationships should enhance efficiency, transparency, accountability and professionalism, and build confidence in all forest stakeholders. The central government should withdraw from activities that can be carried out more effectively by the private sector or other stakeholders, but develop core functions of policy development and regulation; more forest resources should be managed through devolved responsibility wherever practical and advisable; the public's participation in the management of the country's forests should be actively encouraged; the NGOs/CBOs should be encouraged to strengthen the civil society, to build the capacity and grassroots participation and to help develop the rights and responsibilities of forest users.

The forestry policy requires government to promote the sustainable management of natural forests on private lands. Within the context of wider integrated land use and expanding agricultural needs, these private forests are to be managed for the sustainable production of forest resources. In this respect, the policy lays down a number of strategies for its implementation, for instance: raise awareness of the ownership of forests and trees on private land; encourage owners to set aside private forests as permanent forest land; investigate options for economic, social and cultural incentives to encourage private owners to maintain and manage natural forests; develop capacity of institutions such as local governments, traditional institutions and user groups and to sustainably manage private forests; develop capacity of individuals including forest owners, women's and youth groups, to support the

management of private forests and integrate trees into farming systems; encourage NGOs and CBOs to support private forest management; explore and promote options for management by owners themselves, with advice and assistance from relevant service providers; encourage the development of management plans for all private forests. These will promote best practice in the sustainable management of forest resources; review the Reserved Species regulations; and monitor the protection of private forests from alien species, pests and diseases.

The policy also calls for innovative mechanisms for the supply of high quality tree seed and improved planting stock. The policy requires the Ministry responsible for forestry to promote the development of adequate supplies of high quality tree seeds and improved planting stock to meet the needs of small-scale farmers and large-scale commercial tree growers. The private sector has a major role to play in the collection and distribution of tree seeds and planting stock. The government will help to build capacity in the private sector to enable effective seed supply and marketing, and develop mechanisms to ensure high standards and quality control. The Policy also requires government to promote the rehabilitation and conservation of forests that protect the soil and water in the country's key watersheds and river systems.

Overall, this is a modern and good policy that would curb deforestation. However, its implementation is limited by lack adequate capacity and funding for the implementation activities especially at the local levels.

Water Policy (1999)

Objective of the water policy is to manage and develop the water resources of Uganda in an integrated and sustainable manner, so as to secure and provide water of adequate quantity and quality for all social and economic needs of the present and future generations with the full participation of all stakeholders. The policy recognizes that Uganda's freshwater is a key strategic resource, vital for sustaining life, promoting development and maintaining the environment. It also recognizes that increasing population pressure leads to deforestation, drainage of wetlands, overgrazing and intensive cultivation. Changes in vegetation and in cultivation practices may lead to land degradation, soil erosion and siltation of water bodies and may affect the hydrology and the water balance with the risk of inducing unfavourable micro-climatic changes such as droughts, floods and desertification trends.

However, the Policy has some gaps, for instance, it lacks the ecosystems approach to water resources management, it does not consider biodiversity issues in water management and it lacks recognition of ecosystem services provided by water bodies which affects the forests. The Policy is also not clear on decentralization aspects of water management at community levels.

The Uganda Wildlife Policy (1999)

The aim of the Wildlife Policy is to promote the long-term conservation of wildlife and biodiversity in a cost effective manner, which maximizes the benefits for the people. This policy is relevant in the management of forests in the wildlife conservation areas. The policy objectives include conserving the resource within the national parks and other wildlife areas, and enabling the people of Uganda and the global community to derive ecological, economic, aesthetic, scientific and educational benefits. The Policy has important aspects for forest management. It imposes an obligation on UWA to involve local communities and to ensure that conservation contributes towards rural economies. It also requires UWA to share 20% of its entry fees with local government for the development of communities living around the protected areas. One advantage with the policy is that most of these principles have been incorporated into the Uganda Wildlife Act.

There are several bottlenecks that affect the implementation of the policy in relation to forests. There is limited technical and managerial capacity at the districts to provide adequate advice to deal with forests in these areas; and there are also limited funds to help districts to implement best methods to protect forests. The revenue sharing policy is also not transparent which impacts on the collaborative aspects.

National Policy for the Conservation and Management of Wetland Resources (1995)

This policy was adopted in 1995 to compliment the goals and objectives of the NEMP and sectoral policies including those of fisheries, forestry, wildlife, water, land tenure and soils, among others, as well as the Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat. The overall aim of the policy is to promote the conservation of Uganda's wetlands in order to sustain their ecological and socio-economic functions for the present and future generations. One of the goals of the Policy is to promote the recognition and integration of wetland functions in resource management and economic development decision making with regard to sectoral policies and programs such as forestry, agriculture, fisheries, wildlife and sound environmental management. The Policy also calls for maintaining the biological diversity of natural or semi- natural wetlands, maintaining wetlands functions and values and integrating wetlands concerns into the planning and decision making of other sectors. The Policy recognizes traditional uses and access rights. Thus, people living adjacent to a wetland may derive benefits from that wetland such as cutting of trees, rids, water supply, fishing and grazing. The Policy mentions specific activities that may lead to deforestation in wetland areas such as production of bricks from clay soil and instead encourages use of papyrus for smoking fish instead of wood fuel. The Policy also has specific guidelines which discourage practices of annual burning of wetlands unless beneficial management is demonstrated with the district authorities and is approved.

The weaknesses of the Policy include the following: the policy does not discourage planting of trees in wetlands that drain a lot of water in the wetlands such as eucalyptus trees. Secondly, it does not clearly provide for the lead agency of wetlands management. The Policy has not been transformed into a specific Act like case of other resources such as water, forests and wildlife. There are only regulations which may not comprehensively cover all major

aspects of wetlands management such as classifying types of wetlands and how they can be managed.

The National Soils Policy for Uganda (1999)

This Policy contains Government Policy directives, plan of action and statements of aim and objectives to ensure sound management of the soils of Uganda on a sustainable basis. The objectives of this policy include promotion of optimal land use without unnecessarily compromising the environment through the use of soils and establishing a structure for continuous monitoring and assessment of Uganda's potential in terms of its soil properties and weather, soil degradation and then undertaking technical measures required to control it.

One of the strategies for Policy implementation includes land use improvement which requires land resources inventory to provide up-to-date information and reliable data on land resources such as soil, water, climate, vegetation, wildlife and forestry.

The Policy provides the legal strategies to include review of existing legislation with a view to enacting a comprehensive soil conservation Act and urging districts to make Ordinances and By-laws on soil conservation. However this Policy has not been fully operationalised and therefore the strategies have not been fully implemented. Secondly there is no Soil Conservation Act in place and By-laws and Ordinances at the districts have not been made.

