STATE OF THE ENVIRONMENT REPORT FOR UGANDA 2006/2007

NEMA
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ENSURING SUSTAINABLE DEVELOPMENT

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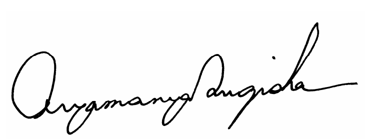
ACKNOWLEDGEMENTS

The National Environment Management Authority (NEMA) is again honored to present another edition of the State of the Environment Report for Uganda. This is the seventh report since the first one was published in 1994. The State of Environment Report has become a vital document in providing an insight to understanding the interactions between social, economic and environmental factors which are the pillars of development. It further answers many questions on what is happening to the environment in our country and what lies ahead in the future.

I sincerely thank all the organizations and individuals who provided data and information that was used as the basis for analyses in this report. All sources of data are acknowledged and referenced where they appear in the report. I wish to express my thanks to the team from EMA consult that compiled the report more especially Dr. Moyini Yakobo for his contribution and efforts in environmental reporting in Uganda.

I thank the technical staff of the NEMA for the role of coordination and review of the report. I look forward to receiving your positive critique and suggestions on the report. I wish you all good reading.



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EXECUTIVE DIRECTOR

FOREWORD

This year 2007 Uganda is hosting the Commonwealth summit with the theme "transforming Commonwealth societies to achieve political, economic and human development". At the same time since the last State of the Environment report of 2004, new opportunities but also threats have emerged and these include: exploration and future production of oil, climate change and its impact on the communities in Uganda and innovations that encourage cleaner and more environmentally friendly sustainable consumption and production. Therefore, as the people of Uganda adapt to the new changes and challenges of climate change, they are also seeking accurate and up-to-date information about the state of the environment to help them make better decisions in all aspects of their lives. In light of The United Nations Conference on Environment and Development held in Rio de Janeiro in 1992 which urged nations to issue reports on the environment that would complement traditional fiscal policy statements, budgets, and economic development plans, I am pleased to present the National State of the Environment Report for Uganda for the years 2006 and 2007 with the theme "managing emerging opportunities and threats from the environment". This is the seventh report for Uganda following from six other editions published earlier with the first produced in 1994.

The current report presents a picture of the condition of the environment and natural resources in Uganda. It is divided into five sections. Section 1 introduces the country overview and background. Section 2 deals with the state of the environment and trends under five themes of atmospheric, terrestrial, aquatic, cross-sectoral resources, and important linkages between environment and poverty, health and the potential value of ecosystems services. Section 3 covers emerging challenges which include among others: food security and climate change. In addition, the section covers an outlook based on the possible scenarios for Uganda's environment and natural resources, ecosystems and human wellbeing, in line with the national long term planning perspectives of the Vision 2025. Section 4 gives the conclusions and policy options for action and section five are annexes. It is clear from the information contained in this report that the state of our environment will determine the level of our prosperity now and for future generations. Over-exploitation of our natural resources is increasingly leading to environmental degradation and contributing to reduced ecosystem services and disasters. Reduced ecosystem services in turn contribute to poverty. As we strive to address social equity and economic development in the years to come, our awareness and ability to improve the state of the environment and secure environmental sustainability will shape our future.

I do not only hope that this report will inform the people of Uganda about the state of our natural resources but also that the information contained in this report will be put to good use by every citizen.

Hon. Maria Mutagamba.
MINISTER OF WATER AND ENVIRONMENT.

EXECUTIVE SUMMARY

This publication is the seventh report of the State of the Environment (SOE) for Uganda and it follows on from six earlier SOE reports with the first one appearing in 1994. The SOE publications have reported on the practice in environment and natural resources management in Uganda. Uganda moved away from an obscure regulatory system into a clear regulatory and policy framework for the Environment and Natural Resources (ENR) sector.

The theme for this year's SOER is "managing emerging opportunities and threats from the environment". It suggests that there are opportunities to be exploited beyond countering environment threats and overcoming sector weaknesses. Since the publication of the last SOER new opportunities and threats have emerged and these include: exploration and future production of oil, climate change and its impacts on the communities in Uganda, innovations that encourage cleaner and more environmentally friendly sustainable consumption and production.

BACKGROUND OF THE STATE OF THE ENVIRONMENT

In 2005, as evidence that Uganda was ready to market the economy from the environment perspective, the Government of Uganda invested US$ 1 million in a campaign to promote the country's tourism potential on the Cable New Network (CNN). The promotion of the image of Uganda as a country gifted by nature was the first ever media campaign to market the country's tourism abroad.

There have been other developments as well. Since 2004, the number of administrative units in Uganda has increased from 56 Districts to 75 Districts. This has led to an increase in the administrative costs for environment and natural resources management at both local government and national levels. Uganda's population growth also continues to be amongst the highest in the world. The population in 2007 stands at 28.4 million an increase of 70 percent since 1991 and 16 percent since 2002. The country's population is expected to exceed 50 million and 127 million by 2025 and 2050 respectively.

ATMOSPHERIC RESOURCES

The intergovernmental panel on climate change indicated in 2006 that the African continent bears the greatest risk from climate change. Uganda's atmospheric resources of temperature, rainfall, sunshine and wind show trends which suggest the possible influence of climate change. In 2005, Uganda along with other countries in East Africa experienced a severe drought that led to a decline in the water levels of Lake Victoria. In 2007, Uganda has experienced its heaviest rains since the el nino of 1997/98. Moreover, the poorest regions of the country in north eastern Uganda: the Karamoja region, Teso region and the Lango region have been most affected.

TERRESTRIAL RESOURCES

Uganda has 7.2 million hectares of arable land under crop agriculture which is less than 50 percent of the arable land (16.8). But it has been suggested that available arable land for agriculture will run out in most parts of Uganda by around 2022. The land available in the eastern region is expected to run out by 2010. The rapid decline in the available land resource is attributed to the very high population growth rate. In addition the annual cropping practices that encourage high soil erosion and increased reclamation associated with new crop enterprises such as rice growing will also lead to the decline in the quality and quantity of the available land and soil resources.

The indicative annual cost of setting up and running institutions required under Uganda's land bill is US$ 400 million. This amount is so large that it imposes a huge financial burden on the government; therefore it could prevent an otherwise good law from being implemented. Moreover, it is unlikely that the reforms suggested in the law will lead to significant increase in the supply of credit by commercial banks and agricultural productivity in the short and medium term.

FORESTS

Uganda's forest cover declined from about 5 million hectares in 1990 to 3.7 million hectares in 2005. This was a result of encroachment for agricultural production, deforestation to produce woodfuel, urbanisation, industrial growth, migration and problems of internally displaced people.

In Uganda forest governance is split at three levels: NFA for Central Forest Reserves, District forest services for community and the privately owned and managed forests. There has been increasing pressure to degazatte Central Forest Reserves for industrial purposes from the Central Government. This has been the case for Namanve, Wabisi-Wajala (in Nakasongola district), Butamira forest reserve and more recently the intention to allocate part of Mabira central forest reserve to sugar cane growing.

The rapid increase in Uganda's population has certainly increased pressure on forest ecosystems for ecosystem services such as timber, fuelwood and food. This increases the risk of encroachment and deforestation unless viable alternatives are found. Nevertheless, opportunities for forest enterprises have emerged from commercial timber production and the Cleaner Development Mechanism. As a result the forest sector has one of the fastest rates of investment.

WILDLIFE

There has not been significant change in wildlife resources and their management since the last National State of Environment Report apart from the encroachment on Queen Elizabeth National Park by the Basongora pastoralists. The invasion of Basongora has increased pressure on the available food resources for the animals in the park and generated debate on pastoralists' activities vis a vis wildlife protected areas. On the other hand, there are emerging opportunities in wildlife use rights such as trade, research and the development of a wildlife sector trade strategy.

AQUATIC RESOURCES

Uganda's wetland resources cover 13 per cent of the country's land surface. Increasingly these wetlands are under pressure from reclamation for agriculture especially rice production. While no estimates exist as yet, several districts have reported an increased use in wetlands for rice production as a result of the current government campaign (upland rice growing) in Uganda. Although upland rice can be grown far away from wetlands communities have preferred growing it near or within wetlands.

WATER RESOURCES

Uganda's water resources cover about 16 percent of the country's total area. The biggest pressure on the water resource is from the growing population and poor waste management practices of industries located near the water system. Uganda is on track to meeting the Millennium Development Goals for access to improved water within the country of 100 percent by the year 2015.

FISHERIES

Fisheries activities provide an important source of livelihoods to many Ugandans and foreign exchange to the country. Between 2002 and 2006 Uganda's fisheries export increased by 82.5 per cent from US$ 78.15 million to 142.69 million. Fish harvest increased from 249,000 metric tonnes in 2004 to 416,000 metric tonnes in 2005. 58 percent of Uganda's fish harvests come from Lake Victoria followed by 16 per cent from Lake Kyoga and 26 percent from the remaining lakes and rivers.

The major pressures on Uganda's fisheries resources come from the growth in international market demand for Nile perch and Tilapia, deterioration of water quality due to excessive pollution, re-invasion of the lakes by the water hyacinth, poor fishing practices and prevalence of diseases especially HIV/AIDS in the fishing communities.

BIODIVERSITY

Given Uganda's location in a zone between the ecological communities that are characteristic of the drier East African Savannas and the more moist West African rain forests, combined with high altitude ranges, the country has a high level of biological diversity. Recent survey reports reveal the occurrence of 18,783 species

The principle threats to biodiversity in Uganda persist, including habitat loss, modification and alteration along with unsustainable harvesting, pollution as well as introduction of alien species.

RURAL WATER SUPPLY AND SANITATION

Access to safe water supplies in rural areas has increased steadily from 57 per cent in 2004/2005 to 61 per cent in 2005/2006. Latrine coverage has also increased from 51 per cent in 2003/2004 to 58 per cent in 2005/6. This level of latrine coverage is still very low. The lowest coverage is in the Karamoja region ranging from 2 pe rcent to 10 per cent. Latrine coverage declined, for example, in Busia and Kibale district by 2 per cent and 5 per cent respectively because the funding for sanitation programmes and enforcement of bi-laws were weak. Notably, 75 per cent of Uganda’s disease burden is preventable since it is caused primarily by poor hygiene and inadequate sanitation.

TOURISM

There have been increases in the number of tourists’ arrivals since 1997 from 175,000 to 468,000 in 2005. The arrivals were mostly from Kenya, Tanzania and Rwanda. Europe contributed 10 percent mostly from United Kingdom and Germany and a good number from USA.

ENERGY

Uganda has an abundant although unexpected variety of potential energy sources from solar, bio-mass, hydro, petroleum and geothermal. The energy sources that have been exploited so far include bio-mass, petroleum and hydro power. The National consumption of energy sources by type is 93 per cent, 6 per cent and 1 percent for bio-mass, petroleum and hydro power respectively. Only 5 per cent of Uganda’s population has access to electricity, two-thirds of the power generated in Uganda is consumed in residences, 14 per cent in commercial buildings, and 10 per cent in industry and the reminder in the transport sector.

In May 2006, a consortium affiliated with the Aga Khan Development work signed an agreement to build the Bujjagali hydro power station. The project has already started and is valued at US$ 500 million. There are two other electricity co-generation projects one at Kakira sugar cooperation and SCOUL and 15 other mini-hydro stations.

CULTURAL HERITAGE

So far about 357 sites and monuments have been identified and documented as part of Uganda’s cultural heritage. The areas included in the world heritage list are the Kasubi tombs, Bwindi national park and Rwenzori Mountain and national park. However, Uganda has several other cultural heritage sites found in all regions of the country some of which have been documented.

POVERTY AND THE ENVIRONMENT LINKAGES

Two of the greatest global challenges are elimination of poverty and the reversal of environmental degradation. Income derived from the environment is a major constitute of the livelihood of the poor and this direct dependency on nature does not appear to be decreasing.

The most frequently mentioned causes of poverty in Uganda are: poor health, limited access or shortage of land, lack of market access for produce, unemployment, high taxes, lack of education, large family size, excessive alcohol consumption, and low productivity and lack of credit facilities.

LAND USE AND POVERTY

A typical farm size in Uganda in 2005 ranged from 0.5 and 1 hectares of land. The reasons for the landlessness include: lack of proper land regulations and effective land management structures which encourages corruption, poor land planning and conflicts.

ENVIRONMENTAL HEALTH PROBLEMS

Malaria is the most prevalent illness in Uganda with the 51 per cent of out patients cases reported between 2002 and 2005. In 2004, the estimated annual number of deaths from Malaria was 70-100,000 people. However, diarrhoea is the major killer of young children and is responsible for 19 per cent of all infant mortality rates in Uganda. On the other hand, cholera cases fatality rate declined from 6 per cent in 2000-2001 to 2.5 percent in 2004-2005 although the WHO recommends that cholera case fatality rate should be below 1 percent.

National adult HIV prevalence was 6.7 percent in 2005, significantly higher among women nearly at 8 percent than among men at 5 percent. While HIV /AIDS epidemic cases declined nationally, prevalence in some rural areas was from as low as 5.6 percent in men and 6.9 percent in women to 6.5 percent in men and 8.8 percent in women in 2004.

PAYMENTS FOR ECOSYSTEMS SERVICES

Payments for Ecosystem Services (PES) represent a set of new financing mechanism for funding conservation activities. Existing opportunities for PES include: payments for watershed services, payments for bio-diversity services, payments for carbon cycle sequestration services and payments for reuse of waste.

However, several barriers to implementing PES in Uganda exist. They include the lack of adequate information for businesses and government, technical barriers to put in place adequate policy evaluation, acceptance and absence of policy and inadequate institutional capacity to organise PES activities.

POLICY OPTIONS

1. Land scarcity is an emerging threat as the population of the country grows. Yet there is evidence that farm productivity is low and there is a need to encourage technologies that improve farm productivity. There should be provision of appropriate training to farmers on how to improve soil fertility management even before soil additives (fertilisers) are suggested. Evidently some farming systems, especially in central Uganda, have been extremely depleted and the use of fertilisers is the only recourse. But in some areas soil

erosion rates are high and population density is also quite high requiring a different set of interventions.

2. Many of the soil and water conservation practices such as strip cropping and the use of terraces have disappeared as the different regimes of extension services have changed. For areas where vulnerability to soil erosion is strong there may be need to restore some of the old institutional arrangements including setting by-laws to reduce the rate of soil degradation.

3. In eastern Uganda's Mount Elgon region the population density and growth rate are so high that the area will run out of available land for agriculture by 2010 and the rest of the country will experience the same in the medium term. The Government has a number of options among these are training rural communities on family planning practices, however, an appropriate family size can also be suggested after carrying out sufficient studies on the subject.

4. Secondly, there is an urgent need to increase the number of non-farm jobs available to rural communities. The government has embarked on several initiatives to encourage private sector investment yet the rate of job creation seems to be fundamentally lower. Government could consider supporting commercial agriculture that is labour intensive as an alternative.

5. Much of north-eastern Uganda and several parts of Uganda have been flooded causing fundamental destruction of people's livelihoods. In future there should be rapid and usually Early Warning Systems or mechanisms in place to prevent possible human fatality as well as the high level of economic loss that is clearly evident in the affected areas.

6. The threats noted in this State of the Environment Report could be addressed if the country had a land use policy in place. However, some of the concerns above could be addressed if the current land policy draft is handled expediently. Indeed, District level Land use Policies are on hold as they await the national land use policy.

7. For several years now international researchers on climate change have been warning that the African continent is most vulnerable to climate change. The floods in north-eastern Uganda are evidence of the level of vulnerability. The country ought to quickly adopt the regime of climate change and desertification adaptation techniques and develop a medium term and long term plan for Uganda.

8. Natural resources are under increased threat from: the growing population, the demands by private investors and the communities that sometimes do not use them sustainably. There is need to consider an additional set of tools outside the formal regulations and management structure and advocating for greater participation of other stakeholders. Some of these are being addressed in the Kyoto Protocol's Clean Development Mechanism, and similar mechanisms under the United Nations Convention on Combating Desertification (UNCCD) and the Convention on Biological Diveristy (CBD).

Still, a large set of tools some of which are market based payments (or compensation) for ecosystems services and insurance arrangements exist and could be adapted to the Ugandan context.

9. There is a need to build consensus of stakeholders on the use of natural resources and environment management on one hand and the need for economic development on the other. Some decisions taken by one group over the other might have large economic, environmental or social impacts that could be irreversible. The current forum seems to lack participation from key actors and decision makers, at least from the perception of the public reflected by the recent demonstrations for the preservation of the integrity of Mabira Central Forest Reserve. There is a need to build a stronger consensus on the governance of key ecosystems in the country.

10. Aquatic resources are increasingly under pressure as competition for fisheries increases with the international exports increase, and the domestic industry expansion. Efforts to develop aquaculture alternatives to capture fisheries require a new effort in addition to research on commercial aquaculture production of the most important commercial fishes such as Tilapia and Nile Perch, and ornamental fishes.

11. Uganda's growing population and poor industrial practices, inefficient use and pollution of rivers, lakes and wetlands pose a threat to water systems. Urban growths that destroy wetlands also reduce the potential for water prurification before waste water reaches the main water systems. Therefore, increased efforts will be needed in the short-term and medium term to strengthen regulations and enforcement of water quality monitoring and effluent management by firms located close to water systems. The country should also develop a long-term strategy on water harvesting, increasing urban water demand and water for agricultural and industrial production.

12. Agricultural expansion from small plots into estate production, conversion of wetlands and deforestation pose a strong threat to the country's biodiversity. Information on biodiversity and threats to biodiversity is not widely spread or understood by stakeholders engaged in activities that are likely to lead to biodiversity loss. Current information dissemination strategies should target the potential violators more strongly.

13. Increasingly there is pressure on woodfuel to provide fuel to rural households and urban households for domestic cooking. The high population growth rate means that the forested areas will disappear at a much faster pace than before. However, there are sufficient alternative sources of energy, although largely unexploited. The country should move rapidly towards increasing the energy options available and making the energy options available for the major consumers households and industrial users. In the medium and long-term the country should move away from heavy fuels as sources of energy because they increase the country's carbon foot print.

14. Environmental health problems still contribute about four-fifths of the country's morbidity. Malaria and diarrhoeal diseases are still major causes of illness and deaths.

There is a need for increased research on the environmental linkages and what options, outside the current set of practices, can be implemented cost-effectively.

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1.0 INTRODUCTION

1.1 Background

The theme for this year's National State of the Environment Report is "***management of the emerging opportunities and threats from the environment***". It draws its inspiration from the Rio Earth Summit, the United Nations Conference on Environment and Development (UNCED) of 1992. In its environment programme of action, Agenda 21, UNCED reaffirmed the links between environment, development, the fundamental connection between environmental goods and services[1] and human well-being. Agenda 21 also emphasises the need for regular reporting on the state of environment. The state of the environment at different management levels provides a framework for national and sub-national integrated environmental assessment and reporting. It also acts as a platform for identifying emerging opportunities and threats, on the horizon for Uganda, for example the prospect of tapping into the incomes that will be generated from oil resources, the return of peace to northern Uganda, and the market-based and more participatory mechanisms for managing the environment and innovations that encourage a cleaner and more environmentally friendly environment.