Legislative Framework

The Constitution of the Republic of Uganda

The 1995 Constitution of Uganda is the Supreme law and provides for environmental protection and conservation of the natural heritage. It sets out the norms, standards, rights and obligations at national level. The Constitution also sets out National Objectives and Directive Principles of state policy. Paragraph (xiii) of the National Objectives and Directive Principles provide that the state shall protect important natural resources including water, wetlands, minerals, oil, fauna and flora on behalf of the people of Uganda.

The Constitution has secured a place for the environment among the fundamental rights and freedoms of all people by providing that every Ugandan has a right to a clean and healthy environment. The incorporation of this right in the Constitution confirms the increasing awareness of environmental problems and provides a permanent constitutional guarantee that confers upon the right the highest legal standing.

Other important landmarks in the Constitution include: involvement of people in the formulation and implementation of development plans and programmes that affect them; and the requirement for enactment of laws to promote environmental awareness and preserve the environment from abuse, pollution and degradation.

As the supreme law of the country, the Constitution has caused some fundamental inconsistencies in some laws passed in the recent past.

For example, under the National Environment Act, the power to bring legal action against anyone degrading or polluting the environment is vested in NEMA or local environment committees. The Constitution vests that power in every Ugandan.

The Constitution makes provisions for land ownership. Article 237 states that all land belongs to the people. This implies that all people of Uganda have a stake in the management of land and the resources therein. Under Article 237 (2), land in Uganda is owned in accordance with Customary, Freehold, Mailo, Leasehold land tenure systems.

The Constitution provides under Article 237(2)(b), that the government or a local government shall hold in trust for the people and protect natural lakes, rivers, wetlands, forest reserves, game reserves, national parks and any land for ecological and tourist purposes for the common good of all citizens.

There are several problems regarding the implementation of these constitutional provisions. For example, the implementation of the public trust doctrine in Uganda has been faced with the conflict between environmental protection and industrial development; for instance, Butamiira forest reserve was leased out to Kakira Sugar Works to grow more sugarcane so that it doubles its sugar out put in a bid to satisfy the domestic demand, the proposal by government to give out Mabira Forest to Kinyara Sugar Works and the leasing out of forests in Kalangala district to BIDCO for palm oil tree plantations. These examples indicate that the government does not appreciate and respect the trust obligation imposed under the constitution which causes destruction of forests in favour of industrial development.

Secondly, the provision that land belongs to the people is usually misinterpreted to mean that environmental authorities such as NFA do not have control over resources such as forests on private lands which lead to deforestation on private lands.

The National Forestry and Tree Planting Act, 8/2003

The purposes of this Act are: - to create an integrated forest sector that will facilitate the achievement of sustainable increases in economic, social and environmental benefits from forests and trees by all the people of Uganda; to guide and cause the people of Uganda to plant trees; to ensure that forests and trees are conserved and managed in a manner that meets the needs of the present generation without compromising the rights of future generations by safeguarding forest biological diversity and the environmental benefits that accrue from forests and trees; to encourage public participation in the management and conservation of forests and trees; to facilitate greater public awareness of the cultural, economic and social benefits of conserving and increasing sustainable forest cover; to promote the decentralisation and devolution of functions, powers and services within the forest sector; and to ensure that environmental benefits, costs and values are reflected in strategies and activities relating to forestry.

The Act require the Government or a local government to hold in trust for the people and protect forest reserves for ecological, forestry and tourism purposes for the common good of the citizens of Uganda. This is what is commonly known as the public trust doctrine. However, an analysis of the degazettement of forests in Uganda points to the fact

that the government has greatly abused this obligation, pointing to the need for industrialization at the expense of forestry resources protection.

The Act prohibits certain activities in forest reserves. It provides that a person shall not, in a forest reserve, cut, disturb, damage, burn or destroy any forest produce, or remove or receive any forest produce except in accordance with regulations or guidelines made for the proper management of the forest reserve; in the course of the management of the forest reserve by the responsible body; in terms of the exercise of a right or interest in the forest reserve; or in accordance with a licence issued under this Act.

A person cutting, working, harvesting, removing or taking forest produce from a forest reserve is required to take all care and necessary precautions to prevent damage to other forest produce or to the environment. Contravention of this requirement is an offence. It is also prohibited for a person to light or cause to be lit a fire in a forest, except in a place established for that purpose, or as otherwise permitted by an authorised person.

Part IV of the Act deals with tree planting and growing. The Minister or a District Council is required to issue directions for the planting and growing of trees. The Act also establishes the Tree Fund which consists of monies appropriated by Parliament; loans obtained by Government; grants, gifts and donations; any monies required to be paid into the Fund; and monies from any other source approved by the Minister in writing, in consultation with the Minister responsible for finance. The Fund has be used to promote tree planting and growing at national and local level; and to support tree planting and growing efforts of a non-commercial nature which are of benefit to the public. However, there has been little, if any, ground work of the tree fund. The seedlings which would have been distributed to the local people at no cost using the fund are sold at relatively high prices in most local areas and therefore the Fund has not achieved the intended objective.

There are several challenges in monitoring and enforcing this Act. These are:

- People who settle in the forest reserves are very hard to evict because they believe they have the right to live in the forests. This situation has been worsened by the presidential directives not to evict people settled in forest areas.
- In some cases, the Uganda land Commission has issued land titles to people in gazetted forests. This is a serious challenge because a certificate of title is conclusive evidence of ownership unless it is issued through fraudulent means. A case in point is Kitubulu forest reserve in Entebbe where NFA has lost a case in court against a person who encroached on the forest reserves.
- Under the Act, an authorised officer is required to seize any illegal forest produce. However, officers who have tried to implement this provision have faced stiff resistance and some times people carrying out the activities are violent.
- Lack of sufficient cooperation from stakeholders especially the police and courts that don't seem to appreciate the provisions of the National Forestry and Tree Planting Act since it is a new Act. This has led to failure to conduct due and diligent inquires that would lead to successful prosecution.
- There is also a conflict within the criminal investigation department as to whether to apply the Penal code Act or the National Forestry and Tree Planting Act in offences related to forestry.
- The enforcement of the Act is further limited by lack of adequate financial and human resources.
- Lack of Regulations also makes the implementation of the Act difficult.
- Political interference in the implementation of the Act. For example, the presidential pronouncement that no eviction of encroachers on forest reserves has made implementation of section 32 of the Act which prohibits occupation of forest reserves difficult.

There are Draft Regulations that have been made under the Act; the Draft Forestry and Tree Planting Regulations, 2003. These Regulations were made under sections section 92 to operationalise sections 2, 4, 5, 6, 9, 12, 13, 15, 25, 29, 30, 31, 35, 36, 37, 41, 43, 44, 45, 50 and 90 of the National Forestry and Tree Planting Act. These regulations provide a comprehensive framework for forest management in Uganda. In terms of deforestation they have the following provisions. They prohibit cutting, disturbing, damaging, removing, purchasing, donating, any of the reserved species of the protected trees without a license, introduction of alien or exotic tree species without a license. The regulations also prohibit possession of inflammable materials in a forest and make it an offence to willfully or negligently light a fire which by spreading may damage or destroy a forest or part of it. The Regulations decentralize fire management to the district council which is responsible for the management of forest fires in the district. They establish a fire management committee, whose functions include preventing and fighting forest fires, mobilizing the people to fight a fire destroying the forest, developing and implementing a fire drill exercise and sensitization and compilation of a list of potential fire fighters.