The importance of regular reporting on the environment was reinforced by the results of the Millennium Ecosystem Assessment (MEA) conducted between 2001 and 2005 with the support of the United Nations Environment Programme (UNEP). The findings in part indicated the following worrying trends.

> *Sixty percent of the world's ecosystems are in decline or even degraded to an extent that society can no longer rely on their services. Global fish stocks are down by 90 percent since the dawn of industrialized fishing, and a third of all amphibians, more than a fifth of mammals and a quarter of the world's coniferous trees are threatened with extinction (UNEP 2005 pg 32).*

Therefore, the importance of periodic review of the world's environment is critical if emerging environmental problems are to receive adequate and timely attention by governments. To date, UNEP has produced two issues of the Global Environment Outlook (GEO), which are a synthesis of regional reports such as the Africa Environment Outlook (AEO). Preparation of the AEO benefits significantly from sub-regional and national state of environment reports.

At the national level, the overall goal of the statement of the environmental report is to capture the prevailing picture of the country's environment. This helps to identify emerging environmental problems so that appropriate actions are taken to ensure a sustainable environment, social and economic development. The objective is to sustain

[1] In this report, where the term environment is used, unless specified otherwise, includes natural resources

environmental quality and resource productivity, on a long-term basis, to ensure that the needs of the present and future generations are met. Specifically, three major reasons are behind the preparation of the State of the Environment Reports (SOERs) and these are: (i) to inform the public on the state of the environment in the country and, particularly on the importance of natural resources to society; (ii) to show major trends, as social and economic development pressures increase on the environment and natural resources (ENRs) and identify areas that need intervention and improvement; and (iii) the SOER is a useful reference material document.

As part of the functions, relationships with lead agencies and delegation, Section 6 Clause 1 (k) of the National Environment Act mandates the National Environmental Management Authority (NEMA) to prepare and disseminate a state of the environment report once in every two years. At the subnational level, the National Environment Act mandates the District Environment Committees, to among others, prepare district state of environment reports every year. Followed to the letter, the district state of environment reports (DSOERs) would act as building blocks for the preparation of the national state of environment reports (NSOERs). Unfortunately, while Uganda has produced NSOERs every two years beginning from 1994, the process is encountering difficulties at the district level, where there is virtually no resource provided for the preparation of the DSOERs. The problem is exacerbated further with the influx of new districts. For example, in 1994, Uganda had 39 districts. By July 2007, there were well over 70 districts. This means that the resources required for the preparation of DSOERs have simply doubled and so has the cost of recruiting and training district environment officers.

1.2 The NSOER process

After the publication of the first National State of the Environment report for Uganda in 1994, a survey of the users of the report was conducted. The survey revealed some important findings. For instance, readers of the NSOER found it informative because of a wide range of environmental issues contained in a single publication. The academicians found the NSOER an excellent reference document, while legislators confirmed that the NSOER was a useful document for reporting and assessing the state and trends of environmental and natural resources in the country. In fact, the only criticism of the document was directed towards the size of the report. The general feeling was that the document was too big to fit in the limited time they have available for reading such materials. The legislators, therefore, advocated for the preparation of policy briefs centred on key environmental issues. A number of policy briefs were prepared out of the material in the 2004/2005 NSOER, and the plan is to continue doing so with subsequent reports. Another constituency which often misses important environmental messages is the primary school pupils and secondary school student population. The approach NEMA is following to enhance the dissemination of key environmental messages is to produce and distribute a wide range of thematic parchment materials from the messages of the NSOERs.

The preparation of the NSOER is largely participatory, drawing from NEMA's horizontal and vertical lead agencies, development partners, research institutions and civil society organisations (CSOs), among others. A Steering Committee is responsible for quality control. Instead of preparing the NSOER in-house, the drafting of the report is outsourced to national consultants thereby building an effective public-private partnership in the process.

1.3 Structure

Traditionally, the State of the Environment Report provides an assessment of the state and trends of the environment and natural resources, and their effect on human well being in the country. This year's State of Environment Report for Uganda (2006/07) is based on five key questions. Similar questions formed the basis for the preparation of the Africa Environment Outlook 2 (UNEP 2006).

The five key questions are the following:

- how and why is the environment important to Ugandans;
- how is Uganda's environment changing (if at all), and why, and what opportunities does it hold;
- are there special issues, which affect the environment and development, that require attention and new approaches;
- how will different policy choices affect the future; and
- what can be done to ensure that environmental value is retained and the lives of people are improved?
  (UNEP 2006)

To answer the foregoing questions, the State of the Environment Report for Uganda 2006/07 is divided into the following five sections:

- *Section 1: Introduction and Country Brief* introduces the report and provides a brief description of Uganda's biophysical, socioeconomic and cultural features. Section 1 is further enriched by the trends of socioeconomic and environmental data for Uganda starting from 1994, where availability of data permitted.

- *Section 2: The Environmental State and Trends* looks at the State of Uganda's environment under the following five themes: atmospheric, terrestrial, aquatic, cross-sectoral resources, important linkages between environment and poverty plus health and the potential value of ecosystems services.

- *Section 3: Emerging Challenges and Outlook* looks at emerging challenges for Uganda; namely: food security; the potential competition of biofuels with food requirements and climate change; genetically modified organisms; invasive alien species; chemicals; and solid waste management. The final part of the section is on the outlook based on the possible scenarios for Uganda's environment and natural resources, ecosystems and human wellbeing, in line with the national Long–term Planning Perspectives of the Vision 2025.

- *Section 4: Conclusions and Policy Options for Action* contains key conclusions and recommendations for policy responses.

- *Section 5: Annexes* is a new addition in the preparation of Uganda's NSOERs. It is an attempt at constructing a series of biophysical, socioeconomic and cultural data which in future could provide a baseline against which changes in a number of environmental parameters can be measured.

1.4 Analytical approach

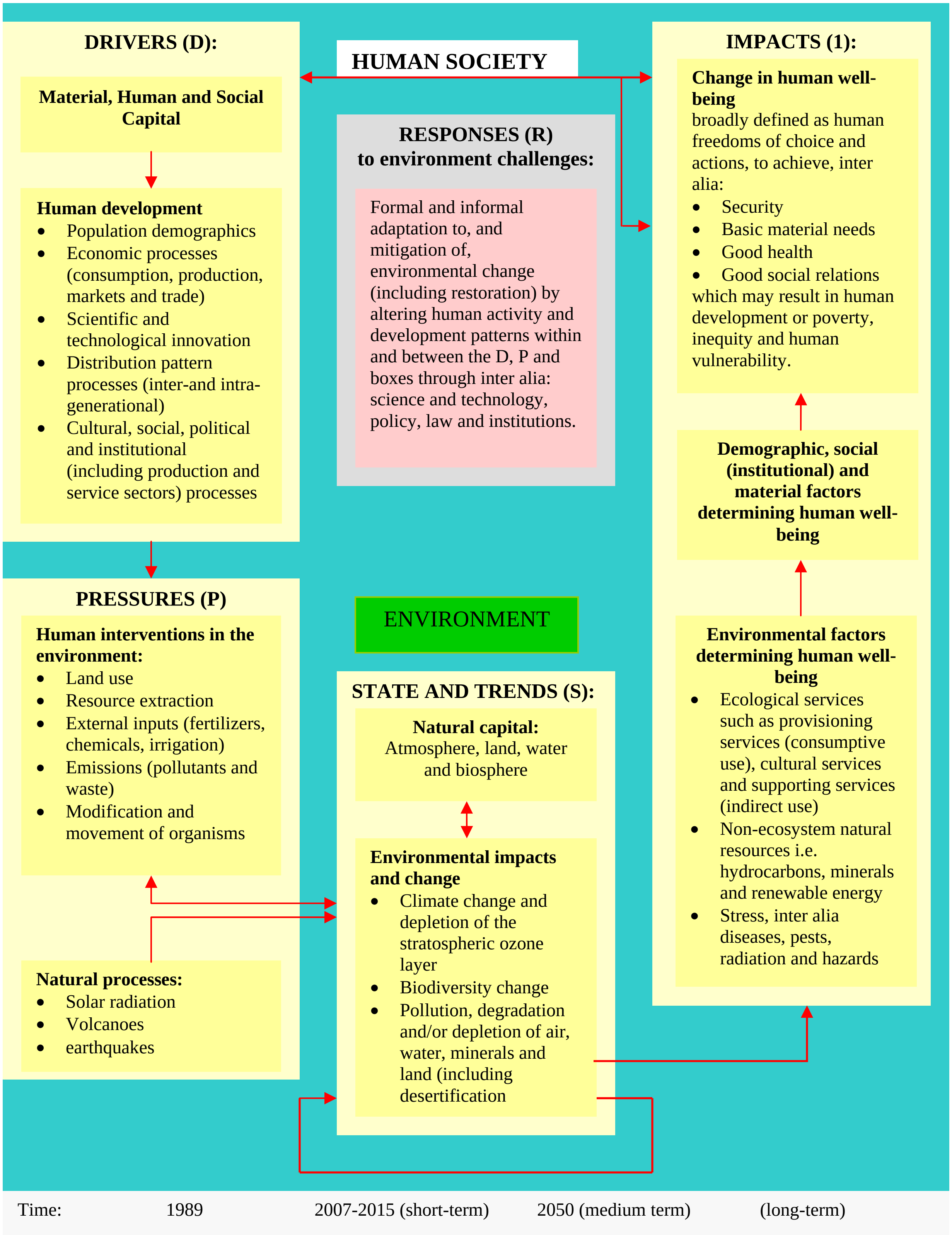
The preparation of the State of Environment for Uganda began with reporting on changes in trends of various environmental and natural resources goods and services and key socioeconomic variables. This was the framework used in 1994, 1996 and 1998 National State of the Environment reports.

In the 2000 report, the PSIR approach that is pressure, state, impact, response was used in an attempt to have an integrated reporting format. To further allow for a better integration, the 2002 and 2004/05 reports used the DPSIR (drivers – pressures – state – impacts - responses) framework (*Figure 1.1*). The 2006/07 report also uses the DPSIR approach but in addition, introduces a modification that includes the opportunities and potential (both current and future) of the resources to address sustainable development, alleviate extreme poverty and reduce vulnerability, and enhance environmental sustainability (UNEP 2006). The opportunities framework was adapted from the DPSIR and addresses the following questions:

- what resources are available at the national and subnational levels (*resources*);
- what is the value of these resources ecologically, socially and economically (*value/opportunities and potential*);
- what are the demands/pressures (*human and natural)* to the sustainable management of these resources (*demands/pressures*);
- what will happen if we do not act now (*outlook*); and
- what are we doing to enhance opportunities and what should we do to reduce such pressures and sustainably maximize on the potential, including rehabilitation (*policy actions*).

The opportunities framework emphasises the more positive indicators, highlighting among others, services delivery, increased livelihood options, adaptability and reduced vulnerability (UNEP 2006). Thus the opportunities framework emphasises hope over despair, resolution over regret, and strategic response over reaction (UNEP 2006).

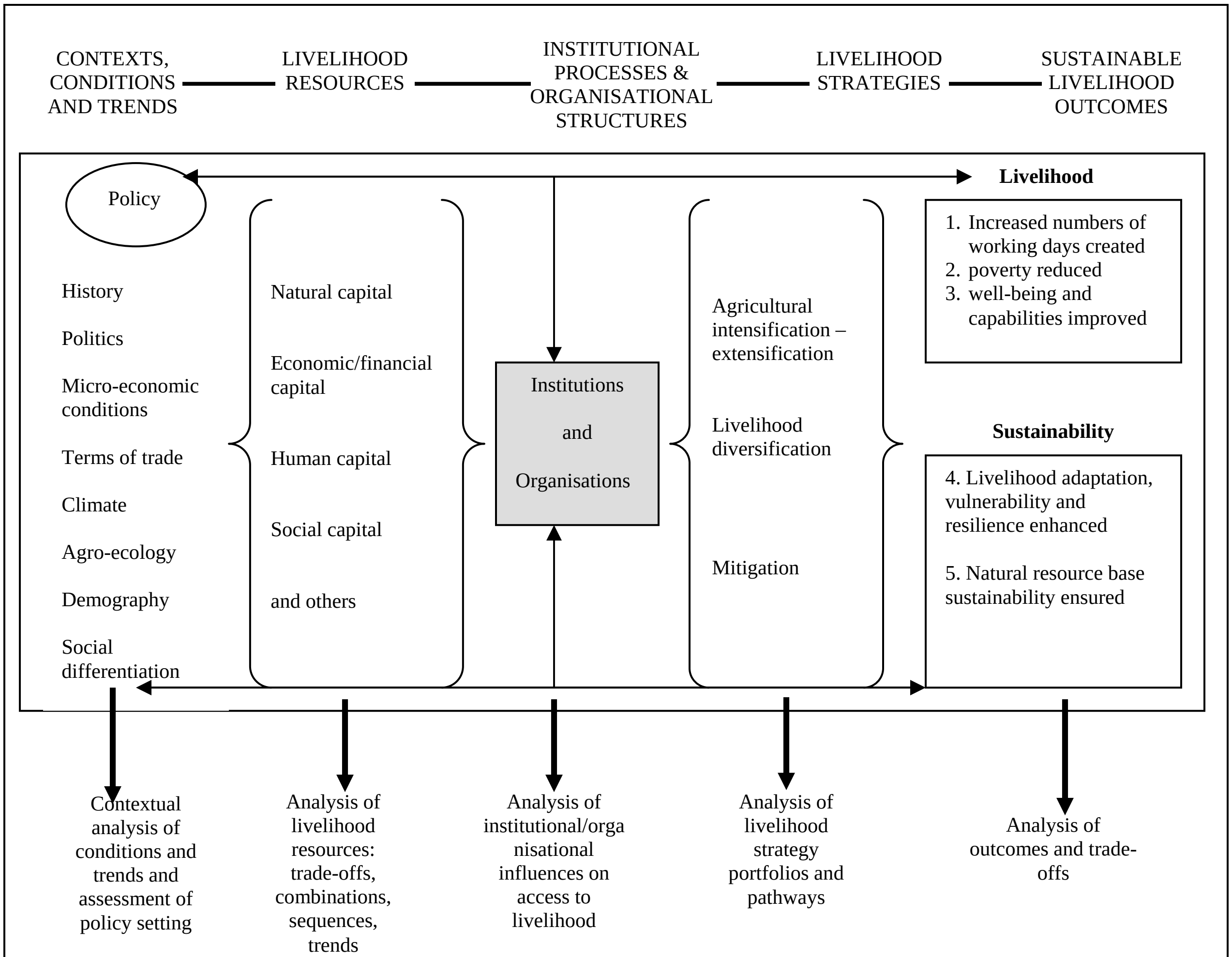
Figure 1.1: DPSIR framework



Source: UNEP (2006)

In close connection to the opportunities framework is a focus on livelihoods. People and livelihoods are at the centre of concern for sustainable development and human beings are entitled to a healthy and productive life in harmony with nature (IGAD Secretariat 2006). *Figure 1.2* represents the livelihoods concept. Certainly, livelihood strategies of the poor often depend directly on healthy ecosystems and the diversity of goods and ecological services they provide.

Figure 1.2: Livelihoods concept



Source: Scoones (1998); Scoones and Wolmer (2003)

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2.0 COUNTRY BRIEF

2.1 Location

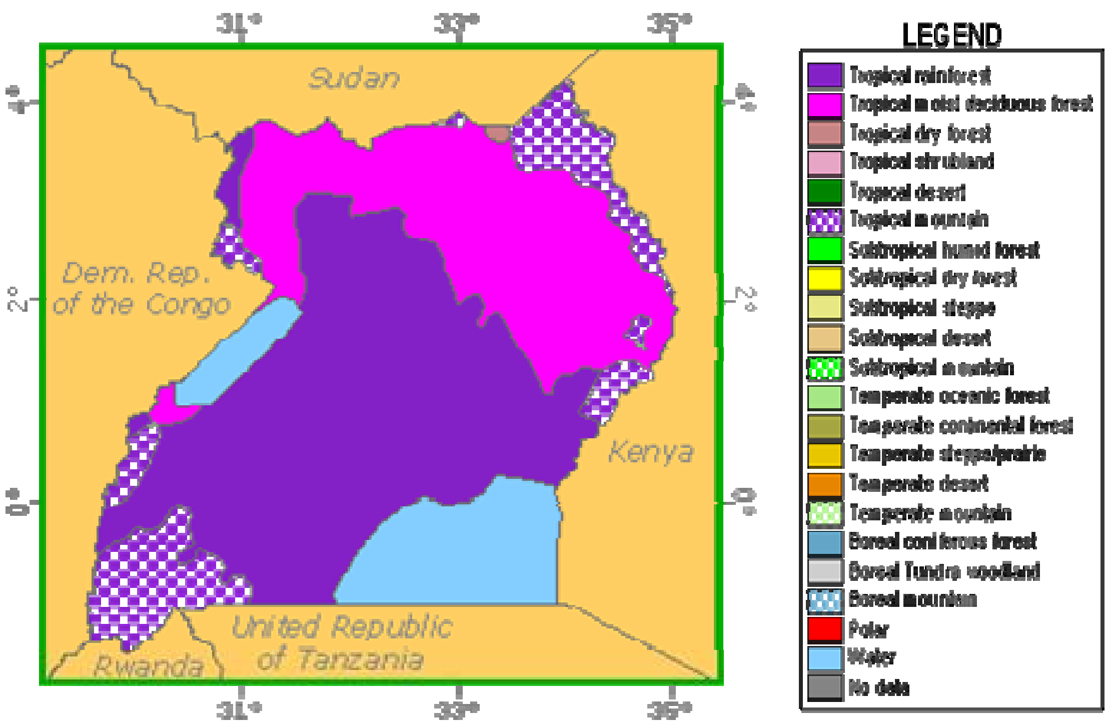
Uganda is located in the Eastern region of Africa, and it is part of the East African Community along with Tanzania, Kenya, Rwanda and Burundi. The country belongs to the Inter-Governmental Authority on Development (IGAD) along with Djibouti, Eritrea, Ethiopia, Kenya, and Somalia in addition to the Common Market for Eastern and Southern Africa (COMESA), along with 18 other African countries. Uganda is a land locked country which lies between latitudes and longitudes 4.2^0 N and 1.5^0 S and 28^0 E and 35^0 W respectively. Its neighbours are Kenya to the East, Tanzania and Rwanda to the South and Southwest respectively, the Sudan to the North and the Democratic Republic of Congo (DRC) to the West. The country covers an estimated total area of 241 020 km^2, of which approximately 15.1 per cent is open water, 11 per cent national parks and game reserves or protected areas (PAs) and about 5.9 per cent forest reserves. Traversing most of its borders with its neighbours are a number of transboundary natural resources such as Lakes Victoria and Albert; River Nile and Mountains Rwenzori and Elgon. This calls for greater cooperation between Uganda and its neighbours towards the sustainable management of shared resources. For instance, Lake Victoria is shared by Uganda, Kenya and Tanzania, thus its sound management requires cooperation among the three countries.

Once described by the former British Premier, Winston Churchill, as the "***Pearl of Africa***", Uganda is gifted by nature. The is endowed with a mosaic of geographical features ranging from glacier-topped mountain ranges, tropical rain forests and dry deciduous acacia woodlands, to vast water bodies (lakes, rivers, wetlands, swamps) as well as fertile soils that are well distributed all over the country. This diversity can be observed along both North-South and East-West transects. In 2005, the Government of Uganda injected US$ one million to promote the country's tourism potential on Cable News Network (CNN), based in Atlanta Georgia in the United States, for six months. The '***Uganda: Gifted by Nature***' promotion was the fast ever global media campaign to market the country's tourism and beauty abroad. The intention of Government was to convince people all over the world of the uniqueness of Uganda as a destination. Some examples of the unique features are: Uganda is the source of the Great River Nile and home to Africa's largest fresh water lake, the Lake Victoria. Seven of Africa's plant kingdoms are represented in Uganda, which is more than any other country on the continent boasts of. Uganda ranks among the top ten countries in the world in terms of the diversity of its mammal groups. The country lies at the overlap between the tropical East African Savannah and the West African rain-forest zones. Along with Rwanda and the Democratic Republic of Congo (DRC), the country has the last remaining population of the great apes (the Mountain Gorilla) among several other features (UIA, 2006).

The diverse landscapes and climate that characterise Uganda support a variety of flora and fauna. Apart from great diversity of fauna, there are some 94 recognizable plant communities. These include, among others, closed canopy high tropical forests, montane bamboo, heather and moorland, swamps and wetlands, moist and dry woodlands, and thickets. In the north of the country, the dominant vegetation cover is the moist deciduous forest while rainforest runs throughout the central region. The northeastern and southwestern parts of the country have pockets of tropical mountain ecosystems. Overall, Uganda has four distinct ecosystem types, which include:

- shrubs, savanna and grasslands covering 44 per cent of the total land area;
- cropland/natural vegetation mosaic covering 35 per cent;
- water bodies (lakes, rivers, wetlands and swamps) covering approximately 16 per cent; and
- forests covering 20 per cent. One percent of the land lies barren and is characterised by sparse vegetation cover (World Resources Institute (WRI) 2003d).

Figure 2.1: Ecological zones, Uganda



Source: FAO (2000)

2.2 Topography, climate and hydrology

Uganda lies astride the Equator and its temperatures range between 15^{0}C- 30^{0}C. More than two-thirds of the country is a plateau, lying between 1 000 – 2 500 metres above sea level. Precipitation is fairly reliable, varying from 750 mm in Karamoja in the Northeast to 1 500 mm in the high rainfall areas on the shores of Lake Victoria, in the highlands around Mt. Elgon in the east, the Rwenzori mountains in the south-west and some parts of Masindi and Gulu. The total geographical area of the country is 241 000 km^2, 75 percent of which is available for cultivation, pasture or both (UN-Water, 2006). The remaining 25 per cent constitutes lakes, swamps and forestry zones. Agriculture (comprising of crops, fish and livestock) is the mainstay of the Ugandan economy, providing a significant share (about 40 per cent) of gross domestic product (GDP), 85 per cent of export earnings, 80 per cent of total employment and the bulk of raw materials used by the mainly agricultural–based industrial sector (NEPAD/FAO, 2004). Much of Uganda's terrain consists of plateau, rolling hills, flatlands and mountains, which are traversed by numerous, lakes, rivers, wetlands and streams. The entire country has almost an altitude of between 900 - 1500m above sea level with the mean average level of 1200m.

The southern half of Uganda has a bimodal ranfall distribution, which allows farmers to have two crops annually, and adequate grazing for livestock throughout the year. Around Lake Victoria is the annual rainfall averages 1 200 – 1 500 mm, and is well distributed. To the north, the two rainy seasons gradually merge into one. Dry periods at the end of the year become longer, with annual rainfall ranging between 900 – 1 300 mm, this restricts the range of crops that can be grown. These conditions are not suitable for bananas but favour extensive livestock production. The influence of soils, topography and climate on the farming systems in Uganda has led to the dividing of the country into seven broad agro-ecological zones. These zones are based on soils, topography, rainfall and major crops grown.

Although the climate is generally tropical, it is mild due to the high altitude, which modifies the annual mean temperatures that fluctuate between 16^0C and 29^0C. Depending on elevation and landscape, the mean temperatures over the whole country show great variation. The Inter-Tropical Convergence Zone (ITCZ) and the air currents such as the southeast and northeast monsoons influence the climate of Uganda. In most parts of the country, the seasons are fairly well marked–as rainy and dry seasons (MWLE, 2003). However, in areas adjacent to water bodies such as Lake Victoria, maritime conditions tend to modify the temperatures. The variations in mean monthly and annual evaporation rates are much smaller than corresponding variations in rainfall, which are 10-20 per cent and 20-40 per cent in the southern and northern parts of the country respectively. The movement of the ITCZ is largely responsible for the variations in meteorological factors that determine evaporation.

Taking precipitation as the dependent variable, fourteen climatic zones can be identified in Uganda. Hydro climatic studies further divide two of the zones M and C in sub zones delineating areas with relatively low rainfall, which form part of the *cattle corridor* that runs across from the southwest to the northeast of the country. Similarly, the study further sub divides zone A into zones A1 and A2 with zone A1 receiving less precipitation than zone A2. Based on these studies, a total of seventeen rainfall zones can now be identified in Uganda.

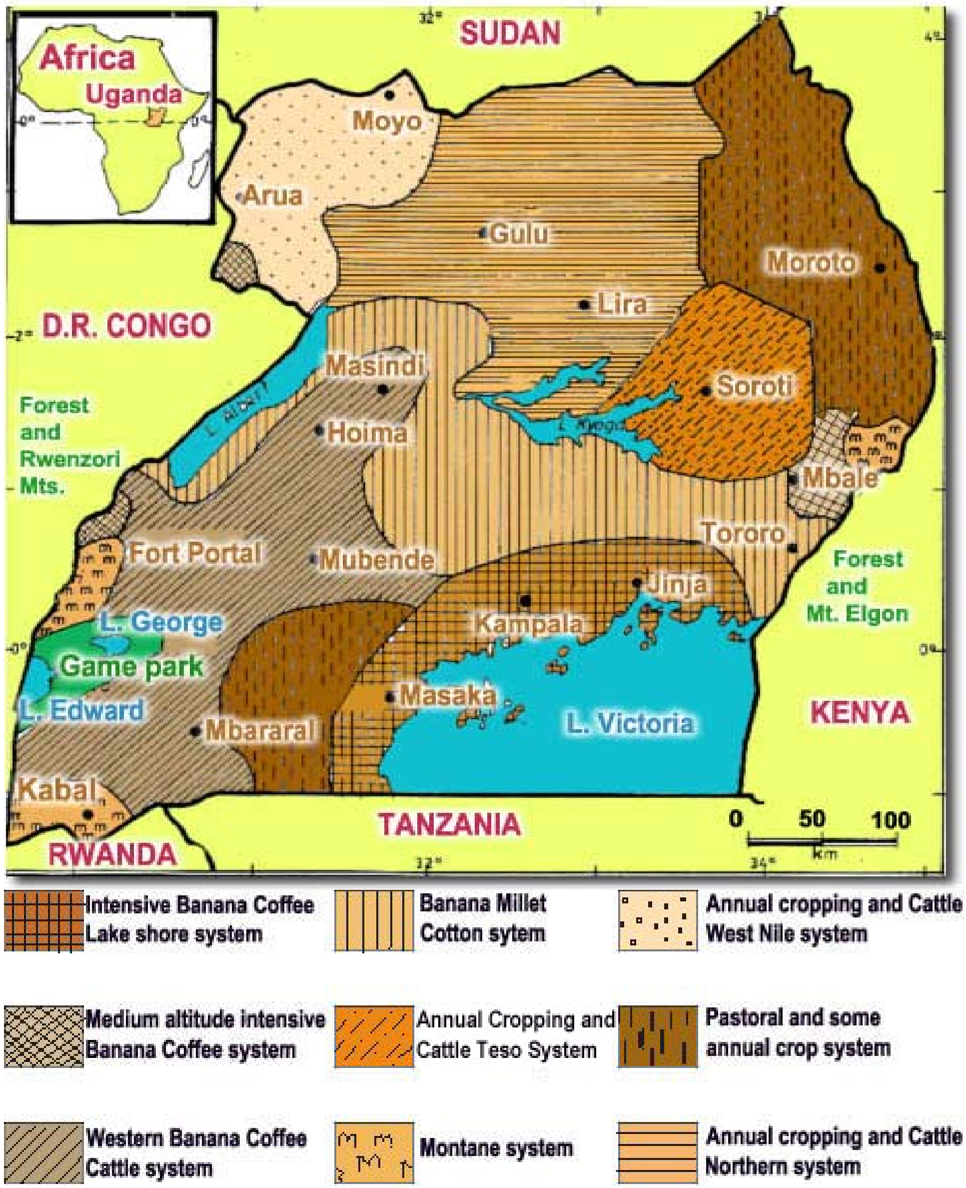
Uganda has a dense drainage system, which is mainly concentrated in the South of River Nile. The system comprises of different networks that include numerous lakes, rivers, streams and wetlands. Wetlands cover 13 per cent of the country's total area, of which two thirds located in the south of the country, are always permanently flooded (FAO 2005). However, River Nile whose basin has eight subdivisions namely; Lake Victoria Basin, Lake Kyoga Basin, Victoria Nile Basin, Lake Edward Basin, Lake Albert Basin, Albert Nile Basin, Aswa Basin and Kidepo Basin accounts for 98 per cent of the country's total drainage. Besides the major lakes: Lakes Victoria, Albert, Kyoga, Edward and George, there are over 160 minor water bodies, covering a total of 1 707 km^2.

2.3 Geology and soils

Uganda is made up of predominantly old rocks from the Pre-Cambrian era (3 000 – 6 000 million years ago). There are also younger rocks, mainly of sedimentary and volcanic origin, from the cretaceous era (135 million years ago). The larger part of the country that is more than two thirds has poor ferralitic soils. These soils have nearly lost all their mineral content through prolonged weathering. They need proper management to give reasonable crop yields. The rest of the country has mostly richer ferruginous and highly productive volcanic soils (UN Water, 2006).

A number of parameters define the soils of Uganda and these include parent rock, age of soil and climate. The most dominant soil type is ferralitic soil, which accounts for about two-thirds of the soils found in the country. Based on studies carried out in the past, Uganda's soils are divided into six categories according to productivity: a) very high to high productivity; b) moderate productivity; c) fair productivity; d) low productivity; e) negligible productivity; and, f) zero productivity. The high productivity soils cover 8 per cent of the area of Uganda (MWLE, 2001). Considering the country's size, this is indeed a small area. Therefore, fair and low productivity soils must be effectively managed in order to sustain Uganda's agriculture.

Figure 2.2: Ecological zones, Uganda

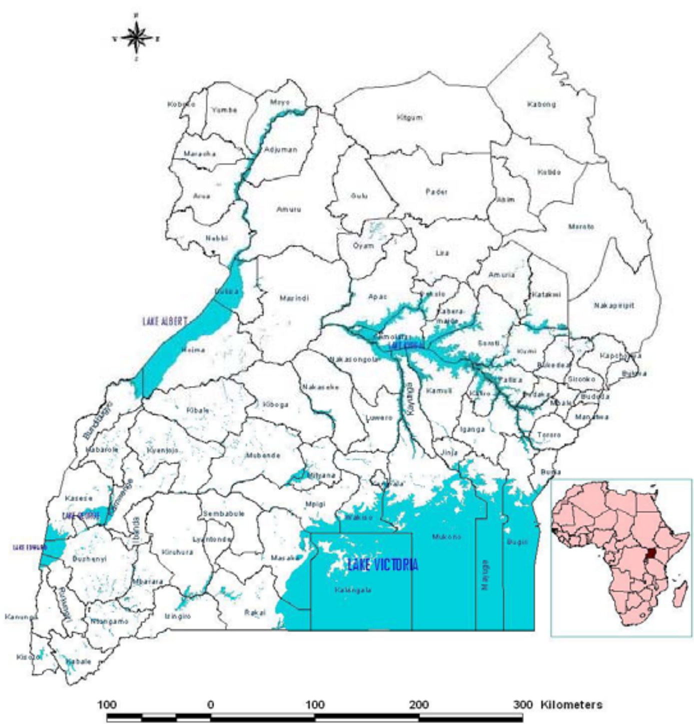


Source: FAO (1999)

2.4 Administrative structure

For administrative purposes, Uganda is currently divided into 75 confirmed districts, and there are more in the offing. The Decentralisation Policy, adopted in 1991, forms the main governance framework. The Local Governments Act (1998) recognises Districts as autonomous local authorities, exercising relative independence on planning and decision making. This arrangement has enabled transfer of resources and responsibilities to levels, which are close to the people. In many respects, it has empowered the people to actively participate in decision making regarding their well being including natural resources management. The creation of more districts has been part of the on going government policy of decentralisation. While more districts will mean greater devolvement of central government functions including that of environment and natural resources management, it will increase the cost of public administration. For instance, these new districts will have to develop their own environment action plans and appoint environment and natural resources management officers in charge of e.g. land, forestry, environment, wetlands, etc. as stipulated in the new structures recommended by the Public Service.

Figure 2.3: Administration, Uganda



Source NEMA 2007

2.5 The People and population dynamics

There are at least 46 indigenous tribes in Uganda. While these various ethnic groups share a common African culture, there are regional differences in traditions that, among others, govern production and consumption patterns. Differences in production and consumption have varied influences on the environment depending on the region. With the population growth rate, on a national average still at 3.4 per cent per annum, the current population, according to Uganda Population Secretariat (UPS) stood at over 27 million people (UPS, 2006).This growth rate varies with the districts, ranging from over 9 per cent to less than 1 per cent, for Kotido and Kabale districts respectively. However, the country has a relatively young population with 56 per cent of the total population comprising people below 18 years of age. This together with a significant number of orphans has created a high dependency ratio amongst the population. The estimated average household size is 4.8 to 4.2 persons and 4.9 persons, in the urban and rural areas respectively (UBOS 2006).

The population of Uganda stands at 28.4 million in 2007 (*Table 2.1*). Uganda's population has increased by 70 per cent since 1991 from 16.7 million. The population of women was higher than that of men by 800 000 in 2007. Moreover, the population growth rate, of 3.4 per cent, is still one of the highest in the world with Uganda's population expected to exceed 50 million, and 127 million in 2025 and 2050 respectively.

Table 2.1: Trends of selected demographic idices (population in millions)

	1991	**1995**	**2002**	**2007**
Total population	16.7	19.3	24.4	28.4
Male population	8.2	9.5	11.8	13.8
Femle population	8.5	9.8	12.4	14.6
Population growth rate (%)	2.5	2.5	3.2	3.2
Urban population (million)	1.7	2.1	3.0	3.7

Source (UPS, 2007)

2.6 Education

Education plays a key role in promoting sustainable development by enhancing capacity building of the population in various skills as well as raising awareness on several issues of national importance including that on natural resources and the environment. In addition, education plays a crucial role in improving the people's standard of living. Available statistics indicate that at present, more than a quarter of the population is illiterate. However, this fraction is confined to those persons over 65 years of age (UBOS 2004b). While many individuals between 20-54 years of age have little or no formal environmental education, the younger population, through the Universal Primary Education (UPE) are likely to benefit from formal environmental education. This can be seen from the trend of primary school education (*Table 2.2*).

Table 2.2: Trend of Primary School Education in Uganda 2001 - 2004

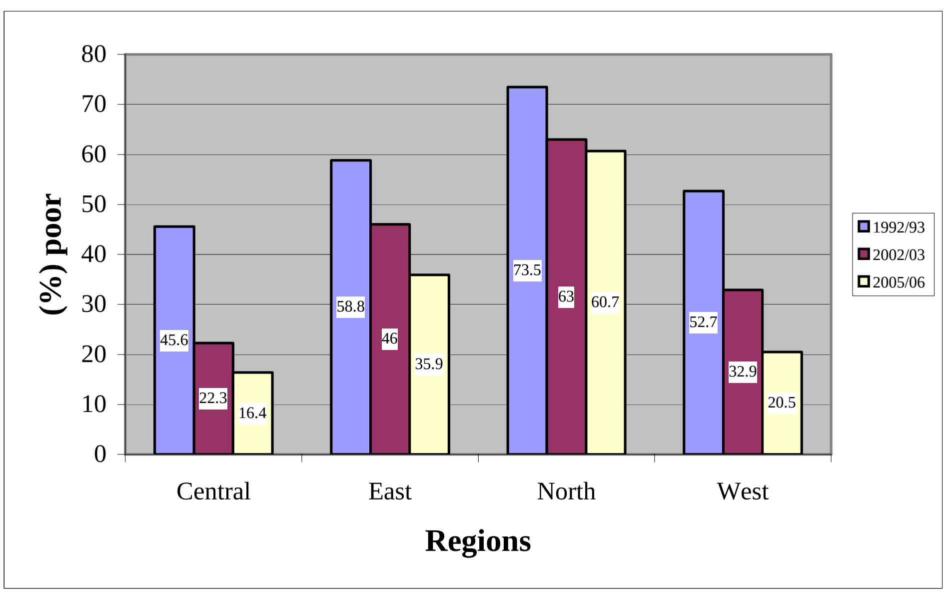
Year	**2001**	**2002**	**2003**	**2004**
Enrolment	6,900,916	7,354,153	7,633,314	7,377,292
No. of Schools	12,280	13,332	13,353	13,407
No. of teachers	127,038	139,484	145,587	141,461
Annual % change in enrolment	-	6.6	3.8	-3.3

Source: UBOS (2006)

2.7 Economy, poverty and employment

Since the first publication of the SOER in 1994, the economy of Uganda has registered an impressive growth. During the periods from 1994 to 2006, growth of the economy, measured by increases in the gross domestic product (GDP), has averaged over 5 per cent per annum. Over the same period, headcount poverty decreased from 56 per cent of the total population in 1992 to 35 per cent by 2000 and 38 per cent by 2002/03. However, according to the recent 2005/06 National Household Survey (NHS), nationwide, headcount poverty levels have further dropped from 38 per cent to 31.1 per cent (UBOS 2006). While nationally headcount poverty has further continued to fall, regional variations remain eminent (*Figure 2.4*). The northern region, having suffered from 20 years of the Lord's Resistance Army (LRA) insurgency and cattle rustling, trails all the regions and has the highest headcount poverty of 60.7 per cent, a slight drop from the 2002/03 situation of 63 per cent. This apparent improvement could be attributed to improved security, aid and trade with South Sudan. At present, 8.4 million Ugandans, of which 7.9 million are rural dwellers, still live in poverty compared to 9.8 million three years ago. Although growth of the economy is impressive, the country is still plagued by inequitable sharing of benefits. While the NHS noted on one hand a nationwide income inequality reduction of 4.5 per cent indicative of a narrowing gap between the rich and the poor, it on the other hand observed a widening income gap between the regions (UBOS 2006). Overall, the Survey observed improvements in the living standards and in the distribution of income.