The regulations require District Councils to make fire ordinances or byelaws which would impose an obligation on each council to develop its fire management plan. The Regulations further empower an authorized person to control entry and damage in forest reserves and make it an offence for any person to damage forests. The Regulations empower an authorized person to request a person to leave a forest reserve or stop an act and remove a person who has entered or is unlawfully remaining or is committing unlawful acts in the forest contrary to the Act or Regulations. The Regulations also require a person authorized to graze, cultivate and lawfully reside in a forest reserve to report to authorized person a diseased plant or animal.

The Regulations make provisions for management of private forests. They impose obligations on private owners

to protect the forest against pests and diseases, illegal cuttings and other activities causing damage to forests; carry out fire-prevention work as well as informing the District Fire Management Committee about forest fires; prepare a forest management plan; prepare a felling plan before proceeding with timber extraction; re-plant felling or burnt areas and afforest areas using certified planting stock; manage the forest using technologies that minimise adverse effects on the environment, soil productivity and biological diversity; carry out timely tending of forest plantations and young stands; ensure maintenance of boundary signs and boundary lines; and present, on annual basis, a report on the state of the forest to the District Forestry Officer. These provisions are adequate to control deforestation on private forests.

The Regulations make provisions for community forests management. They require that a community forest management plan be submitted to the district council for approval and integration into the district forestry development plan.

The Regulations make provisions for tree planting, growing and management. They require every person in Uganda to plant trees whenever called upon to do so using the best practical means and ensure that the trees planted are tended until maturity. The Regulations also make it unlawful for a person to uproot or cut a tree over three years old or cut down a tree unless the owner of the tree has consented to the tree being uprooted or cut. The Regulations require every sub country to maintain a record of all planted trees and the tending program must include protection from fire, trampling uprooting and replacement schedules. The Regulations impose on the owner of the land or occupier or owner of trees a duty to plant another tree of an appropriate species at the same time within a reasonable period where a tree which is planted dies or is lawfully harvested.

The Regulations impose a duty on every sub county to have and maintain a tree nursery which contains seedlings of multipurpose ornamental or timber tree seedlings.

These Regulations are comprehensive enough to control deforestation. However, they have not yet been enacted into law and therefore they cannot be enforced.

There are also Rules that were made under old Forests Act that are relevant in controlling deforestation. The Forests Rules, Statutory Instrument 146 - 2 apply to central forest reserves and open land, other than open land in an area declared by statutory order to have an adequate forest estate, and forest produce grown or produced on such reserves or land.

Under these Rules, a senior forest officer may declare any area closed for the cutting or removal of forest produce or any class of forest produce if he or she considers it necessary for the proper planning and administration of the area; in order that there should be proper regeneration of any forest produce; to safeguard the requirements of a particular market; or to safeguard the economic or climatic value of any forest.

The Rules also prohibit possession in or bringing into a forest reserve, unless that person lawfully resides in the reserve, any articles or materials of any inflammable or combustible nature unless those materials are necessarily required for the lawful cutting or removing of forest produce. This provision is relevant in reducing accidental forest fires.

This statutory instrument however, was made on the basis of the Forest Act Cap 246 that was not in tandem with modern environmental law and narrows in its scope and placed emphasis on commercial aspects of forests as opposed to conservation of the species. The instrument reflects the features of the Forest Act.

Guidelines for Implementing Collaborative Forest Management in Uganda (2003)

These Guidelines were made under section 15 of the National Forestry and Tree Planting Act. The objectives of the guidelines are to provide a more sustainable forest resource use and improved forest adjacent community livelihood. They were developed specifically for collaborative management of central and local forest reserves. The Guidelines provide incentives to the local communities for participating in the collaborative forest management process. The major elements of the guidelines that are relevant to deforestation are: ensuring fairer distribution of benefits, responsibilities and decision-making authority in management; reduction of conflicts as the community uses will be succinctly provided with a MoU; creating awareness as to the different roles to be played by the different actors in the community; creating sense of ownership over forest resources; and sharing knowledge and skills between NFA and communities.

The major advantage for local communities which enter into CFM agreements is that it provides them an increased opportunity for negotiating resources from the NAADS, PEAP and other government programmes. However, it does not entitle them as of right.

However, there are several constraints that can be identified. First, there are institutional constraints. NFA is a new institution, which is not yet well established at the local level. The structures of the NFA do not facilitate enough dialogue between top officers, field officers and the communities neighbouring the protected areas. This limits sharing of information and may affect the process of effective collaboration with other stakeholders. It has also affected the establishment on formal linkages between the authority and the communities.

Secondly, CFM can only succeed if there is sustainable source of funding. Funding is necessary to develop the CFM program and sustain those that have been developed. Presently, lack of sufficient funding continues to stifle the existing initiatives.

It is important to note that for collaboration to work all the institutions need to work together because there are several institutions whose actions have a direct bearing on the way forest resources are managed. Unless the actions of the various organizations are harmonized, community participation in any initiatives focused at involving them will meet a lot of resistance. In Uganda, institutions whose policies and actions have a direct bearing on forest management include NEMA, MAAIF, Ministry of Tourism, Trade and Industry, NGOs, UWA, UTB, NFA, Wetlands Inspection Division and DWD. There is very little institutional collaboration between these institutions. This

networking is important to show experiences, information and resources in order to duplicate efforts, avoid conflicts and confuse the communities.

CFM may not succeed without proper mechanisms to facilitate the process of consensus building, sharing rights, roles, responsibilities and returns. There is still a lot of suspicion between NFA staff and communities neighboring forests. Most NFA staff do not have confidence to consult and involve the communities in the management of the resources and therefore see the community as capable of doing only a few things. The field staff have not been transparent to the local people while implementing their programmes such as drawing up management plans, supervision of licenses and collection of revenue.

Communities neighbouring forests have been ignored for too long and therefore their collaboration in forest management needs a long process of consensus building, understanding and compromise. Information on community institutional structures and an understanding of user and ownership rights have not been fully integrated in the current collaborative initiatives. There is still a general lack of awareness regarding who owns what resources and why, management objectives and the capacity of local communities to implement certain programmes even without commands from the relevant institutions.

Other constraints include: lack of quick incentives for the communities for participating in the process because illegal cutting of timber is more paying than their involvement in CFM; politicization of CFM: Politicians can manipulate people by using forestry issues for political gains; communities outside the CFM villages may be unhappy because CFM denies them access to forest resources hence raising more conflict within communities; there are no by-laws at the village and sub-county levels to control illegal; limited understanding of the concept of CFM by key stakeholders; CFM requires funding. The few CFM arrangements that have been developed have been donor funded, this raises the issue of sustainability of CFM; and there is no clear linkage between CBO and NGOs and NFA regarding the development and management of CFM.