Figure 2.4: Headcount poverty by region 1992-2006



Source: UBOS (2006)

Besides inequitable sharing of benefits accruing from the rapidly growing economy, there is concern over whether this growth can be sustained. Using adjusted net savings (ANS) as a measure of sustainable development; Uganda's present economic growth trend is unsustainable. A major contributor to this is soil nutrient loss. In other words, Uganda's environment and natural resources (ENRs) are being exploited without any sufficient compensatory formation.

While nationwide poverty levels have further fallen from 38 per cent of the national population in 2002/03 to 31.1 per cent by 2006 and there is an observed narrowing of the gap between rich and poor, poverty still remains a major problem. To the poor, natural resources are the pillar on which livelihoods depend all the time.They present the only alternative that bail the people out should there be crop failures due to unforeseen circumstances such as droughts, floods or diseases outbreak. The limitation of livelihood alternatives coupled with limited coping abilities renders the poor people both agents and victims of environmental degradation.

Favoured by good climate, well-distributed and reliable rainfall and relatively fertile soils, Uganda remains predominantly an agricultural country. Consequently, agriculture is largely the main source of livelihood and employment particularly among the rural population. However, with other sectors of the economy growing, agriculture's share of total employment is expected to decline. Until now, industrial output has registered a yearly average growth of over 10 per cent. Most of the industrial activity is based on agro-processing and the processing of natural resources products. Increased levels of air, water and soil pollution accompany industrial production and pose serious environmental problems. Currently, measures to mitigate pollution effects are being addressed through environmental assessment processes and adoption of cleaner production technologies.

2.8 Transport and communication

As the number of vehicles on the roads keep rising every year, transportation has increasingly become easier. For instance, in 2005, the number of vehicles on the roads increased by 12.8 per cent compared to 9.2 per cent in 2004 (UBOS 2005). Similarly, air transport has greatly improved with more frequent international flights. The road network is improving and the environmental effects of road construction and maintenance are lessened using the EIA guidelines for the Roads Sub-Sector and several guidelines to address other crosscutting concerns. Recently, both road and air transport have improved but rail and water transport remain poor and insufficiently developed.

Considering the current statistics, Uganda in the last ten years made significant progress in improving and expanding its communication network. The most dramatic increase has been in the number of cell phone owners from few individuals since the publication of the first SOER in 1994 to currently over 1.9 million subscribers. By 2004, there were approximately 8 000 Internet subscribers from almost none in the last decade. While communications will facilitate the dissemination of environmental messages, expanded cell phone use comes with some significant environmental problems. For instance, the indiscriminate disposal of the non-biodegradable plastic air time cards including scrap phones and their parts degrades the environment.

2.9 Human settlements, housing and urbanisation

In Uganda, and particularly in rural areas, settlements are often unplanned and thus, wasteful use of land makes the cost of providing social services high in many areas. Even in places, particularly in urban areas where plans exist, they are rarely followed.

The quality of housing Ugandans live in has continued to improve over the years and at the same time, there has been a decline in the use of mud and poles for walls easing pressure on both native forests and woodlands. The change has instead resulted in increased mining of clay for brick making as well as stone quarrying. In the absence of mitigation measures open pits left behind from both clay mining and stone quarrying fill with stagnant water and become potential fertile breeding grounds for mosquitoes. In 1991 over 85 per cent of the houses in both urban and rural areas had rammed earth for floor but by 2002 only 29 per cent urban and 77 per cent rural houses had the same.

Although, in absolute terms, Uganda is one of the least urbanised countries in the world, the urban population is growing. Beginning from about 635 000 in 1969, the urban population increased to 938 000 in 1980, 1 890 000 in 1991 and 2 922 000 in 2002 (UNDP, 2005). The growth rate is higher (3.7 per cent) than the national average (3.4 per cent). Expanded urban population is accompanied by, among others, increased consumption that results in increased concentration of wastes, which could raise serious pollution issues if not properly addressed.

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Section 2: The environmental state and trends

- **Atmospheric resources**
- **Terrestrial resources**
- **Aquatic resources**
- **Cross-sectoral resources**
- **Linkages**

3.0 ATMOSPHERIC RESOURCES

3.1 Climate

The climate of East Africa is broadly controlled by large-scale easterly trade winds, which are responsible for the transport of moisture from the neighbouring oceans (advection of moisture inland). The moisture transported from the neighbouring oceans makes up over 75 per cent of the moisture forming the inland rainfall. The space-time state and reliability of weather and climate within the East African region in general and Uganda in particular is controlled by a number of large to medium scale atmospheric meteorological systems which include: The Inter Tropical Convergence Zone (ITCZ), Monsoons, Meso–Scale Circulations, and Teleconnections (El Nino/ Southern Oscillation) ENSO[2] (Faculty of Arts, Makerere University, 2006)

The Inter Tropical Convergence Zone is the main synoptic scale system that controls the intensity and migration of the seasonal rainfall over the East African region. The ITCZ is a broad zone of low surface pressure into which the low-level equator-ward moving air masses from both hemispheres converge. The two components of the ITCZ, the meridional and the zonal brings about two rain seasons in most parts of the country - the so called "long rains" of March to May and the "short rains" in October to November (EAMD, 1962).

The monsoons that affect East Africa are the North East (December to February) and the South East (June to August) monsoons phases. These phases correspond to the maximum positions of the ITCZ to the South (Southern summer) and to the North (Northern summer). However, the fully developed East African monsoons are associated with relatively little rainfall and coincide with the dry period within the bimodal areas.

Due to the proximity of East Africa to the Indian Ocean, highly variable topography and the existence of the large Lake Victoria basin, the region experiences vigorous meso-scale circulations. Furthermore the region gets marked diurnal variation of precipitation due to the vigorous mesoscale circulations since they contribute substantially to the distribution and intensity of rainfall over the region. All over Uganda there are broadly two diurnal time periods of intense precipitation. The first is in the morning period, especially between 0400hrs – 0900hrs when the Lake Victoria basin experiences its maximum precipitation while the second period is between 1500hrs and 1700hrs when the inland areas, especially the high grounds experience their most intense precipitation (Faculty of Arts, Makerere University, 2006).

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[2] *Meteorology Unit of the Department of Geography, Makerere University/Water Resources Management Department/ Department of Geography, University College London (UK)/ Meteorology Department (2006)*

The El Niño/Southern Oscillation (ENSO) is the principal mode of inter-annual variability in the global tropics. To a first approximation, ENSO can be viewed as a modulation of the global monsoon / trade-wind system. This modulation is manifested in modification and displacement of large-scale precipitation patterns and includes episodes of both floods and droughts, which may occur at various phases of the ENSO evolution and in particular during the opposite extremes of the ENSO cycle (UNEP, 2002).

In Uganda there are particularly two important climatic variables; rainfall and temperature and they have been fairly monitored and recorded over the years. The Meteorology Department in Uganda monitors climatic changes in the country. The Department originally had 1 000 weather stations spread throughout the country to provide a dense network of climatic data. Conversely, due to the political turmoil of the 1970's most of these got damaged or were neglected. By 2001, only 60 weather stations were operational. These were too scanty to provide enough climatic data to cover the country. Moreover, the few remaining stations have often focused their attention on obtaining data regarding only two climate variables; temperature and rainfall whose discussions are given in subsequent sections (Meteorology Department, 2007).

Presently, it is widely agreed by the scientific community that climate change is already a reality. The rate and duration of warming observed during the twentieth century are unprecedented in the past thousand years. Increases in maximum temperatures, numbers of hot days, and the heat index were observed over nearly all lands during the second half of the twentieth century[3] (AFDB,2003) The impacts of climate change are likely to be highest in the vulnerable and poorest parts of the world in Africa, Uganda inclusive. Some of these impacts are:

- increase in droughts, floods, and other extreme events adding to stress on water resources, food security, human health, and infrastructure further constraining development;
- changes in rainfall and intensified land use would exacerbate the desertification process;
- grain yields are projected to decrease and as aresult diminish food security;
- major rivers are highly sensitive to climate variations and may experience decreases in run-off and water availability, affecting agriculture and hydropower systems, which may increase cross-boundary tensions; and
- increase in frequency of some extreme climatic events in some places.

[3] African Development Bank; Asian Development Bank; Department for International Development, United Kingdom, Directorate-General for Development, European Commission; Federal Ministry for Economic Cooperation and Development, Germany; Ministry of Foreign Affairs - Development Cooperation, The Netherlands; Organization for Economic Cooperation and Development; United Nations Development Programme; United Nations Environment Programme The World Bank (2003)

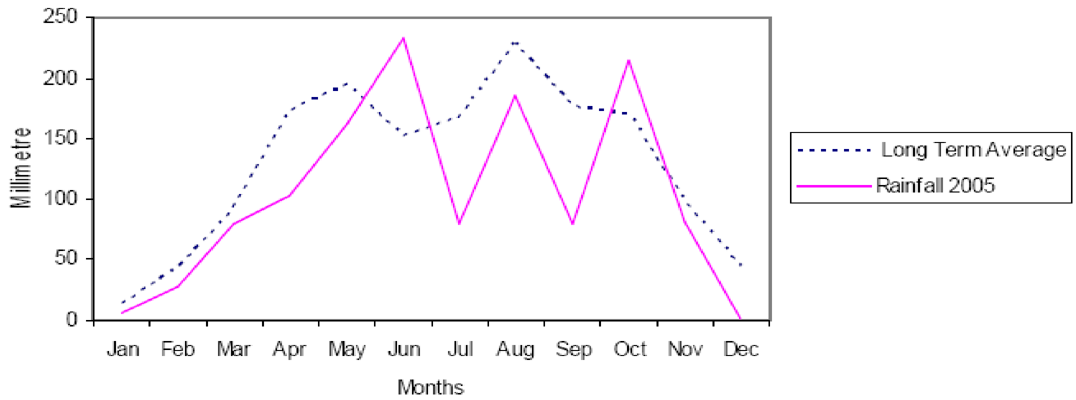
3.2 Rainfall

3.2.1 General rainfall patterns in Uganda

In Uganda, rainfall is the most sensitive climate variable as it affects many social and economic activities. The wettest districts are located within the lake basin areas and include the districts of Kalangala, Kampala, and parts of Masaka, Mpigi, Mukono, Jinja and Bugiri (UBOS, 2006). The western and northern districts occasionally experience long droughts, which are recently becoming more frequent. The eastern region including the districts of Pallisa, Mbale, Kapchorwa, Kumi, Soroti, Tororo, and Busia receive moderate rainfall. The average long-term annual rainfall for Uganda is 1 318 mm. *Figures 3.1, 3.2, 3.3,* and*3.4* indicate rainfall anomalies across the four regions of Uganda. While there were marked positive anomalies from the 1940s up to the early 1960s, these have progressively reduced in the subsequent years and remained somewhat balanced across the four regions.

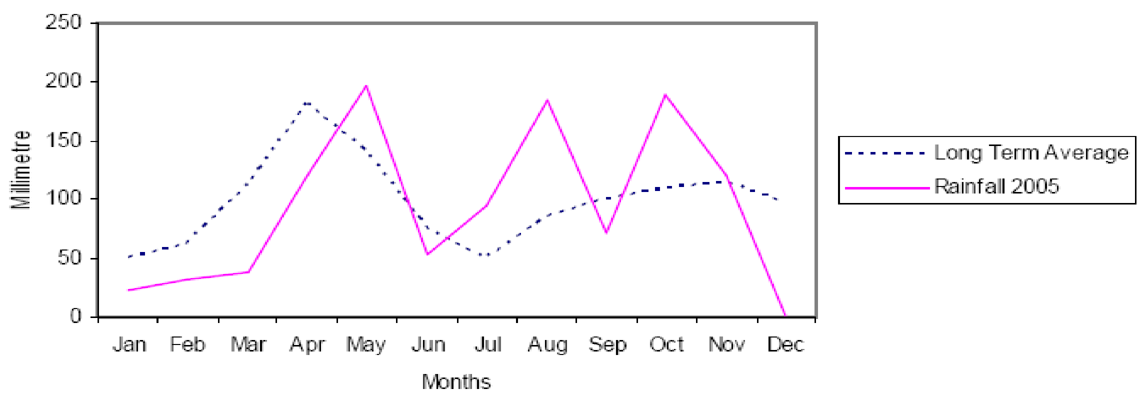
March to May is the main stable rain season over most parts of the country (UN-water, 2006). The probability of normal range of rainfall is generally over 80 percent except over the extreme north eastern areas where the probability drops below 70 percent. The probability of below normal rainfall is low, around 10 percent over most parts of the country except over the extreme north eastern areas where it goes up 20 percent. The probability of above normal rainfall is low, just around 10 per cent, over most areas of the country. October to December is the most variable rain season over most parts of the country. The probability of getting the normal range of rainfall is between 70 to about 80 per cent over the western areas where the main rainy belt for this season is centred but drops to around 50 per cent over most areas of the eastern region and the central parts of the country. The probability of below normal rainfall is fairly high, over 20 per cent over most parts of the eastern region and to above 40 per cent over the north eastern areas. The probability of above normal rainfall is also fairly high (over 20 per cent) over most parts of the eastern areas. The high variability of rainfall during this season results in high incidences of droughts and floods especially over the eastern parts of the country (UN-water, 2006).

Figure 3.1: Monthly rainfall in Gulu district



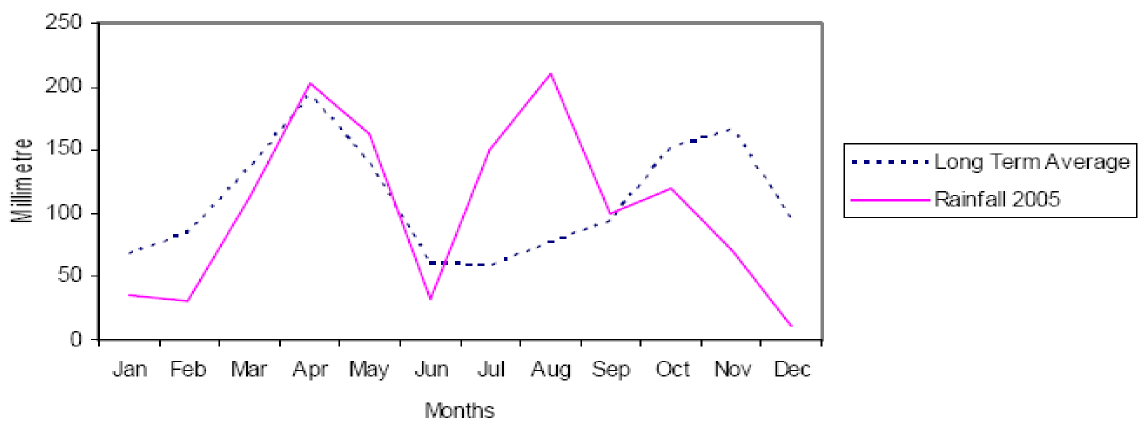
Source: UBOS (2006)

Figure 3.2: Monthly rainfall in Kampala district



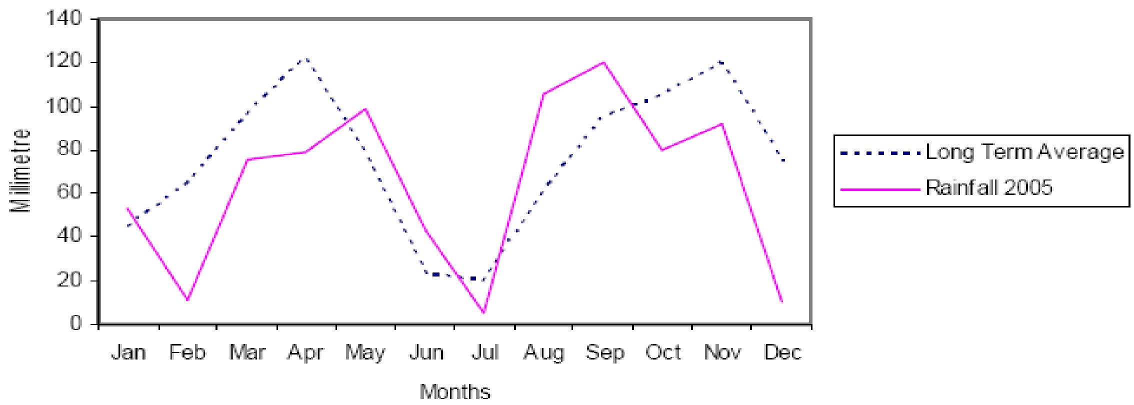
Source: UBOS (2006)

Figure 3.3 Monthly rainfall in Jinja district



Source: UBOS (2006)

Figure 3.4: Monthly rainfall in Mbarara district



Source: UBOS (2006)

3.2.2 Floods in north and north-eastern Uganda

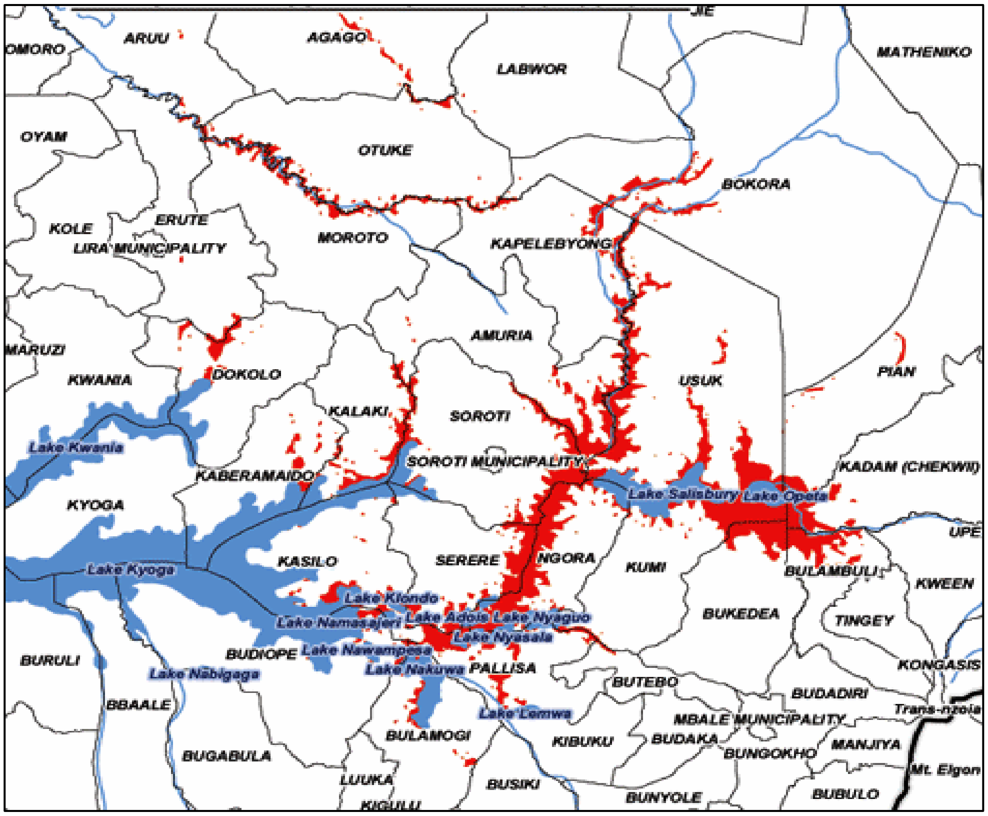
Torrential downpours over the last few months have caused major floods across Africa, submerging whole towns and washing away bridges, farms and schools. According to the United Nations, at least 1.5 million people in 18 countries have been affected by the worst downpours in 30 years (BBC News, 2007). In East Africa severe weather going back to July has badly affected Ethiopia, Somalia, Kenya, Eritrea, Rwanda and Uganda. Hailstorms and landslides have compounded the problems.

In Uganda, on 19 September, President Yoweri Museveni declared a State of Emergency in the areas of eastern Uganda affected by flooding. The State of Emergency was endorsed by Parliament on 25 September (IRIN, 2007). Flooding affected the Districts of Amuria, Bukedea, Kaberamaido, Katakwi, Kumi and Soroti in Teso sub-region (*Figure 3.5)*:; Amuru, Gulu, Kitgum and Pader in Acholi sub-region; Amolatar, Apac, Dokolo, Lira and Oyam in Lango subregion; Abim, Kaabong, Kotido, Moroto and Nakapiripirit in Karamoja region; Bududa, Bukwo, Kapchorwa, Mbale, Manafwa and Sironko in Elgon region; Adjumani, Arua, Moyo, Nebbi and Yumbe in West Nile region; and Kiboga and Kamuli districts in central Uganda (Relief Web, 2007).

Over 400 000 people have been displaced. The incidence of malaria and diarrhoeal diseases has increased and is expected to increase further. An entire season's crop has been lost and it is envisaged that the worst affected communities will need food aid for at least one year before they can restore their livelihoods (BBC News, 2007).

Figure 3.5: Flood affected areas in eastern Uganda

(Satelite image derived map)



The flood-analysis outlines (areas in red) include normally occurring water bodies and drainage networks. Some of these areas may not accurately reflect the recently inundated areas.

Source: UNOSAT Uganda maps (2007)

The Uganda Department of Meteorology's seasonal rainfall forecast for September to December predicts high chances for normal to above normal rains to continue over most parts of the eastern region of Uganda (New Vision, 2007).

Plate 1: Image of floods in the Teso region of Uganda

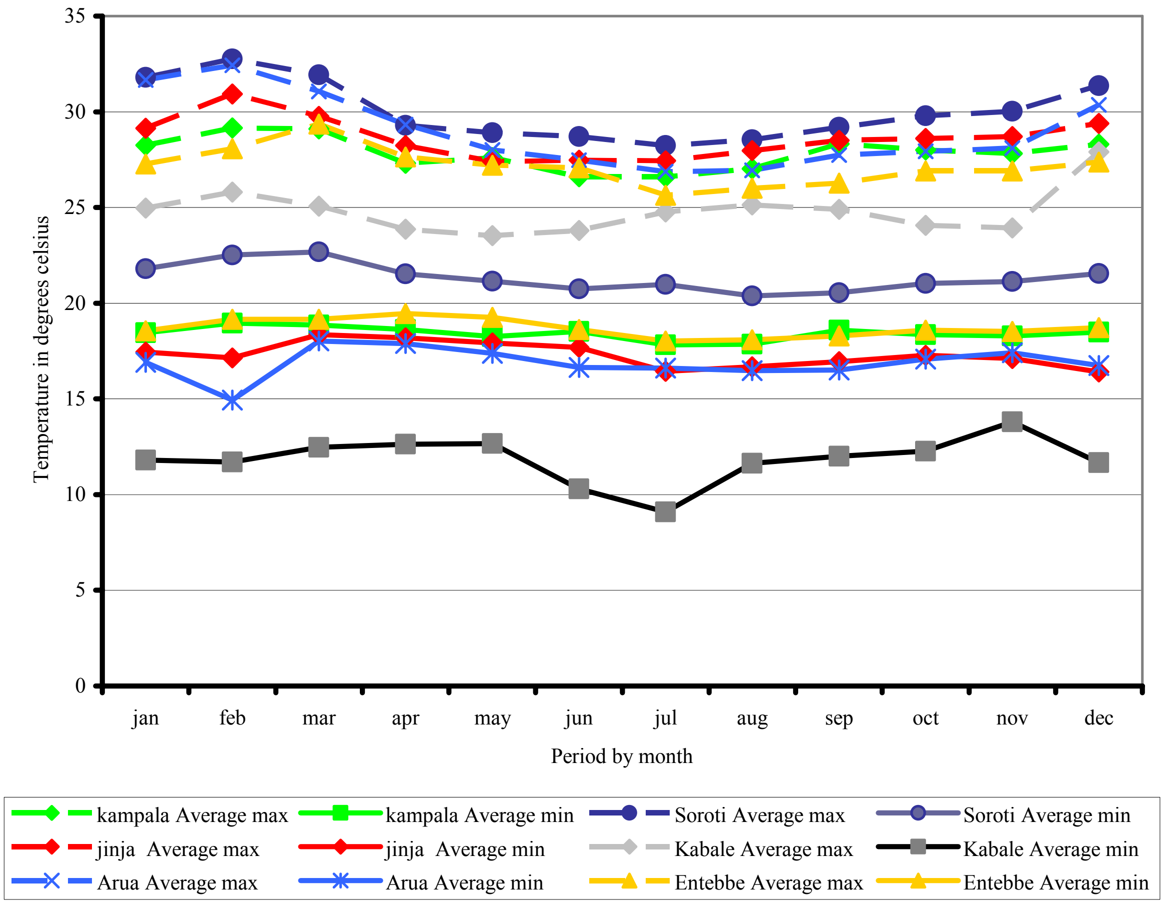
Source: NEMA Files (2007)

3.3 Temperature

Uganda experiences moderate temperatures throughout the year. The country is pleasantly cool with a long-term mean temperature of 21^{0} C. Over a year, mean temperatures range from a minimum of 15 ^{0}C in July to a maximum of 30 ^{0}C in February. In the highlands and around mountains, the elevated landmass exerts a local influence in climate producing rainfall and temperatures that are unique from the lowlands (UN-Water, 2006). The mean daily temperature is 28^{0}C. Extreme temperatures as low as 4^{0}C are experienced in Kabale District while temperatures below 0^{0}C are registered on the higher mountain ranges of Rwenzori and Elgon situated, respectively, in the western and eastern regions of the country. Rwenzori has a permanent ice cap, whose size is currently reducing due to global warming. Highest temperatures of over 30^{0}C are experienced in Gulu, Kitgum and Moroto in the north and northeastern parts of the country (Uganda Met Department, 2000; UBOS, 2006).

The highest temperatures recorded during 2005 were in Soroti and Arua Districts and the lowest in Kabale District (*Figure 3.5*). The other temperatures recorded in Kampala, Jinja and Entebbe towns were in the medium range. The northern part of the country continues to have the highest temperatures during the year with the lowest temperatures found in south western Uganda.

Figure 3.5: Maximum and minimum temperature over selected regions of Uganda, 2003-2005



Source: Adapted from UBOS (2006)

3.4 Sunshine

Uganda enjoys a fair amount of sunshine throughtout the year and sunshine is an important environmental resource. According to IGAD Secretariat (IGAD, 2006), an important driving force to the wide-scale use of solar energy has been the dramatic drop in the price of photovoltaic (PV) technologies. This development is significant in that an environmental good which previously was taken for granted has proven very successful in high-tech applications of communications. Solar energy has also been found to be an ideal alternative powering vaccine refrigeration and reducing post-harvest losses through drying of produce. In Eritrea, for example, the Ministry responsible for energy has been promoting the application of PV systems for community benefits such as powering health centres, schools and village water pumps (Habtetsion *et al.,* 2002). In Kenya, there has been some evidence of a higher uptake of solar PV systems in some areas, particularly those where there is growing wealth (Karekezi and Kithyoma, 2002).

3.5 Wind

Compared to other parts of the world, the wind speeds in eastern Africa in general and Uganda in particular, are low. Nonetheless, there are some localised sites with good wind speeds that could be tapped for water pumping and electricity generation. Currently, in Uganda there are no installed wind turbines used for electricity generation. The main reasons are the very low wind speeds and the high cost electricity generation from wind energy requires a wind speed of >5m/sec (Harries, 2002). In neighbouring Kenya, a few wind generators have been installed which are connected to the grid (Karekezi, 2002); and it appears that in the medium to long-term, electricity from wind energy could become more attractive and even become a strong competitor to conventional sources (EAC, 2005). Uganda needs to re-assess its wind energy potential for the generation of electricity especially micro-size units.

The use of wind energy for pumping water for irrigation is ideally suited for dryland areas such as the '*Cattle Corridor*' in Uganda. One only needs wind speeds of about 3m/sec for pumping water (Karekezi and Kithyoma, 2002). Unfortunately, the initial high cost of US$ 10 000 per installation has been a deterrent. Even then, there are several wind energy operated water pumps in the Karamoja region.

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4.0 TERRESTRIAL RESOURCES

4.1 Introduction

Uganda's terrestrial resources consist of four distinct ecosystem types: shrublands, savannah and grasslands covering 44 per cent of the total land area, cropland/natural vegetation mosaic covering 35 per cent, wetlands and water bodies covering 16 per cent and forests covering four percent with one percent of the land being barren or with sparse vegetation (UNEP/IISD, 2005). Specifically terrestrial systems consist of land, soils and agriculture; forestry and woodland resources; wildlife resources; and mineral resources.

Land resources include agricultural land and soils that are public resources managed by the Government, and private resources owned and managed by individuals, communities or cultural kingdoms in Uganda. The land resources form the main asset for the derivation of livelihoods by Ugandans. Nearly 80 per cent of the Ugandan population relies on land, agriculture and soils for their primary livelihoods (UBOS, 2006), of which forestry and woodland resources contribute about six percent to Uganda's Gross Domestic Product (UBOS, 2006).

4.2 Land, agriculture and soils

4.2.1 Land resources

Of Uganda's 241 500 square kilometres (sq km) total area, the land area cover 236 000 sq km and the remaining 44 205 sq km is under water (UBOS, 2006). Uganda has 7.2 million hectare of arable land under permanent crops or approximately 30 percent of the country's territory (ECA, 2005). Whereas there is a subtle tendency in most of Africa to view large-sized farms as critical for exports and to regard small producers under customary tenure as producers for own consumption and for domestic markets, in Uganda almost all traditional export crops, such as coffee, cotton, tobacco, and food crops for instance maize, beans, cassava, and ground nuts are grown by smallholders on customary land (ECA, 2005). Moreover, evidence suggests that production for own consumption is critical for the livelihoods of the majority of the people in the country (ECA, 2005).

The growth in subsistence agricultural production in urban and peri-urban areas in Uganda is largely a strategy of low income women to protect the food security of their households (Maxwell, 1995). Still, a lot of the agricultural production is on land that is informally or illegally accessed and cultivators have little definite security of tenure (ECA, 2005). For instance, areas such as Nakasongola and Kibaale District still have persistent problems of absentee landlords (MFPED, 2006). The rural poor have continued to live in relative insecurity of what decision the largely absentee landlords will take and the consequences to them if the land is reclaimed or sold. This is inspite of the assurances that are engrained in the Land Act (1998) (UNEP/NEMA, 2007).

Pressures of economic reforms such as the requirement to offer incentives to attract private capital investment into the country have influenced changes in government policy an attitude towards the environment and natural resources. Protected areas especially Central Forest Reserves have increasingly become a target for industrial estate development to be allocated to investors (ECA, 2005). While in some few cases, the degazettement of forest reserves has an overall benefit to the community, stakeholders and government, in the the majority of cases, there is insufficient evidence or proof to suggest that an overall loss can be avoided. Indeed analysts have indicated that it is more economically beneficial to for example maintain Mabira Central Forest Reserve than to replace it with another enterprise such as sugar cane (Moyini and others, 2007).

4.2.2 Land governance in Uganda

The indicative annual cost of setting up and running the institutions required under the Land Bill of Uganda is US$ 400 million. The amount is so large a financial requirement that it could prevent an otherwise would be good law from being implemented (ECA, 2005). For example, a study by the Department for International Development (DFID) of the United Kingdom found that implementation of Uganda Land Act 1998 was beyond the capacity of government budget and that the costs outweigh the envisaged economic benefits of the reform (GOU, 1999). The reforms were in due effect unlikely to lead in the short and medium term to significant supply of credit by commercial banks and increased agricultural production through improved tenure security.

Table 4.1: Analytical model of land policy and food security in Africa

Issue	Dimension of Problem	Implications	Linkages with Food security and sustainable Development
1. Land Distribution	▪ unequal access to land ▪ costly land redistribution	▪ powerful, better quality land under freehold ▪ customary lands small poor	▪ majority of indigenous populations cant produce enough food
2. Land Utilisation	▪ coercive land use regulations ▪ land use mainly for export	▪ Customary lands insecure ▪ Freehold attainments investment	▪ Low productivity ▪ Emphasis on exports ▪ Unbalanced in food security
3. Land tenure	▪ insecure/ discriminatory ▪ no clarity between land tenure and resource tenure at policy level	▪ development of improper/ inferior tenure ownerships	▪ Prevalent tenure conflicts undermine food security
4. Land Administration	▪ Centralized ▪ Dispersed and weak	▪ Unequal land administration	▪ Weak local lead administration
5. Land Adjudication	▪ Biased towards management (protection of free hold) ▪ Inaccessible land adjudication systems	▪ Legal frameworks favour free hold ▪ Indigenous systems don't have legal backing.	▪ Indigenous people vulnerable

Source: ECA (2005)

On the other hand government has continued to lease out prime estate to investors. Since the last State of the Environment Report (2004/05), Government has leased the area formerly under Shimoni Primary School in Kampala, the area formerly under Uganda Television and several other plots. Indeed, the Cabinet of Uganda is still debating the matter of leasing 7 100 hectares of the Mabira Central Forest Reserve to the Sugar Corporation of Uganda (SCOUL). Box 4.1 below discusses an example of government allocation of land to private investors in Uganda.

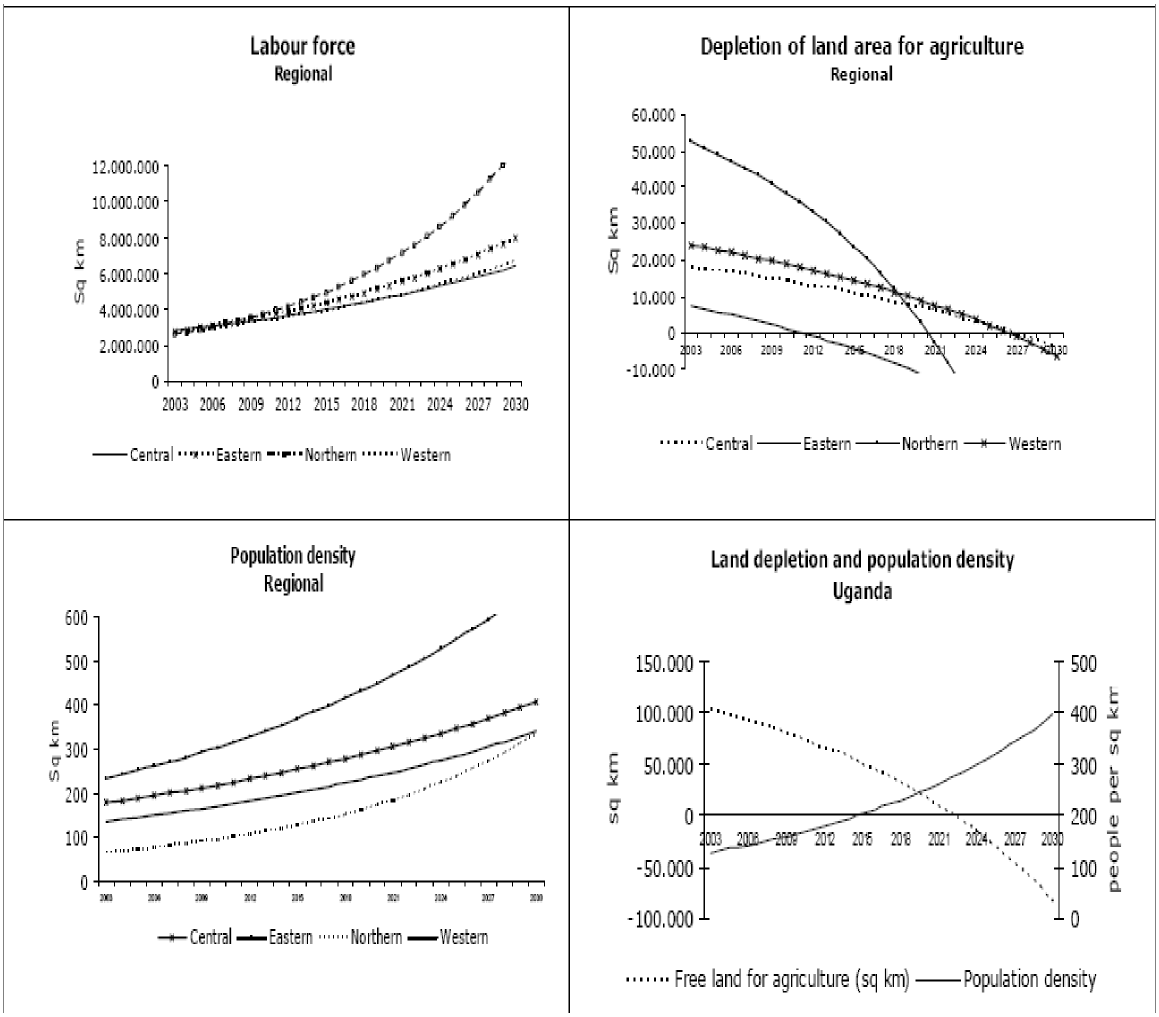
Box 4.1: Summary Debate extension of private leae for Butamira CFR for sugar plantation

Butamira Central Forest Reserve measures about five square miles and was originally leased to Kakira Sugar Works (KSW) in the 1940s. The company planted eucalyptus trees that were used in the processing of sugar. Later, the factory adapted a new technology for sugar processing using baggase and steam, and co-generated energy; thus abandoning fuelwood. However, when KSW's lease for Butamira CFR ended in 1998, the company sought and was granted a renewal of the permit. But the grounds had changed, KSW wanted to use the land for sugar cane production and 700 acres out of a total 1 247 hectare of the forest were cleared for that purpose. However, the process was halted by the parliamentary select committee on forestry seeking clarification on the procedure of renewing the lease. Permits were later issued to wood farmers to replant the area that had been cleared. However, after strong economic arguments from KSW with government, where KSW argued that government would save up to US $ 30 million from the alternate enterprise, the government relented and the permit was given to KSW and farmers were to be compensated.