The National Environmental Act, Cap 153

The National Environment Act provides for sustainable management of the environment and establishes an authority as a coordinating, monitoring and supervisory body for that purpose. The Act deals with forestry resources management. NEMA, in consultation with the lead agency, is required to issue guidelines and prescribe measures for the management of all forests in Uganda. The guidelines and measures issued have to take into account forests in protected areas, including forest reserves, national parks and game reserves and forests on lands subject to interests held by private persons NEMA is also empowered, in consultation with the lead agency, to expressly exclude human activities in any forest area by declaring a forest area a specially protected forest.

NEMA is required to promote measures for the conservation of non renewable sources of energy; take measures to encourage the planting of trees and woodlots by individual land users, institutions and by community groups. Planting of trees will increase the forest cover of the Nile Basin. However, these efforts are curtailed by the inadequate financial and manpower resources which hinder the production and distribution of the seedlings.

The Act makes provision for environmental planning at the national level by requiring production of National Environmental Action Plan every five years and district environmental action plan every three years. The Act also makes provision for environmental regulation by making EIA, environmental audits and monitoring legal requirements. All these tools are useful in controlling deforestation. However the financial and human capacity especially at the district and the local levels is still limited which leads to ineffective monitoring and information flows to take appropriate decisions related to deforestation.

Several regulations have been made under the NEA. These Regulations are important in controlling deforestation. The relevant ones are: The National Environment (Wetlands, River Banks and Lake Shores Management) Regulations, No. 3/2000. The Regulations are divided into three main parts with provisions that have implications for the control of deforestation. Part two of the Regulations deals with the management of the wetlands. One of the objectives under this part is to ensure water catchment conservation and flood control. The regulation 17 (1) imposes a duty on every landowner, occupier or user who is adjacent or contiguous with a wetland to prevent the degradation or destruction of the wetland and is required to maintain the ecological and other functions of the wetland.

Part three of the Regulations deals with the management of river banks and lake shores. Regulation 19 provides the objectives of this part of the Regulations to include facilitation of the sustainable utilization and conservation of resources on river banks and lake shore by and for the benefit of the people and community living in the area; promotion of the integration of wise use of resources in river and lakes into the local and national management of natural resources for socio-economic development and giving effect to the public trust doctrine which require strict protection of forests. Regulation 20 provides that one of the principles to be observed in the management and conservation of river banks and lake shores is to have special measures that are essential for the protection of river banks and lake shores such as preventing soil erosion.

Regulation 21 requires local governments to make by-laws for promoting soil conservation measures along river banks and lake shores on the following aspects: bundling, terracing, mulching, tree planting or agro-forestry, grassing, soil engineering, compaction and placement of fills, zoning and planning, baggions and control of livestock grazing which all have implications for controlling deforestation.

Regulations 28 imposes a duty on every land owner or user in whose land a river bank or lake shore is situated to prevent and repair degraded river banks and lake shores through the following measures: soil engineering; agro-forestry; mulching; bundling; grassing; control of livestock grazing; or terracing. Under this regulation it is an offence for a landowner or user to fail or refuse to carry out these measures.

The Regulations provide for special protection measures for zones of river banks. Regulation 29 (1) prohibits any activity within one hundred meters from the highest watermark of

the major rivers such as River Nile and River Kagera. Regulation 29 (2) prohibits any activity within thirty meters from highest watermark of the minor rivers.

Regulation 30 provides for special protection of zones for lake shores. Regulation 30 (1) prohibits any activity within two hundred meters measured from the low water mark of the major lakes such as Lake Victoria. Under Regulation 30 (2), activities are prohibited within one hundred meters from the low water mark of other lakes.

The implementation of these Regulations is still problematic. For example, the limit of the one hundred meters from the highest watermark of the major rivers and the thirty meters from highest watermark of the minor rivers and the limit of the two hundred meters for major lakes shores and one hundred meters for other lakeshores is still hard to implement in areas where there is land shortage such as Kabale and Kisoro.

The by-laws as required under regulation 21 have not been made and therefore the provisions of the Regulations have not been used to control deforestation.

The duties imposed on the land owners and users under regulation 28 are hard to monitor or supervise because of lack of financial and human capacity.

Another set of regulations made under the NEA is the National Environment (Minimum Standards for Management of Soil Quality) Regulations, 2001. The purpose of these Regulations is to establish and prescribe minimum soil quality standards to maintain, restore and enhance the inherent productivity of the soil in the long term, establish the minimum standards for the management of the quality of soil for specified agricultural practices, establish a criteria and procedures for the measurement and determination of soil quality and to issue measures and guidelines for soil management.

Under regulations 12 (1), every person is required to comply with the measures and guidelines for soil conservation for the particular topography, drainage and farming systems. These measures include: contour cultivation; contour ridges or absorption banks at a spacing of 30 m; grass strips and strip cropping; mulching; agroforestry; crop rotation and fertility improvement; and wind breaks or shelter belts; should be located perpendicular to main erosive wind direction. Other measures include: terraces; contour cultivation (ploughing and planting along the contour), and absorption banks at a spacing of 10-20 m; crop rotation and fertility improvement; strip cropping - strip width 10 to 20 m; and agroforestry.

The fourth schedule makes recommendations for the management of rangelands especially in the cattle corridor. These recommendations are supposed to deal with the following aspects: revegetation or reseeding - close the area to grazing and allow natural grasses to establish or reseed with suitable species of grasses and legumes; gully control with mechanical barriers (dry reeds, vegetation, stones,); controlled or rotational grazing; run off harvesting - divert and impound run off to prevent soil erosion, gully development and allow slow permeability into the soil; fertility improvement; and remove low value grass and tree species to allow nutritive species to proliferate and cover bare ground. These measures have implications for the control of deforestation and soil erosion. The implementation of these Regulations is however, hampered by the limited financial and human capacity.

Another set of regulations made under the NEA is the National Environment (Hilly and Mountainous Area Management) Regulations, 2000. The objective of these Regulations is to facilitate the sustainable utilisation and conservation of resources in mountainous and hilly areas.

The Regulations provide principles on how every land owner or occupier should utilize land in a mountainous or hilly area. These are: observing the carrying capacity of the land; carrying out soil conservation measures; utilizing underground and surface water resources; carrying out measures for the protection of water catchment areas; using the best available technologies to minimize significant risks to ecological and landscape aspects; and maintaining such vegetation cover as may be determined by an agricultural extension officer or a local environment committee. These are important principles for controlling soil erosion and deforestation.

Regulation 5 provides for the establishment of a subcommittee on soil conservation whose function is to require the person upon whom such conservation order is served, to adopt, undertake and complete such measures and works as may be specified in the order for the prevention of erosion of the soil and to prohibit the person upon whom such conservation order is served from doing any act or thing specified in the order which in the opinion of the district environment committee, has caused, is causing or is likely to cause erosion of the soil.

Regulations 6 require District Councils to make by-laws identifying mountainous and hilly areas within their jurisdiction which are at risk from environmental degradation. Such areas include areas that are prone to soil erosion, landslides and areas where vegetation has been or is likely to be removed.

Regulation 10 provides that every land owner or occupier whose land is situated in a mountainous and hilly area should among other things take measures to reduce water run-off through the grassing of medium and steep slopes, mulch and bund gardens on medium and steep slopes, practice agroforestry and prevent the burning of grass in areas of intensive agriculture or on steep slopes.

Under Regulation 11, a person should not without the authorisation of a forest officer or a local environment committee, cause a fire to a forest or grassland on a hilly and mountainous area.

Regulation 13 makes provision for afforestation and reforestation. Where a hilly and mountainous area is at a risk of environmental degradation, a local environment committee may issue an order in writing to a person or persons holding an interest in land in that area to take measures for planting trees and other vegetation to protect the area. The Regulations make it an offence for any person to contravene any provision of the order and a person who contravenes the order is liable on conviction to imprisonment for a term not exceeding eighteen months or to a fine not less than one hundred and eighty thousand shillings and not more than eighteen million shillings or both as provided for under section 98 of the NEA.

Regulation 14 requires the District Council to make by-laws with respect to identified hilly and mountainous areas to

prohibit or restrict grazing in such areas. Regulation 15 empowers a District Council or a local government by statutory instrument to declare a mountainous or hilly area closed to all or any activity.

Regulation 16 prescribes the rules on soil conservation. The regulation requires that a land owner or occupier on gentle slopes in a hilly or mountainous area should not cultivate any garden exceeding one hundred meters in width; leave an uncultivated strip of land of not less than two meters width between all cultivated plots which shall be planted with grass approved by the local environment committee; follow contour lines marked by the local agricultural extension officer and the local environment committee in planting crops; grass with low growing grasses all house compounds except winnowing areas and areas for drying foodstuffs; not demarcate fields or plots by furrows or gullies; and lay parallel to, halfway between the existing bunds, trash lines consisting of dead vegetation where the land is planted with permanent crops.

Regulation 18 restricts the introduction of alien or exotic species. It provides that a person who introduces into any mountainous and hilly area an alien or exotic plant or animal contrary to the provisions of NEA and the Plant Protection Act, commits an offence in the terms prescribed by those Acts.

The major limitation to these Regulations is the limited financial and human capacity. Thus, most of the provisions are not operational. For example the sub-committees on soil erosion under Regulation 5 have not been established. This limits the control of soil erosion and deforestation.

The Land Act, Cap 227

The Land Act provides for the tenure, ownership and management of land; and amends and consolidates the law relating to tenure, ownership and management of land. Under the Act, a person who owns or occupies land has to manage and utilise the land in accordance with the environmental laws and any other law. This restricts use of forest resources on private land contrary to environmental laws. The Act also provides for control of environmentally sensitive areas such as natural lakes, rivers, forest reserves, national parks and any other land reserved for ecological and touristic purposes for the common good of the citizens of Uganda. The control of these resources is vested in the Government or local government. Therefore, the Government or a local government cannot lease out or otherwise alienate any of the above natural resources but may grant concessions or licences or permits.

The Land Act defines four land tenure systems; mailo, customary, freehold and customary tenure

The Local Governments Act, Cap 243

The Local Government Act provides for the system of local governments, which is based on the district under which, there are lower local governments and administrative units. The District Council is the highest political authority in the District. It has both legislative and executive powers to be exercised in accordance with the Constitution and Local Government Act. The composition of the District Council is laid down in the Act, and includes a Committee responsible for the management of the environment and natural resources.

The Second schedule to the Act prescribes the functions of the Government that the District Council is responsible for. The following are the functions relevant to environmental management; land surveying, land administration, physical planning, forests and wetlands, environment and sanitation, protection of streams, lake shores, wetlands and forests.

The transfer of powers of management of forests to local governments has the following major problems: lack of financial and human capacity to manage and monitor forests at the local level; and corruption in the procurement procedures of timber licenses, concessions and in appointment of district forestry officers by the district councils which may compromise the powers of the district forestry officers to manage the forest reserves..

Section 47 of the Act provides that the executive committee of Local Councils includes a secretary for production and environmental protection; this causes a conflict between production and environmental protection especially to environmentally sensitive resources such as forests.

The Uganda Wildlife Act, Cap. 200

The purposes of this Act are, among others, to promote the conservation of wildlife throughout Uganda; the sustainable management of wildlife conservation areas; and the enhancement of economic and social benefits from wildlife management by establishing wildlife use rights and the promoting of tourism. The Act establishes the Uganda Wildlife Authority (UWA) as the lead agency for wildlife resources management. The mandates of UWA under the Act include ensuring the sustainable management of wild conservation areas, controlling and monitoring industrial and mining developments in wildlife protected areas. The Act defines wildlife to include a wild plant and a wildlife conservation area to include a national park and wildlife reserve.

The Act gives the Minister responsible for wildlife powers to declare an area a wildlife conservation area. The declaration of wildlife conservation areas is important for forestry resources protection because in most cases the conservation areas are forested areas.

Under section 69, the Act provides that 20% of the parks entry fees collected from wildlife protected areas be paid to a local government area surrounding the area. This is an incentive that can encourage protection of forests resources within a wildlife protected area.

There is a possible conflict between UWA and NFA in the management of forests in wildlife conservation areas especially in relation to licensing of the use of forest reserves. This conflict can cause deforestation where the two authorities make conflicting decisions.

The Prohibition of the Burning of Grass Act Cap 33

This Act provides for the prohibition of the burning of grass in Uganda and for other matters connected therewith. Under the Act, 'grass' is defined to include all vegetation. This definition is wide enough to cover even scattered forests. The Act prohibits the burning of grass by any person

in all areas of Uganda. However, the sub county chief may after consultation with an officer of the veterinary or agricultural departments, authorise controlled burning of grass for a specific purpose; and such burning has to be under the supervision of a parish or sub parish chief. In the case of the burning of grass in a forest reserve, the burning has to be carried out, or authorised by an officer of the forest department not below the rank of a forest ranger.

This Act creates offences and penalties. A person who carries out the burning of grass contrary to the Act or fails to obey an order to control or extinguish fire or to prevent the burning of grass in the area commits an offence and is liable on conviction to a fine not exceeding five hundred shillings or to imprisonment for a period not exceeding three months. Whereas the term of imprisonment appears to be somehow proportional to the offence, the fine of five hundred shillings is too low and lenient having regard to the environmental damage caused and does not serve the purpose of deterring offenders. In reality this Act has been rarely implemented.