Source: Makumbi, 2002; ECA (2005)

Demographic projections by district suggest that as a country Uganda will be depleted of land available for farmers by around 2022 (Jorgensen, 2006). By region, eastern Uganda will run out of available land for agriculture, earlier than all the other regions, by around 2010, while western and central Uganda will take longer. (*Figure 4.1*). Projected labour supply will increase with different magnitudes with an annual population growth rate of 6.17 percent will experience a very sharp increase in its labour force. The northern region will be depleted of available land area for farmers as late as around 2020 despite the high population growth, due to the relatively large unexploited agricultural land area (Jorgensen, 2006).

Figure 4.1: Population dynamics in Uganda relative to availability of land for agriculture and projections for the labour force



Source: Jorgensen (2006)

Uganda's soils were once among the most fertile in the tropics, however, nutrient depletion, erosion and other forms of land degradation are increasing. Many traditional systems such as shifting cultivation that were sustainable 50 years ago have been abandoned. In most of the highly populated areas in the country, farmers use greatly shortened (or no) fallow periods and practice continuous cultivation without resting the soil with harvested crops. Consequently, the soils are systematically mined and their natural fertility disappears (UNEP/IISD, 2005).

Soil erosion from water is the most serious and extensive form of degradation and is especially severe in Kotido, Moroto, Mbarara and northern Luwero district where overstocking and overgrazing have obliterated fragile vegetation cover (IISD/UNEP, 2005). Water erosion is also severe in Mbale, Kabale, Kabarole, Kapchorwa, Bundibugyo and Kasese Districts where mountain slopes have been heavily deforested for crop production. It is particularly evident in the highland regions which are more favourable agricultural area and rangelands (Nkonya *et al.,* 2002). With Uganda's two growing seasons a year, the depletion rates of crucial nutrients such as nitrogen, phosphorous and potassium are among the highest in sub-Saharan Africa. Moreover, agro-chemical input to overcome soil nutrient loss has polluted the land (NEMA, 2001).

Deforestation also promotes soil erosion and is a primary cause of land slides during seasons of intense rainfall causing damage crops (NEMA, 2005). However, it has been observed that the underlying cause of landslides and soil erosion on mountainous areas and hills in Uganda is the abandonment of soil and water conservation practices such as terraces, embarkments, strip cropping that were promoted during the colonial period and immediate the post independence period (UNEP/NEMA 2007). Farmer cooperatives and comprehensive agricultural extension systems ensured that soil and water conservation practices such as construction of terraces water channels were integral to farming on hills and slopes (Zaake *et al.,* 1999). With the disintegration of farmer cooperation, formal agricultural extension, and increased population density particularly in the mountainous areas most farmers are unregulated in their land use practice. For instance, in the Bududa, Manafwa, Mbale District areas many farmers have abandoned the relatively flat areas and have instead moved to the steep slopes (UNEP/NEMA, 2007). Similarly, as the population has increased, farmers have been forced to grow their crops closer and closer to river systems e.g. River Manafwa. As a result, the river carries a lot of sediment and silt. For instance, extracting sand enterprises along the rivers for sale to builders and truck drivers are growing throughout Mbale, Manafwa and Butaleja Districts (UNEP/NEMA, 2007).

4.2.4 Land degradation and grasslands

Uganda's wet and dry grasslands are found largely in the "*Cattle Corridor*", which extends from Moroto and Kotido Districts in the north-east through Lake Kyoga's flat lands to Masaka, Rakai and Mbarara Districts in the south-west, with smaller parts scattered throughout the country. This area is referred to as the "*Cattle Corridor*" because of the pastoral livelihoods that dominate the zone. Tropical grasslands constitute important natural systems and they provide several ecosystem services that support life. For example, they are a source of food for humans and their animals and act as a means of maintaining essential life support functions (Kisamba-Mugerwa, 2003). The general support functions, the services and products we derive from tropical grasslands are diverse and the indigenous people and communities that live on the fringes of these grasslands rely on them to graze their animals that in turn provide them with food. They also rely on them for shelter. The well being of these communities therefore extensively depends on these grasslands.

Even though, there are many causes of degradation in grasslands, it appears that the activities of the pastoralists are among the major ones. Pastoralists manage their resources in many different ways. The distinct finding, however, is that these activities have generally resulted in overgrazing and overstocking. Overstocking occurs when the stock levels exceed the rangelands' carrying capacity, implying reduction of forage below the biological minimum when considered in terms of some unit of time. (UNEP/NEMA, 2007).

The effects of overstocking on sustainable development can be extremely detrimental. Bare plain slopes lose the ability to retain water, resulting in extensive erosion on the plains. The devastation from widespread erosion includes low crop yields, poor animal health and yields, loss of livestock and other animals, damage to human sources of survival. In regions such as North-eastern Uganda, these situations are common. Overgrazing may also cause a decrease in soil retention capacity, greatly allowing the erosion of fertile topsoil and thus reducing the productivity of the land (Moyini and Masiga, 2005). This poses a threat to the lives of the people in these regions.

In an ongoing integrated assessment study conducted on the Kyoga Basin catchment area (UNEP/NEMA, 2007 in print) has shown that close to 50 percent of the grasslands in Nakasongola District disappered between 1990 and 2004, largely due to the activities of pastoralists. The area under grasslands in Nakasongola District declined from 78 100 ha to just 40 182 ha due to overstocking of livestock and regular bush burning (UNEP/NEMA, 2007).

In an earlier State of the Environment Report (NEMA, 1998), about 21 per cent of the total land in Uganda was covered with grassland and the annual loss was estimated to be 9 per cent. This destruction has continued unabated and, by many estimates, seems to be increasing in Uganda particularly in the Northeastern region. Whereas much research and attention has been concentrated more on forest depletion, grassland areas are threatened and this may have a major impact on the ecological systems of Uganda (UNDP 2005).

4.2.5 Land degradation and dry lands

Uganda's drylands also lie in the "*Cattle Corridor*", an area of approximately 84 000 km^2, stretching from the north-east, through central to south-east of the country. The major problems in Uganda's dry lands include overgrazing, deforestation, inappropriate farming systems, land and tree tenure and bush burning. Due to the increasing demand for charcoal and other tree related products derived from the dry lands, there is a big decline in the tree cover in these areas, justifying the need for concerted efforts by all stakeholders to address this and other environmental issues.

Uganda's drylands also include Kotido, Moroto and Katakwi in the northeast through Nakasongola and parts of Luweero in the central to Rakai, Mbarara and Ntugamo. These areas are mainly rangelands and they have semi-arid and dry sub-humid conditions. They receive low and unreliable rainfall ranging between 450 - 800 mm and drought is a common recurrent phenomenon thus the vegetation is sparse. The drylands are considered to be the second most fragile ecosystem in Uganda, after the highlands.

4.2.6 Overgrazing

The land tenure of most of Uganda's dry lands is communal, with grazing mainly on natural pasture. Moreover, major socio-economic changes are occurring in the dry lands and these have affected this ecosystem, for instance, increasing human population density and immigration by agricultural settlers. The increase in both human and livestock populations in Uganda's dry lands over the years is placing pressure on the land with intensive degradation occurring, especially at watering points, along livestock paths and on hilltops. Most of the dry lands in Uganda face a lot of environmental problems.

Except in the north, much of the *Cattle Corridor* is considered over-stocked and seriously degraded, with problems of vegetation loss and soil compaction leading to erosion. Gully erosion is especially visible in many areas (Kisamba-Mugerwa, 2003). Particular areas affected are the pastoral districts of Mbarara, Nakasongola and Karamoja region. The resulting effects of overgrazing include soil compaction, erosion (particularly gully erosion) and emergence of low-value grass species and vegetation with subsequent declines in carrying capacity of the land and therefore low productivity.

4.2.7 Deforestation

The present level of Uganda's forestland is just about 20 per cent of its original value in 1890 as a result of deforestation. The major causes of deforestation are provision of wood fuel and clearing of land for agricultural activities. About 90 per cent of the total populations who live in rural areas directly depend on firewood for their energy needs, and a big fraction of the urban dwellers depend on charcoal. In general, about 92 per cent of Uganda's source of energy is wood fuel. By 1986, Uganda was already in wood fuel deficit by 2.7 million cubic metres. Additionally, bush burning during the dry season is also increasing the extent of wind erosion, especially in the eastern districts of Katakwi, Moroto and Kotido. In general, the extent and frequency of xerophytic species has expanded due to soil degradation, leading to a decline in forage quality (Zake *et al.,* 1999).

4.2.8 Inappropriate farming systems

The most critical problem in Uganda's drylands like in many parts of the country is that the majority of farmers have inadequate knowledge or few opportunities to learn about improved farming methods. For example, with most of the farmers growing the same crops on the same piece of land year after year, crop rotation is often not practiced; a situation which leads to serious soil degradation. The situation is worsening because improved agroforestry practices capable of renewing and regenerating the soil are still lacking in most farming systems (MAAIF, 1999).

Other changes in Uganda's dry lands include the fencing and turning into private lands of formally communal grazing lands. This is causing a concentration in particular areas of livestock that had previously grazed on those lands thus leading to severe sheet erosion on hillsides. Similarly, a large land area in Kotido and Moroto districts where the Karimojong graze their huge herds of cattle is being worn out due to the reduction of mobility of the formerly nomadic pastoralists, following the imposition of administrative boundaries, security problems and increasingly frequent droughts. The area is experiencing concentration of cattle and severe degradation including invasion of unpalatable forage species and soil erosion. Apart from the rapid decline in fertility and productivity of the land, soil erosion has also led to the siltation of lakes, rivers and streams. A problem of severe water shortage and serious wind erosion has also been recorded in the districts of Karamoja, Katakwi, Nakasongola, Mbarara and Rakai.

It is therefore clear that there is intensified land and environmental degradation leading to loss of the productive potential of the dry lands, famines, low household incomes and increased social unrest in the affected areas, particularly in the north eastern part of the country (MAAIF, 1999). This situation is exacerbated by the fact that in Uganda, there is widespread reliance on rain fed agriculture, subsistence farming and pastoralism, poor crop and animal husbandry practices, water scarcity and population pressure all contributing to vulnerability to drought.

4.2.9 Response

One of the major achievements of the 1992 Rio de Janeiro Earth Summit was the launching of the United Nations Convention to Combat Desertification (CCD) with goals to alleviate the effects of drought. Over 170 countries, including Uganda, are signatories to the CCD, whose primary focus is to combat the loss of natural vegetation and deterioration of physical, chemical, biological and economic properties of the soils. Uganda signed the CCD in 1994 and ratified it in 1999 (UNDP 2005).

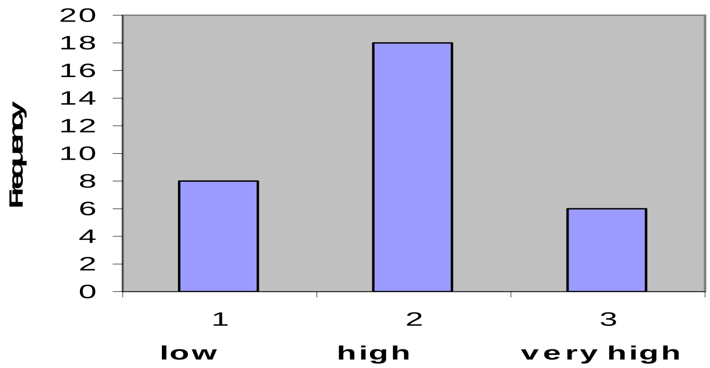
4.2.10 District level case studies

4.2.10.1 Nakasongola district

The main economic activity in Nakasongola district is cattle keeping. The cows are moved around by pastoral communites as they search for grass (Muyomba *et al.,* 2006). Many of the livestock keepers have over 150 livestock on their plots regardless of size. As a result most of the rangelands are overstocked beyond normal carrying capacity. It is believed that the large herds of cattle are one of the major reasons for the large reduction in vegetation intensity especially on the upland. A number of farmers have bare soil patches dominating their farms. These areas are without any grass apart from some scattered shrubs and thickets, which are not even utilized by the cattle.

In some patches of land the vegetation was completely lost and as a result the soil is extremely susceptible to erosion. There is a tremendous loss of soil to the low-lying areas, which has resulted into siltation of dams, reducing their productive potential. Coupled with the vegetation loss is the serious compaction caused by the trampling of the large herds of livestock. This impedes water infiltration aggravating the rate of runoff (Nakasongola DSOER, 2004).

Figure 4.2: Extent of soil erosion

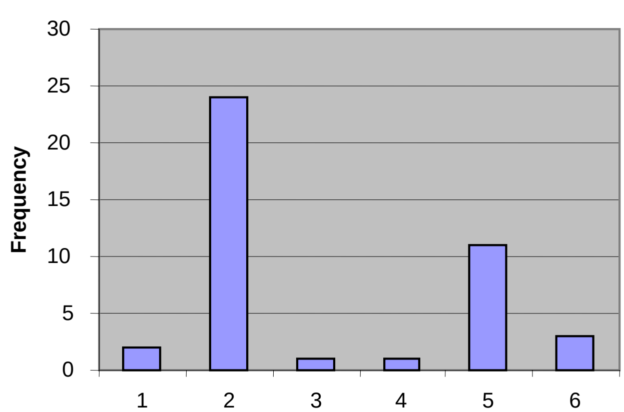


a) Activities leading to land degradation

i) Bush burning

At the end of every dry season, pastoralists often burn the standing grass. This practice is intended to break the cycle of the disease by killing off vectors such as ticks. The grass burning is also intended to reinvigorate the grass (UNEP/NEMA, 2007). However, this bush burning decreases soil organic matter and increases volatilization of nutrients. Intense heat can also cause soil articles to become repellent, causing rain water to run off leading to water erosion (Muyomba *et al.,* 2006). Burning of vegetation with high frequencies of fires, results into reduced rangeland forage productivity .This is due to high organic matter loss and high loss of nutrients to the atmosphere, which would promote high vegetation growth. Over two-thirds (Figure 2) of the local communities in Nakasongola, are engaged in activities that cause deforestation, although there are important campaigns engaging the communities in planting trees, where about one-third of the farmers are engaged followed by people carrying out both bush burning and afforestation (1-2).

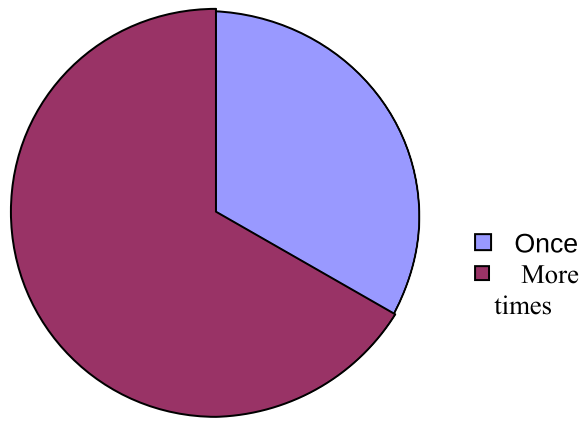
Figure 4.3: Land management practices in Nakasongola



1- Bush burning ; 2- Deforestation; 5 Afforestation

Source: Muyomba et al 2006.

Figure 4.4: Number of times burning is carried out



Source: Muyomba et al 2006.

ii) Deforestation

Community and Central Forest Reserves in Nakasongola district have suffered a very high rate of deforestation. For instance, between 1990 and 2004, Nakasongola district lost over 50 per cent of its forest area (Table 4.2). The trees are cut to meet a variety of needs, the production of charcoal for the urban markets in Kampala and neighbouring districts being foremost. As a result, a number of tree species that produce good charcoal, are almost becoming extinct, including (local names) "Enkoola", "Tookekulu", and "Ndajji" (Nakasongola DSOER *et al.,* 2004). The reduction of the forest size in Nakasongola has led to increased detachment of soil particle as well as controlling the blocking of the pore spaces by the fine soil particles, which impedes infiltration (Muyomba *et al.,* 2006). Moreover, trees with deep roots that helped to recycle nutrients that might have been leached to lower horizons are lost. In addition, other forest functions such as the tree roots holding the soil together and consequently reducing its susceptibility to erosion have disappeared.

In Nakasongola district the reduction of forage trees and grasses has also led to an invasion of termites, which attack people's gardens, tree plantations and the remaining trees further reducing the ground vegetation cover. The loss of vegetation due to termites' attacks intensifies in the dry season when there is limited moisture in the soil. The moisture stress reduces the available alternative vegetation on which the termites could feed and the termites instead attack crops and newly planted trees. Termites are now wide spread in Nakasongola district and are considered one of the primary causes of environmental degradation in the district (Nakasongola DSOER, 2004; UNEP/NEMA, 2007).

iii) Crop production

Crop production is the second most important economic activity in Nakasongola district. In the 1990s crop production ranked third behind charcoal burning and livestock production,but the reduction in forest cover and the declining volumes of charcoal produced have pushed charcoal production down to third position and crop production upwards (UNEP/NEMA, 2007).Still the increased stocks of livestock threaten crop production. For instance, about 77 percent of all crop farmers in the district reported a reduction in the yield of their crops.

Table 4.2: The soil status of farmers carrying out deforestation, bush-burning and overstocking

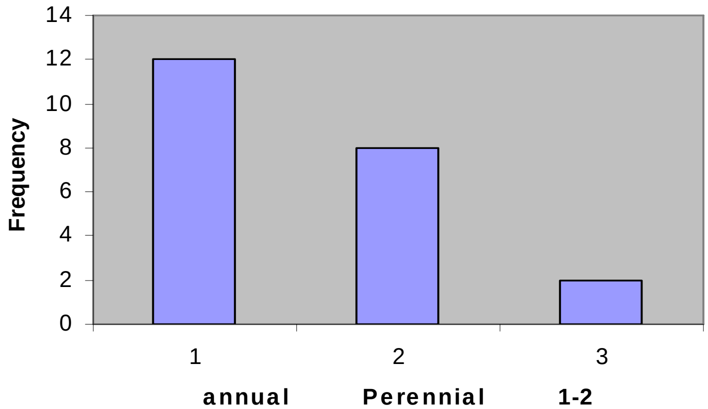
Soil sample	G1	G2	N1	N2	B1	B2	S1	S2
Bulk density gcc-3	1.49	1.43	1.67	1.55	1.49	1.47	1.73	1.62
P gmkg-1	4.19	6.09	3.41	4.86	4.80	3.18	2.96	3.58
PH	6.48	4.12	5.75	3.96	5.53	4.64	5.17	4.91
% N	0.297	0.066	0.066	0.066	0.162	0.099	0.099	0.099
% O.M	3.6	1.0	1.93	0.99	2.94	1.0	0.84	1.26
% Sand	48	48	60	44	66	58	78	54
% Silt	18	06	14	14	12	06	11	07
% Clay	34	46	26	42	22	36	11	39
K	4.12	0.45	0.67	0.51	0.96	0.56	0.62	1.07
Na	0.29	0.38	0.45	0.57	1.53	0.86	1.05	1.43
Textural class	S.C.L	S.C	S.L	S.C.L	S.L	S.C.L	L.S	S.C.L

1	= Soil sample in low land	CRITICAL VALUES	
2	= Soil samples on upland	Bulky density	= 1.3gcc-3
S.C.L	= Sand Clay Loam	P.	= 15gmg-3
S.L	= Sandy Loam	PH	= 5.5
L.S	= Loamy Sand	N	= 0.25%
S	= Sand	O.M	= 3.0%
S.C	= Sandy Clay	K	= 0.22Cmolkg-1

Source: Muyomba et al. (2006).