The Plant Protection Act, Cap. 31

This Act makes provision for the prevention of the introduction and spread of disease destructive to plants. Under the Act, 'plant' is defined to mean any member of the vegetable kingdom and includes any part of a plant, whether severed from the plant or not. The commissioner for agriculture is charged with the administration of the Act and the Minister is empowered to make rules for the purpose of preventing and controlling attacks by or the spread of pests or diseases in Uganda. The Act also makes it an offence for any person who, without reasonable excuse, fails to comply with any lawfully given order of an inspector or who contravenes any rule or order made under the Act and is liable on conviction to a fine of two thousand shillings. Equally, the penalty prescribed by this provision is very lenient and does not have a deterrent effect.

Under the Act, every occupier or, in the absence of the occupier, every owner of land is required to take all measures for the eradication, reduction or prevention of the spread of any pest or disease. Where any occupier or owner fails to take any of the measures which he or she is required to take, the inspector may, on giving not less than seven days' notice in writing of his or her intention to do, cause the measures to be taken; and thereupon the occupier or owner should, without prejudice to any penalty which he or she has incurred through the failure, be liable to pay all the costs of the undertaking, which should be recoverable as a debt due to the Government.

The administration of this Act is by the Commissioner of Agriculture. This makes the administration of the Act bureaucratic and over centralized. This affects the control of pests and diseases that may affect forests. Further, this Act makes no provision for participation by the local communities in plant protection activities.

The Regulations required to be made under the Act which is relevant to the control of pests and diseases in forests have not been made by the Minister responsible

The Control of Agricultural Chemicals Act, Cap 29

This Act regulates the manufacture, storage, distribution, use, importation and exportation of agricultural chemicals. The Act restrict importation or sell in Uganda of any agricultural chemical unless that chemical has been registered, packed and labelled in accordance with the Agricultural Chemicals (Registration and Control) Regulations, 1993 and conforms to the standards specified in the Regulations. The Act establishes the Agricultural Chemicals Board whose membership includes the chief forest officer. The Act also establishes the agricultural chemicals technical committee whose membership includes a forest officer. The Act empowers the inspector to enter any place in which he or she believes there is material, a person, an animal, or crop contaminated by an agricultural chemical. This Act is important in restricting introduction of agricultural chemicals into forests.

One of the limitations of this Act is that the agricultural chemicals board is not very active which may affect implementation of the restrictions on the importation of agricultural chemicals into the country which may have adverse effects on the forestry resources protection.

The Cattle Grazing Act, Cap 42

This Act makes provision for the control and regulation of grazing cattle to prevent over grazing and overstocking. The Act requires the Minister to make rules to control over grazing and overstocking. The major gap is that these rules have not been made and therefore there is no control of overgrazing which can cause soil erosion.

Recommendations

Remedial measures need to be made at local, national and regional levels. The measures also need to be made in institutional, policy and legal frameworks.

General recommendation *Establishment of a Joint Coordinating Committee of Government and other stakeholders*

There is a need to improve Inter-sectoral and Intra-sectoral collaboration and stakeholder involvement to address underlying causes of deforestation. Development of policies and forest law enforcement and governance should not be dealt with solely through national forest and development programmes, but in collaboration with other sectors, and to the extent possible, within existing mechanisms.

A joint coordination committee involving national bodies such as the Ministry of Environment and Water, NFA, NEMA, UWA, DWD, WID, Civil Society, Private Sector, Academic and Research Institutions, Religious and Cultural leaders could be established to oversee management of forests in Uganda.

Private Sector Initiatives

There is need to encourage the private sector initiatives such as forest certification, voluntary corporate codes of conduct, independent monitoring of forest operations and log tracking which can help in fighting illegal cutting of trees in forests. This would simplify policing of illegal activities.

Participation of stakeholders in legal and policy reform

There is need to ensure that all legal and policy reforms involve all stakeholders. For example in Honduran there was an extensive multi stakeholder dialogue which begun in 1999 involving farmer trade unions, indigenous peoples, timber producer associations, professional forest associations, municipalities, academics, parliamentarians and other stakeholders, within the framework of the Honduran Forestry Agenda (AFH). This multi stakeholder dialogue reshaped the forest sector by increasing the participation and influence of civil society in forest-related decision-making processes. Stakeholders' participation in forestry policy and legal reform will make the reformed policies acceptable to all and easy to implement without stiff resistance.

Capacity Building of the Judiciary to Enforce Environmental Laws

There is need to develop the capacity to handle environmental cases such as those that deal with illegal activities in the forests. For example in Mozambique, a FAO-supported project is conducted through the Centre for Legal and Judicial Training (CFJJ) in order to promote the effective implementation of new laws related to land and natural resource management. Taking the same approach in Uganda would help judicial officers appreciate modern principles of natural resources management essential for the protection of forestry resources.

Need for a regular review of fees

It is important that the fees should be reviewed regularly to discourage over harvesting of timber which leads to deforestation. Lower fees would always encourage more timber harvesters. The last review of the forest produce fees on licensing was done in 1999 under The Forests (Produce Fees and Licences) Rules S I 146-3 and came into operation in 2000. This indicates that there has been no review for last 8 years and the fees chargeable are very low cared to the prices of the forest produce. It is recommended that these fees be studied and reviewed to reflect the current price of forest produce.

A Tripartite Approach in Forestry Law enforcement

There is a need to use a tripartite approach in enforcing the law by using government institutions, the private sector and civil society. This approach means that the government, private sector and civil society are involved in investigating and reporting illegal activities in the forestry sector. The three meet to discuss their findings and seek for solutions. This approach was used by the stock-taking workshop on African Forest Law Enforcement and Governance (AFLEG) held in March 2005 in Ghana.

This was the first open and honest dialogue between the key stakeholders of the Ghana Forest Sector on corruption since the signing of the AFLEG declaration in Yaounde in 2003. A level playing field during the discussions was ensured through independent, third party facilitation and the various participants voiced many concerns regarding forest law enforcement.

Public Disclosure of Information about Illegal Activities in Forests

There is a need to develop mechanisms for public discloser of information about illegal activities in forests where the public can submit and access information regarding illegal forest activities. This has for instance been used in Cameroon to ensure forestry law compliance. The Government of Cameroon has developed mechanisms for public disclosure of information to forest stakeholders about illegal acts and has published several lists of companies that have committed illegal forest acts which have been fined. This helps government and other law enforcement organs to effectively respond to the illegal activities in forests that cause deforestation.

Establishment of Independent Forest Monitoring Unit

This body can be responsible for assessing how NFA and Local Government process information and make decisions related to forests. This unit can report directly to the natural resources committee in parliament. For example in Cameroon there is a Unit which is assisted by an independent observer, whose services have been established through a contractual agreement between the Government of Cameroon and Global Witness, an environmental NGO acting as watchdog since 2001. This Unit reports to the Minister responsible for forests. This unit can assess the rate of deforestation and provide data to the committee of parliament on natural resources.

Increasing Capacity to Detect and Suppress Illegal Activities in Forests

Forestry law enforcement bodies have limited staff, infrastructure, equipment and money to effectively regulate forest resource use. Presently, there is one forestry officer and one ranger who cannot effectively monitor illegal activities in the forests. There is need to increase funding and staff to detect and suppress illegal activities in forests that cause deforestation.

Need to have a regular review of the policies

There is need to have a regular review of the policies to reflect new developments in the forestry management principles. This would help to assess new causes of deforestation.

Re-surveying of forest land

The boundaries of the current forest land are not clear and in some cases they have been tampered with and private people have acquired titles in forest reserves. This encourages encroachment on the forest land since the forest officers may not be able to determine the exact boundaries of the forest land. Therefore, there is an urgent need to re-survey the forest lands so that the boundaries are clearly demarcated.

Streamlining Management of Forestry Resources

The National Forestry and Tree Planting Act creates 5 forest managers namely: the NFA responsible for central forest

reserves, District Forestry Service responsible for local forest reserves, Community Forest Reserves managed by a local community or group, private forests managed by private individuals or institutions and forests forming part of wildlife conservation area managed by UWA. The management of all these forest reserves is scattered and not well coordinated. There is a need to streamline the management of these forest reserves under NFA.

Establishment of Community Forest Reserves

The Act provides for the establishment of community forests and the Guidelines for the formulation, registration and management of community forests which were developed by the ministry of environment in 2007. However, these forests have not been formally established. It is recommended that the district councils workout the modalities of establishing community forests. The establishment of these forests will help to promote the improvement of livelihoods of rural communities who depend on forests for subsistence and economic gains, ensure and facilitate group member participation in the management and conservation of trees and forests and facilitate and support public awareness of cultural, economic and social benefits of conserving and increasing forest cover.

Improve the decentralization process of forest management

To be able to comply with the policies and laws designed to decentralize forest management, the current management system must be evaluated and consider the possibility of making local governments become the main recipients of the benefits generated by sustainable forest management in their jurisdiction.

It is recommended that a study be done in all local governments to evaluate their role in forestry management and how it impacts on socio-economic and environmental aspects. Various aspects of forestry management need to be considered especially investment in the forestry sector by local governments.

References

Ashish Kothari & Saloni Suri (1995) *Collaborative Management of Protected Areas: Exploring the Opportunities in Uganda, Proceedings of a Workshop held in Mbale,* Uganda

Bahiigwa G, (2004) Rural Taxation in Uganda: Implications for Growth, Income Distribution, Local Government Revenue and Poverty Reduction, Kampala, Economic Policy Research Centre (EPRC).

Food and Agriculture Organisation (1996) Forest Legislation in Selected African Countries, Rome.

Jones R Kamugisha (1993) Management of Natural Resources and Environment in Uganda: Policy and Legislation Landmarks, 1890-1990, Regional Soil Conservation Unit, SIDA.

The Republic of Uganda (2007) Environment and Natural Resources Sector Investment Plan, Kampala.

The Republic of Uganda (1995) National Policy for the Conservation and Management of Wetlands Resources, Kampala.

The Republic of Uganda (1995) National Environment Action Plan for Uganda, Ministry of Water, Lands and Environment, Kampala.

The Republic of Uganda (2007) State of the Environment Report for Uganda 2006/2007, Kampala, National Environment Management Authority

The Republic of Uganda (1994) The National Environment Management Policy for Uganda.

The Republic of Uganda (2001) The Uganda Forestry Policy,

The Republic of Uganda (1998) Vision 2025, Kampala Ministry of Finance Planning and Economic Development.

The Republic of Uganda (2007) Guidelines for the Formation, Registration and Management of Community Forests.

The Republic of Uganda (1999) The National Water Policy

The National Forestry and Tree Planting Act, Cap 8, 2003

The National Forestry and Tree Planting Regulations. 2003

The Uganda Wildlife Policy, 1999

Republic of Uganda (2007) State of Environment Report, 2006/2007, National Environment Management Authority.

United Nations Development Programme (2007) Uganda Human Development Report, Rediscovering Agriculture for Human Development, Kampala.

United Nations Development Programme (2007) Human Development Report, Fighting Climate Change: Human Solidarity in a Divided World, New York.

Wabunoha Robert, Mugemana Jean-Marie Vianney and Kalasi Guy, (2004) Review of Development Policies, Legislation, and Regional Processes and Frameworks that affect the Conservation of the Great Apes in the Democratic Republic Of Congo, Uganda And Rwanda, A Consultancy Report for the International Gorilla Conservation Programme.

This section answers the question, how can regional organisations influence national policies? The question was discussed during the NTEAP 2nd Macro policies workshop. The following are the issues that emerged during the plenary session:

- There is need for clarity between policy and law enforcement of policy leads to formulation of the law;
- Policy should take into account issues such as gender, private sector, user pay principles and polluter pays principles;
- Suggested strategies for influencing policy, to the extent possible in each country by:
  - Working with Parliamentarians /politicians
  - NBI Regional structures
  - Lobbying and advocacy
  - Working with the media
  - Engaging civil society
  - Working with NGOs
  - Networking and consultations
- Policies influence environmental issues (negative and positive);
- Identify share the difficulties and challenges in the process of influencing policy across the countries
- NBI should identify key entry points for advocacy and lobbying for policy formulations advocacy and lobbying is a national agenda
- NTEAP PSC members will remain with the NBI in advisory capacity
- Re-packaging the regional report on macro policies into policy briefs/ policy dialogue
- Work with universities and other research institutions (promote partnership with universities)
- Initiate the process formulation from both the bottom or from the top
- Identification of champions of policy/sectoral formulation and work with them
- Policy formulation is country specific but the NTEAP could facilitate the process of sharing common approaches and deepen participants' knowledge and understanding;
- Need for synergies and harmonisation of work across countries and organisations dealing with the same issue