Moreover, farmers in Nakasongola district rely on low input use, despite the large quantities of livestock manures the farmers have. Only 36 percent of the farmers stated that they use livestock manures the rest do not use any additional nutrients. In addition, only 15 percent of the crop residues were used as compost or mulch in the fields. As a result the soils were severely mined of nutrients by the crops. The graph below shows the number of people growing annual and perennial crops (*Figure 4.4*).

Figure 4.5: Types of crops grown



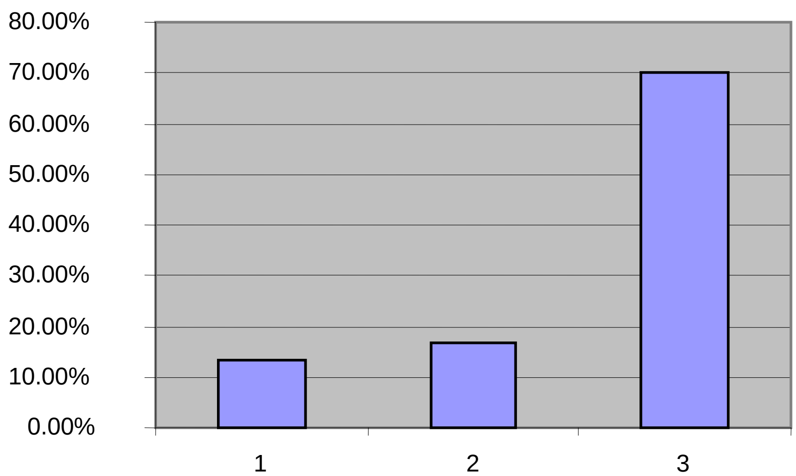
Source: Muyomba et al 2006.

An assessment of the nutrient status of soils used for crop production in Nakasongola district indicated that most soils had a high sand content. Sixty nine percent of the samples have sand of more than 60 percent, indicating susceptibility to leaching (*Table 4.2*). The bulk density for all samples was above the critical value of 1.3gcc-3; this is attributed to the trampling of the soil by livestock. The compacting of the soil impedes water infiltration. As a result, water runoff increases resulting into the loss of top soil especially in upland areas. Additonally, Phosphorus level is very low compared to the critical value of 15gmkg^{-3}. 87 percent of the samples lie below 3gmkg^{-3}. This level is too low to support vegetation growth. The general low level of Phosphorous is attributed to the constant removal of vegetation by the livestock, and deforestation. Generally, there has been high loss of nutrients due to poor land management practices like bush burning, deforestation and overstocking (Muyomba *et al.,* 2006).

4.2.10.2 Arua district

Tobacco is the dominant cash crop in Arua district (Aleti 2005). There is wide deforestation due to the high demand for fuel wood for tobacco curing and for cooking. 70 percent of the household depend entirely on fuel wood from natural growing trees as their source of energy, 13.3 per cent depend on Eucalyptus, 16.7 per cent use both Eucalyptus and natural trees (*Figure 4.6*).

Figure 4.6: Major energy sources for tobacco curing in the sub county



1- Eucalyptus and natural tree cutting, 2- Fuel wood from Eucalyptus,
3- Fuel wood from natural trees

Source: Aleti 2005

The higher contribution to tree cover loss is due to the fact that 56.7 percent of farmers have the perception that naturally growing trees produce higher amounts of heat in curing than Eucalyptus. Eucalyptus burns slowly, thus taking longer hours to produce heat. Large quantities of wood are required for drying the leaves depending on the size of the farmer's field and the nature of the barn constructed.

46.7 percent of the farmers use between 11-30 m^2 of fuel wood indicating that many trees have been felled down (Table 4.3). Therefore on average every farmer uses $21m^2$ of wood each season for curing tobacco leaves. Tere was concern that soil fertility has also declined in the area. Farmers observed that there has been decline in the harvest after three consecutive planting seasons. This was due to continuous cultivation, nutrient removal and soil erosion. To achieve a yield of 100kg/ha of cured leaf, a tobacco crop is capable of extracting 1-6 kg of Nitrogen (N) , 1.5-2 kg of phosphorous and 9-10 kg of potassium from the soil.

Table 4.3: Amount of wood used (m^3)

Number of wood (m^2)	**Percentage**
1-10	3.3
11-20	26.7
21-30	20.0

Source: Aleti 2005.

Soil erosion is more frequent particularly in the fields. Erosion is mainly brought about by the crude seed bed preparation methods. Removal of vegetation cover means less resistance to soil erosion agents such as running water and wind.

The farmers do not practice nutrient recycling. The largest percent of the remains from the tobacco crop is used for cooking indicating that large quantities of nutrients such as nitrogen, phosphorous and potassium removed by the crops are not returned to the fields. This has led to soil nutrient depletion which is responsible by the low yields obtained by the farmers.

4.2.10.3 Gulu district

The internally Displaced People (IDP)'s camps in Gulu district are characterised by a high human congregate and such a situation is usually accompanied by land degradation (Omony 2005). The burning of fuels, indiscriminate disposal of human excreta, poor farming methods/practices, poor settlement patterns or structures, rapidly deteriorating water quality, and poor crop yields have been reported. IDPs generally have a limited knowledge of using improved technology and lack the skills of modern agriculture which has led to soil and land degradation. The areas neighbouring the IDP camps are characterized by a high rate of deforestation, since fuel wood is the only source of energy. In the camps, about 80 percent of trees and other higher plants have been destroyed. The use of energy as a prime energy source coupled with high population in the camps and the high cost of other types of fuel have combined to cause environmental degradation such as deforestation. For instance 'Lalaa' forest in Alero camp Gulu district has been destroyed by the camp members in search for firewood, building materials (Gulu DSOER, 2004). The increased cutting of forest areas for agriculture has been worsened by the lack of extension support on sustainable natural resources management. For instance, the National Agricultural Advisory Services (NAADS) programme in Gulu district has has only one extension worker who supports a number of IDP camps.

About 90 percent of the people living in the IDP camps are traditionally local farmers who have no incentive to practice farming on a large scale. In the IDP camps, there is serious land shortage especially for farming. The high population has also led to land fragmentation where a household could have up to about 3-5 different small plots of land at separate locations (Gulu DSOER, 2004). Land fragmentation has also dictated the types of crops to be grown. Soil and water conservation practices are not adequate as most farmers do not know modern scientific methods of soil and water conservation practices.

4.210.4 Bugiri district

Bugiri District lies in the banana, millet and cotton farming belt. The production of bananas is largely taking place on the hill slopes. The land use practices are; cultivation, charcoal burning, brick making and settlement. The crops grown are; perennial, cereals, root crops and legumes. Regrettably, poor and inappropriate farming practices used by most of the farmers, for example, burning of the crop residues, continuous cultivation, no crop rotation, use of rudimentary tools, no soil and water conservation measures have affected productivity and caused soil exhaustion. (Bugiri DSOER, 2004).

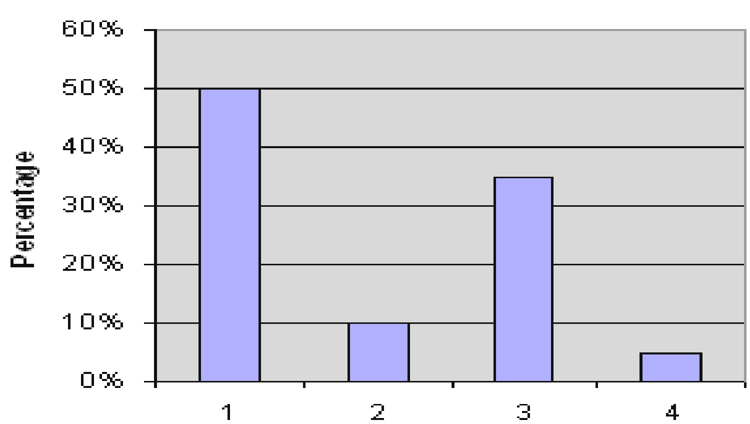
Table 4.4: Influences of existing land uses

Land carrying capacity	Percentage	Impacts
Land size		
Less than two hectares Between 2 and 4 hectares More than 4 hectares	30 50 20	Poor farming practices
Total	100	
Landform		
Consolidated	40	
Fragmented	60	Soil erosion
Total	100	
Tenure systems		
Inherited Bought Others	50 47.5 2.5	Fragmentation Mono cropping
Total	100	

Source:Bugiri DSOER, 2004

The majority of the big population derives their livelihood directly from the land. Yet there is land shortage (Table1) and about 80 percent of the people have land less than 4 hectares which is highly fragmented due to the nature of land ownership. 50 percent of the total land is inherited (customary land tenure). This system encourages the division of land between the children and their respective grandchildren (Isabirye, 2006).

Figure 4.7: Causes of land degradation in Bugiri

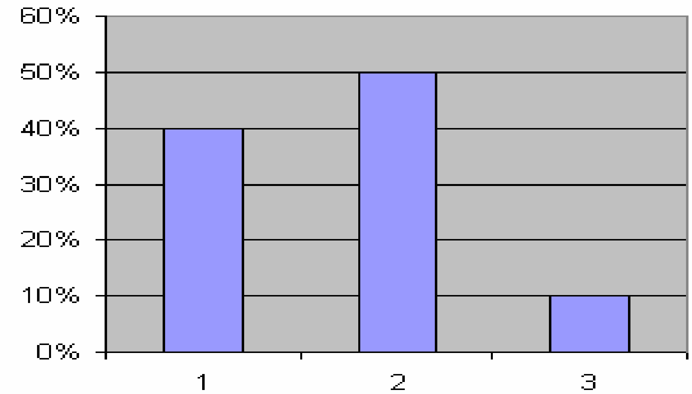


1-Defforestation, 2-Overgrazing, 3-Poor farming methods, 4-Bush burning

Source:Bugiri DSOER, 2004

Most people in Bugiri held the view that deforestation leads to 50 % of land degradation, followed by poor farming methods with 35%, grazing with only 10% and bush burning 5% as shown in *Table 2* above.

Figure 4.8: Impacts of land use practices on land

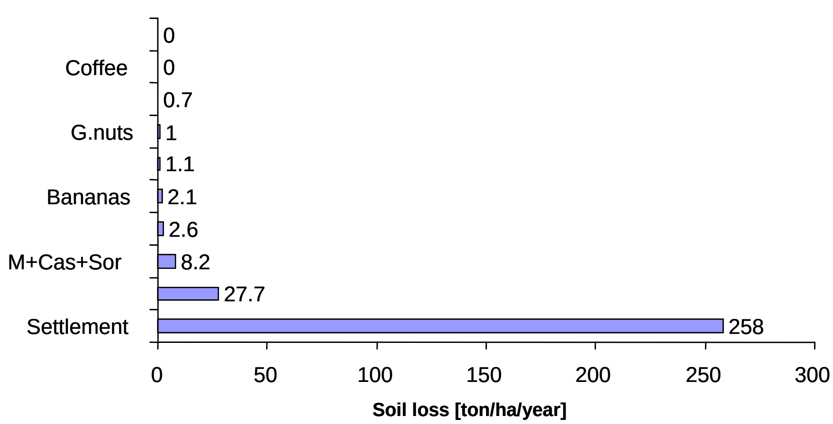


1-Soil erosion, 2-Loss of soil fertility, 3-Pollution

Source:Bugiri DSOER, 2004

In spite of the general acceptance that the current land use changes are unlikely to yield a sustainable environment, the extent of the contribution of agricultural fields to sedimentation and eutrophication of Lake Victoria is not clearly understood. It is hypothesized that roads, paths, and compounds (settlement) are a major source of sediments. A study was conducted on the northern Lake Victoria shoreline to determine the amount of sediment generated by agricultural and settlement (paths, compounds, roads) land use types (Isabirye 2006).

Figure 4.9: Sediment generation from different land use types in Mayuge District



Source: Isabirye 2006)

4.1.11 Current interventions

The soils and soil fertility management programme of NARO together with other collaborative institutions have undertaken on-station and on-farm research activities aimed at curbing land degradation trends and improve people's livelihoods. These encompass participatory identification of environmental problems, understanding the underlying causes , sensitizing stakeholders about these problems, identification and experimentation with different potential solutions.These it is hoped will lead to development and dissemination/promotion of 'best bet' technology options for better land management.

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4.3 Forestry and woodland resources

4.3.1 Introduction

Uganda's forestry sector comprises of both natural forests (tropical high forests, and woodlands) and made forests such as plantations (both pines and hardwoods). Forests and woodlands cover a total of 4.9 million hectares, about 24 per cent of the total land area. Tropical high forests (THF) cover 924 208 ha, forest plantations cover 35 066 ha and woodlands cover 3 974 102 ha. Of the 4.9 million hectares, 30 percent are in the protected areas (Forest Reserves, National Parks and Wildlife Reserves) and 70 percent are found on private land. Protected Areas (PAs) contain the country's Permanent Forest Estate (PFE), which is 1.9 million hectares. Of this, Central Forest Reserves (CFRs) cover 1 265 742 ha. The forests on private land are largely being devastated, and those in National Parks are inaccessible for provision of forest products. Therefore, CFRs constitute the only forestland that will be available for a variety of uses (MWLE, 2001). However, the sector is facing a number of pressures.

The Colonial Government gazetted Forest Reserve land in Uganda under three main categories, which still form the back bone of the current gazettement plans. Their aim was to ensure continuous supply of forest goods and services to the Government and the people of Uganda in perpetuity. These are:

- *Production Forest Area:* These are gazetted for immediate and medium term supply of goods, especially hardwood timber, which was the main interest of the colonial masters then. These include all the Natural High Forests with rich and mature timber trees; the main ones are Budongo, Mabira, Kalinzu and Maramagambo.
- *Protection Forest Area:* These comprise of all the natural forest areas (NHF and Savanna woodlands) from where rivers that supply continuous water, for domestic use by the population in the rural areas of Uganda, originate but also include hilly areas prone to landslides and soil erosion. Many such forests are along the shores of lakes and also take in all anti-malarial plantation areas in major towns in Uganda and the hilly areas of Kiboga, Mubende districts. Other areas are in most parts of Karamoja, Mbale, Arua, Gulu, and Kitgum districts with their watersheds.
- *Future Forest Area:* As early as the 1940s, the Colonial Government was already aware that the Natural High Forest Reserves in Uganda would be unable to supply enough timber in perpetuity for the developmental needs of the country. They knew that the future of timber in Uganda would be in the industrial timber plantation development and therefore reserved land for it. Most of these forest reserves are covered with less economic savanna woodland trees or grassland and are the areas most affected by encroachment.

4.3.2 Size and trends of forest resources in Uganda

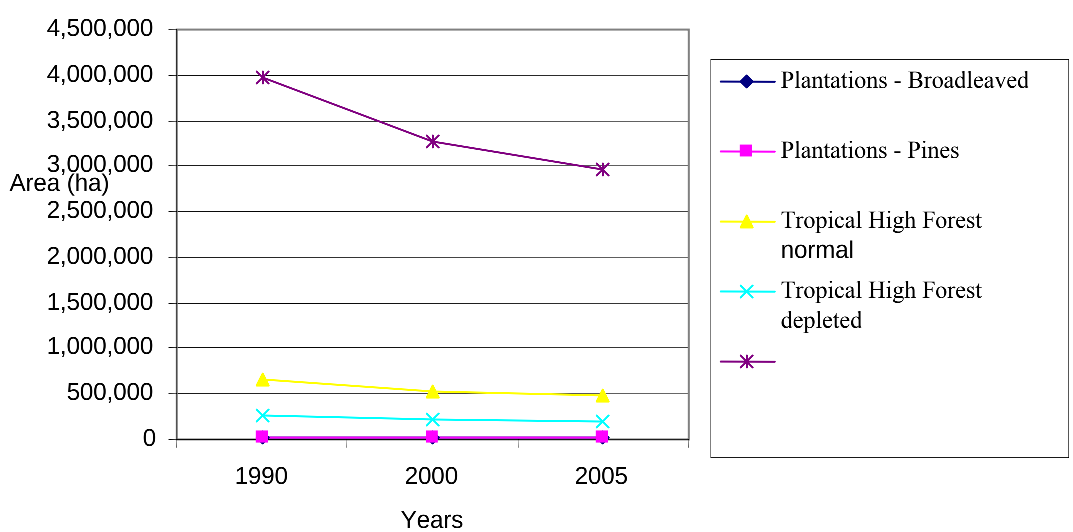
The size of Uganda's forest cover has continuously declined by 25.7 percent between 1990 and 2000 and by 9.4 percent since 2000 (*Table 4.5*). The major declines were observed in woodlands, broadleaved and pine plantations. In some areas particularly in the *Cattle Corridor* the wooded land declined by over 50 per cent (UNEP/NEMA, 2007 in print). In general, there has been a decline in all forms of forest cover and the decline is expected to increase.