List of Acronyms

ADLI	Agricultural Development Led Industrialization
ADSFA	
AI	Active Ingredient,
ANCR	Auto-évaluation nationale des Capacités à renforcer pour la gestion de l'Environnement Mondial
APC	Agricultural Pesticide Committee
APCO	Advanced Petroleum Company
ARC	Agriculture Research Centre
ASARECA	Association for Boosting Agricultural Research in Eastern and Central Africa
b/d	Barrel per day
CAPL	Central of Agricultural and Pesticide Laboratory
CBO:	Community Based organization
CCD	Convention Cadre contre la Désertification
CCNUCC	Convention Cadre des Nations Unies sur les Changements Climatiques
CDB	Convention sur la Diversité Biologique
CDC:	Community Development Committee
CDM	Clean Development Mechanism
CEBEA	Centre d'Etudes Burundais des Energies Alternatives
CHC	Chlorinated Hydrocarbons
CHI	Chlorinated Hydrocarbon Insecticides
CIA	Central Intelligence Agency
CNE	Commission Nationale de l'Environnement
CSLP	Cadre Stratégique de Lutte contre la Pauvreté
DPPC	Disaster Prevention and Preparedness Commission
EAPC	Estimated Annual Percent Change
EDPRS	Economic Development and Poverty Reduction Strategy
EEA	Electric Energy Agency
EEAA	Egyptian Environmental Affair Agency
EEPCo	Ethiopian Electric Light and Power Corporation
EFAP	Ethiopian Forestry Action Program
EGS	Employment Generation Scheme
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ENTRO	Eastern Nile Technical Regional Office
EPA	Environmental Protection Authority
EPA	Environmental Protection Agency
ETB	Ethiopian Birr
EU	European Union
FACAGRO	Facultés des Sciences Agronomiques
FAO	Food and Agricultural Organization
FASE	Foundation for Advancements in Science and Education,
FCBN	Forum Burundais de la Société Civile du Bassin du Nil
FDRE	Federal Democratic Republic of Ethiopia
FEM	Fonds pour l'Environnement Mondial
FFW	Food for Work
FIDA	Fonds International pour le Développement de l'Agriculture
FMAF	Federal Minister of Agriculture and Forest
FNC	Forestry National Corporation
FNCSD	Forestry National Corporation - Sudan
GDP	Gross Domestic Product
GEF	Global Environmental Fund
GNPOC	Greater Nile Petroleum Operating Company
GOR:	Government of Rwanda.
GOSS	Government of Southern Sudan
GTZ	German Technical Cooperation
GW	Giga Watts
HCENR	Higher Council for Environment and Natural Resources
IARC	International Agency for Research on Cancer
IBAs	Important Bird Areas
IGEBU	Institut Géographique du Burundi
IMF	International Monetary Funds
INECN	Institut National pour l'Environnement et la Conservation de la Nature
IPM	Integrated Pest Management
IRAZ	Institut de Recherche Agronomique et Zootechnique
ISABU	Institut des Sciences Agronomiques du Burundi
ISABU	Institut des Sciences Agronomiques du Burundi
ISAE	*Institut de l'Agriculture et d'Elevage*
ISAR	Institute for Research in Agronomic Sciences
JMPR	Join Meeting Pesticide Reform
Kg	Kilogramme.
kV	Kilo Volts
kWh	Kilowatt hours
LA	Local Authority
LE	Notation for the Egyptian Pound
LPG	Liquefied Petroleum Gas
MDGs	Millennium Development Goals
MINAGRI	Ministry of Agriculture and Animal Resources
MINALOC	Ministry of Local Gov., Community Development and Social Affaires
MINATETP	Ministère de l'Aménagement du Territoire, de l'Environnement et des Travaux
MINECOFIN	Ministry of Finance and Economic Planning
MINICOM	Ministry of Commerce, Tourism, Industry, Trade and Cooperatives
MININFRA	Ministry of Infrastructures
MINITERE	Ministry of Lands, Environment, Forestry, Water and Mines

List of Acronyms

MME	Ministry of Mines and Energy
MOA	Ministry of Agriculture and Land Reclamation
MoFED	Ministry of Finance and Economic Development
MoWR	Ministry of Water Resources
MT	Metric Tonne
MT/year	Metric ton per year
MTR	Mid Term Review
MW	Mega Watts
NAP	National Agricultural Policy
NES	*National Environment Strategy in Burundi*
NEC	*National Environmental Commission*
NBI	Nile Basin Initiative
NBI-SVP	Nile Basin Initiative Shared Vision Program
NEMA	National Environmental Management Authority
NEP	National Environment Policy
NFP	National Forestry Policy
NGO	None Government organization
NGOs	Non Governmental Organization
NLP	National Land Policy
NRM	Natural Resource management
NTEAP	Nile Basin Trans-boundary Environment Action Plan
NTEAP	Nile Transboundary Environmental Action Project
NUR	National University of Rwanda
OIE	Office International des Epizooties
OIE	Office International des Epizooties
OMD	Objectifs du Millénaire pour le Développement
ONG	Organisation Non Gouvernementale
ONGC	Indian Oil and Gas Company
OPI	Organophosphrous Insecticides
PABU	Projet d'Aménagement des Bassins Versants
PABU	Projet d'Aménagement des Bassins Versants
PAN	Programme d'Action National de lutte contre la dégradation des terres
PASDEP	Plan for Accelerated and Sustained Development to Eradicate Poverty
PCBs	Poly-Chlorinated Bi-Phenols
PDOC	Petrodar Operating Company
PEP	Profil Environnemental du Pays Burundi
PES	Payment for Environmental Services
PESTROSA	Petroleum of South Africa
PHI	Pre- Harvest Interval
PNM	Plan National de Mise en Œuvre
PNUD	Programme des Nations Unies pour le Développement
PNUD	Programme des Nations Unies pour le Développement
POP (s)	Polluants organiques persistants
POPs	Persistent Organic Pollutants
POPs	Persisted Organochlorine Pesticides
PRASAB	Projet de Réhabilitation et Appui au Secteur Agricole du Burundi
PRDMR	Programme de Relance et de Développement du Monde Rural
PRSP:	Poverty Reduction Strategy Paper.
PSIR	Political Science and International Relations
PSNP	Productive Safety Net Program REES Rural Electrification Secretariat
PTRPC	Programme Transitoire de Reconstruction Post-conflit
RADA:	Rwanda Agriculture Development strategy
REES	Rural Electrification Secretariat
REGIDESO	Régie de Production et de Distribution de l'Eau et d'Electricité
REMA	Rwanda Environment Management Authority
RET	Renewable Energy Technology
SAP	Structural Adjustment Program
SFCDD	State Forest Conservation and Development Department
SHP	Small Hydropower
SLM	Sustainable land management
SMAAWI	State Ministers of Agriculture, Animal, Wealth and Irrigation
SNEB	Stratégie Nationale pour l'Environnement au Burundi
SNPA-DB	Stratégie Nationale et Plan d'Action en matière de diversité biologique
SNV	Netherlands Technical Cooperation
SPAT:	Strategic plan for Agricultural Transformation in Rwanda
SVP:	Shared Vision Program
TOE	Ton oil equivalent: Calorific value of a fuel equivalent to one ton of oil
TOTAL	Total Oil Company
ULV	Ultra Low Volume
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Education and Science Commission
UN-EUE	United Nations Emergency Unit for Ethiopia
USD	United States Dollar
VAT	Value Added Tax
WHO	World Health Organization
WNPOC	White Nile Petroleum Operating Company

Nile Basin Initiative
Entebbe, Uganda
P.O.Box192
Telephone: +256 41 321424 / 321329
Fax: +256 41 320971