Table 4.5: Uganda's forest cover 1990, 2000 and 2005

Vegetation	**Forest cover in (ha)**		
	1990	**2000**	**2005**
Plantations – Broadleaved	18,682	15,326	13,881
Plantations – Pines	16,384	13,441	12,174
Tropical High Forest normal	650,151	533,350	483,072
Tropical High Forest depleted	274,057	224,822	203,628
Woodlands	3,974,090	3,260,138	2,952,807
Total	**4,933,364**	**4,047,076**	**3,665,562**

Source: NFA (2006)

Figure 4.9: Trends in Forest cover since 1990

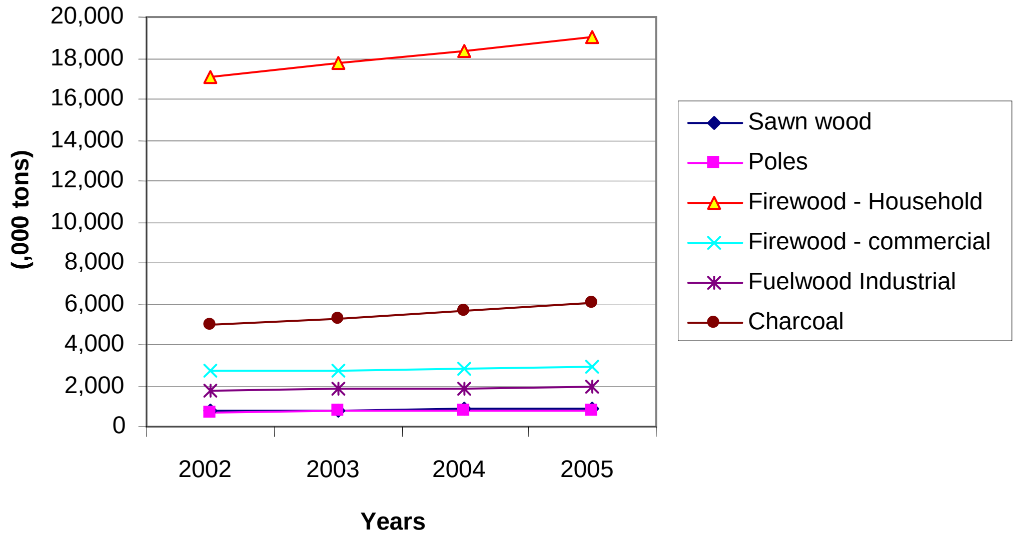


Source: NFA (2006)

4.3.3 Trends of forest product consumption

Fuelwood, consisting of firewood and charcoal is by far the most important product from Uganda's forests. About 90 percent of the energy consumed in Uganda is obtained from fuelwood (MEMD, 2005). Moreover the most significant growth in forest products consumption was fuelwood (firewood and charcoal) used in residences for household cooking (*Figure 4.10*). The other products drawn from the forests include poles, sawn wood, and fuelwood for commercial use

Figure 4.10: Trends in consumption of forest products since 2002



Source: NFA (2006)

4.3.4 Forest resources governance in Uganda

Since the promulgation of the 1995 Constitution, the Governement has moved quickly to put in place appropriate policies and enactments of laws for the proper management and control of the forest resources in Uganda. The following are some of these policies and laws put in place since 1995.

- Constitution of the Republic of Uganda, 1995.
- The National Environment Management Policy for Uganda, 1994.
- The National Environment Management Act.
- The Water Act.
- The National Policy for the Conservation and Management of Wetland Resources, 1995.
- The Uganda Wildlife Act, 2000.

- The Local Government Act, 1997.
- The Land Act, 1998.
- The Gender Policy, 1997.
- The Forest Reserves Order, 1998
- Forest Policy 2001
- The National Forestry and Tree Planting Act
- The Uganda Wildlife Policy, 1999.
- The National Water Policy, 1999.

Under the National Forestry Tree Planting and Tree Planting Act, the National Forestry Authority (NFA) has the role of managing Central Forest Reserves. The National Forestry Authority over the last few years has achieved the following (NFA, 2006):

- Since 2004, NFA has managed to restore order in the management of the central Forest Reserves. For instance out of the 506 forest reserves, 405 have written forest management plans.
- Introduced competitive bidding in the sale of standing stock in the mature softwood plantations thereby raising the value of standing volume from around 28,000/= shs during the Forest Department times to now nearly 100,000/= shs per m^3 of standing trees in the forests
- Increased private sector tree planting and since 2004, NFA has issued over 186 licences covering over 32 308 ha.
- Increased the area under Collaborative Forest Management from 500 ha to nearly 8 000 ha.
- Sold over 2 million seedlings to the private sector.
- Replanted over 2 000 ha of pines and the private sector also planted about 2 500 ha of new forest plantations

Notwithstanding the above achievements, NFA has been faced with a number of challenges both from the public and the government. In the former the issues are mainly to do with eviction of encroachers from the Central Forest Reserves, for example, in the South Busoga Forest Reserve. Whereas the challenges with the government are over use of land, for instance in Bugala Islands in Kalangala District where government has allocated over 10 000 ha of land to a private company (BIDCO) to plant palm oil trees. To many these actions of government are seen to contradict the principles of sustainable forest management particularly amidst all the concerns of environmental impacts such actions will cause.

4.2.4 Pressures on forestry resources

The main pressures noted on Uganda's forestry resources are population growth, over-harvesting, encroachment, urbanization/ industrialization and civil strife especially in the North.

i) Population growth

Population growth (estimated at 3.3 per cent a year) is leading to an increase in the demand for land, food and energy. Institutions such as schools, prisons among others rely almost exclusively on firewood for cooking, as does over 90% of the population. Many areas are already experiencing shortages of firewood, and hence rising costs and increased burdens on women and children who collect firewood.

ii) Over-harvesting

Poor planning, weak regulations and inappropriate processing technology have resulted in the unsustainable harvesting of forest products, and the degradation of the resource base. It is estimated that 800 000 m^3 of logs are cut each year, a rate of timber harvesting that exceeds sustainable cutting levels by a factor of four. This problem affects both government and private land. There is limited institutional capacity and limited resources in both central and local government to improve planning and regulation, and little incentive for the private sector to improve its performance in the absence of firm regulation and the enforcement of professional standards.

iii) Encroachment

There was much clearance of forest cover to make settlements in the Forest Reserves during the troubled 1970s and 1980s. Residual encroachment of the government lands still continues. Most of the boundaries of the encroached reserves have not been reopened and are not clearly demarcated, which forms part of the reason for the current confusion.

iv) Urbanization and industrial growth

Urbanization and industrial growth are also putting pressure on the forest estate. 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 the capital, Kampala.

v) Underlying factors

a) Policy deficiencies

A number of factors that underlie this decline in the forest resource base can be identified. There are *policy deficiencies* relating to the private sector and local communities over land tenure, access rights and responsibilities for resource management.

b) Market failures

There are market failures such as inappropriate royalty rates, poor market information, trade restrictions and hidden subsidies which distort the markets for forest products. There is *poor regulation* by weakened institutions which lack funding, and capacity.

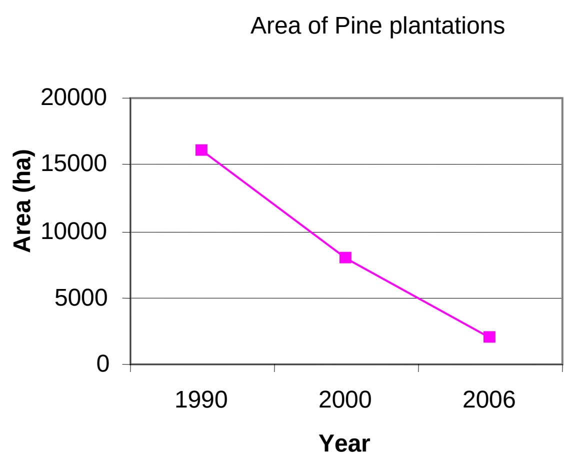
c) Population growth and migration

Population growth and migration has increased demand for agricultural land and firewood energy. Additionally, rural poverty restricts the ability to invest in sustainable land use practices. Much of the current wood for consumption comes from the clearance of land for agriculture, especially as far as wood for charcoal production is concerned. However, it is reported that only one third of the wood that is cut in the clearance of land for agriculture is used in charcoal production, the remainder being burned off as waste, used for firewood, or in construction.

d) Over harvesting

In attempt to control over harvesting in the Natural High Forests, the then Forest Department stopped licensing harvesting operations in the Tropical High Forests. Instead, it encouraged saw millers to move into the already over-maturing softwood Plantations. However, this move had its serious effects on the little remaining forests. According to Forest Department and National Forestry authority records, the softwood plantations declined from around 16 000 ha in 1990 to less than 2 000 ha in 2006.

Figure 4.11: Trends in harvesting in Pine plantations since 1990



Source: NFA (2006)

4.2.5 Forest encroachment

4.2.5.1 Forest encroachment case studies

Many encroachers as well as politicians, unaware of the arrangement where land is set aside for forestry development always claim that such areas are not Forest Reserves because they do not have trees in them. Many of the affected forest reserves, covering large areas are within the Cattle Corridor of Uganda, the Terminalia woodlands of Northern Uganda and the Acacia woodlands of the Eastern Uganda. Hilly areas with gentle slopes in Mbarara, Kabale and Rukungiri districts were also reserves for a similar purpose.

The current trend in Uganda is one of loss of forest cover and degradation of the remaining forest resource base (*Table 4.6 and 4.7*). The main player is encroachment, although illegal harvesting also has a role.

Table 4.6: Summary of current situation

Individuals, activity & structures	Number in the forest reserves
Number of encroachers	180,500
Number of households	9,241
Area under cultivation (ha)	57,589.20
Number of livestock being grazed	136,517
Number of individuals houses	35,065
Number of schools	72
Number of churches	60
Number of mosques	11
Number of land titles / leases	101
Number of permanent houses	1,473
Number of cattle dips	374
Number of health centres	11
Number of cattle kraals	3,460
Number of markets	13

Source: NFA Database (2007)

Table 4.7: The 20 most heavily encroached CFRs

	CFR	District	Total area of Reserve (ha)	Area under cultivation (ha)
1	Apworocero	Apac	246	238.67
2	Kitasi	Masaka	272	260
3	Bundikeki	Bundibugyo	396	364
4	Kijanebalola	Rakai	3,023	2,734
5	Mataa	Bundibugyo	109	97
6	Nyaburongo	Bundibugyo	174	152
7	Kabango-Mutandi	Bundibugyo	361	296
8	Kasolo	Mubende	3,244	2,500
9	Kisakombe	Mukono	197	150
10	Muinaina	Mubende	1,067	700
11	Irimba	Iganga	294	173
12	Eria	Moyo	575	317.15
13	Kyalubanga	Nakasongola	4,278	2,288.80
14	Buyaga Dam	Rakai/Masaka/Sembabule	16,068	8,250
15	Luwunga	Kiboga	9,718	4,739
16	Wabisi-Wajala	Nakasongola	4,453	2,148.25
17	Kyamazzi	Rakai	4,848	2,308.88
18	Lusiba	Mubende	670	300
19	Kyalwamuka	Rakai	6,527	2,778.05
20	Kazooba	Sembabule	7,423	2,068

Source**:** NFA Database (2007)

The impacts or effects of the above pressures are mainly declining forest cover, loss of productivity commercial volumes for timber, loss of biomass and fuel wood scarcity. According to estimates by the National Forestry authority and also Food and agriculture Organization (2005), Uganda has lost about 1.2 million ha since 1990. This translates into an annual loss of about 80,000 ha per year (FAO, 2006).

4.2.5.2 The impact of war and conflict on the forest resource

It should be recalled that the war in Northern Uganda, particularly in the Acholi subregion has been going on since 1985. The parties to the war are the Lord's Resistance Army led by Joseph Kony and Uganda Peoples Defence Forces on behalf of Government of Uganda. Through the years a lot of lives and properties have been lost by the people of Acholi and neighbouring districts. The war has also left many people internally displaced into what came to be known as Internally Displaced People camps or IDPs in short.

A recent study by USAID and the Wildlife Conservation Society is the first to exclusively look at the impact of the conflict in Northern Uganda on the environment. Given the ongoing unrest in the area, data from the ground was limited to an assessment of the woody cover changes inside and outside protected areas using satellite images and aerial reconnaissance.

Using two sets of Landsat imageries for 1980s and 2000s, Nampindo et al determined the extent of woody cover changes in Northern Uganda.. This satellite data was supplemented with aerial photographs taken from a small plane, which were used to 'ground truth' the satellite imagery and also to assist in proper classification of the land as forest, savannah, agricultural and other habitat types (Nampindo *et al*. 2005).

Their findings showed that the war has had significant impact on the environment in Northern Uganda. The impact manifests in two ways a) overall impact on the woody vegetation, b) impact on the protected areas especially CFR, NPs and WR**.**

4.2.5.3 Impact on central forest reserves and local forest reserves

The woody vegetation change 1985-2002 showed that the land cover of several forest reserves increased in woody vegetation (Figure 3.7 page 34). The forest reserves that showed significant increases in woody land cover include Mt. Kei, Wiceri and Aswa River (20-30%). Otzi forest reserve/Wildlife Sanctuary recorded the highest (40-59) woody cover increase. The rest of the reserves (e.g. Agoru-Agu, Kilak, Era, and Zulia) showed low (1-19%) increases in woodland cover. Mt. Moroto FR showed the highest woodland cover loss of 20-39%, while other forests experienced a loss of 1-19% (e.g. Nyangea-Napore, Opit, Lwala and Rom). Other small natural forest reserves, particularly around Lira town suffered severe decreases in woodland cover (40-59%).

A similar pattern was observed within the parks and wildlife reserves. Murchison Falls National Park, Ajai WR, East Madi WR, Lomungu CHA, Iriri CWA, Mt Kei and Otzi wildlife sanctuaries registered an increase in woody cover (*Figure 3.12*). Matheniko and Bokora WR suffered a decline in woody cover. Kidepo Valley NP on the other hand, showed little change in woody cover. Otzi WS/FR registered the highest increase in woody cover of 40-59% while Matheniko WR recorded the highest loss (20-39%).

In all parks and wildlife reserves, there was a total net increase in woody cover of 114,022 ha (9.2%) and a net loss of 49,239 ha (4.0%). Of this share, Matheniko WR registered a net loss of 34,305 ha (20%) while Kidepo Valley NP recorded 1,074 ha loss.

In the main, there was a loss of woodland cover outside the protected areas. There have also been significant losses of woody cover in the area immediately surrounding Internally Displaced People's (IDP) camps in Gulu and Kitgum and near larger urban centres in northern Uganda such as Lira, where the population has exploded from 9,122 people in 1980 to 80,879 in 2002. These areas have been heavily cultivated and settled. It is also important to note that the demand for fuel wood, building poles for construction and other allied resources is high. Although away from the hills, specifically in the south, there was an increase in woodland cover.

The results also indicate that there has been significant natural habitat recovery in the northwest where the LRA has been most active, corroborating the theory that the land has recovered because people have been forced to abandon it. Similarly, the loss of habitat cover mirrors the movement of the people, showing the detrimental impact of the highly concentrated populations in IDP camps and city centres.

Table 4.8: Woody cover changes (1985-2002) in parks and wildlife reserves

Protected Area Name	Area of Decreased Woody Cover (Ha)	Decreased Woody Cover (%)	Area of Increased Woody Cover (Ha)	Percentage of Increased Woody Cover (%)	Area of Unchanged Woody Cover (Ha	Percentage of Unchanged Woody Cover (%)	Total Area (Ha)	Net Change in Woody Cover (Ha)	Net Change in Woody Cover (%)
Matheniko WR	35009	20	704	0	2575	1	175848	-34305	20
Karenga CWR	8358	9	1963	2	2346	2	95613	-6395	-7
Bokora Corridor WR	10245	6	1706	1	831	0	181685	-8539	-5
Kidepo Valley NP	2376	2	3450	2	4651	3	142969	1074	0
Lomunga WR	598	4	1060	7	526	4	14947	462	3
Karuma WR	675	2	2461	7	28026	84	33255	1786	5
Iriri CWR	2128	2	7799	8	494	0	103035	5671	6
Ajai Wr	450	2	3618	20	283	2	18467	3168	18
Murchison Falls NP	7449	2	67670	20	50641	15	345129	60221	18
East MAdi WR	4433	5	26464	32	27901	34	83086	22031	27
Mt. Kei WS/FR	244	1	8186	34	1281	5	23879	7942	33
Otzi WS/FR	478	3	8545	45	2851	15	18808	8067	42

Source: (Nampindo S, Phillipps G.P, and Plumptre A. 2005)

4.2.5.4 Overall impact

The overall impact showed a combination of increases and decreases in woody ground cover in different parts of the region. For instance, woodlands have increased from 12-23 per cent in the districts of Kitgum, Gulu, Pader, Adjumani, Moyo, and Yumbe and to a lesser extent (1-11 per cent) in Arua, Nebbi and Masindi districts. On the other hand, the districts of Kotido, Apac and Katakwi experienced a decline in woodland cover of 1-12 percent. Lira and Moroto registered a decline in woodland cover of 13-24 percent and Nakapiripiriti experienced the worst woody cover loss of 25-36 per cent and from 20-39 percent within protected areas. Overall there has been a net loss of woody cover, including losses in protected areas. Lira and Moroto registered a decline in woodland cover of 13-24 per cent and Nakapiripiriti experienced the worst woody cover loss of 25-36 per cent.

Table 4.9: Woody cover changes (1985-2002) by districts in northern Uganda

District Name	Area of Decreased Woody Cover (Ha)	Percentage of Decreased Woody Cover	Area of Increased Woody Cover (Ha)	Percentage of Increased Woody Cover (%)	Area of Unchanged Woody Cover (Ha	Percentage of Unchanged Woody Cover (%)	Total Area (Ha)	Net Change in Woody Cover (Ha)	Net Change in Woody Cover (%)
Nakapiripirit	48993	37	1506	1	7232	5	132462	-47488	-36
Lira	118578	28	38386	9	36250	9	419298	-80192	-19
Moroto	140838	19	24050	3	23962	3	753112	-116789	-16
Katakwi	41505	19	21953	10	8288	4	220655	-19553	-9
Kotido	156105	12	58383	4	77909	6	1317434	-97722	-7
Apac	70661	23	48109	16	73418	24	309673	-22552	-7
Arua	5790	2	19326	6	8223	2	344850	13536	4
Nebbi	3397	1	21162	8	6643	3	258561	17765	7
Masindi	16731	6	43441	16	76735	28	275546	26710	10
Gulu	89066	7	262972	22	303982	25	1205387	173905	14
Adjumani	11323	4	62154	20	68903	22	308966	50831	16
Kitgum	84891	8	273923	27	183943	18	1021285	189032	19
Pader	79432	12	202097	32	102515	16	641108	122665	19
Moyo	4188	2	41664	22	9323	5	185318	37476	20
Yumbe	3388	1	58320	24	4881	2	239179	54932	23

Source: (Nampindo S, Phillipps G.P, and Plumptre A. 2005)

The war has definitely a link to the increases in biomass. This is because people abandoned their villages and were forced to live in IDPs, Since no agricultural activities were abandoned the vegetation was left undisturbed and therefore registering positive growth. However where the people are concentrated in the IDP camps, the immediate surroundings registered a negative growth.

In addition, cattle population also dropped therefore low grazing activities helped also the vegetation to register positive growth.

4.3.6 Responses

Voluntary vacation had been successful in many CFR. All together, 112 CFRs had been vacated, either in whole or in part. It was observed that without interference, most encroachers were willing to vacate the CFRs provided they were given adequate notice to harvest their crops and prepare smoothly for relocation.

Sensitisation of political, civic leaders and encroachers has been carried out using local FM radios, print media and meetings. During the year 2005/06 alone, the NFA held over

210 meetings with Local Government Authorities and communities to sensitise them about the need to keep forest reserves intact without excluding lawful activities. Over 8,500 people attended the meetings. During the preparation of the District Forest Development Plans for Mayuge, Masindi and Nakasongola, there were widespread consultations on all matters of forestry. Actually, the process was led by the District Local Government with technical and financial support from the Forestry Department and later the NFA.

Registration of encroachers was completed in areas where the local politicians cooperated and where there was no insecurity. Although some of the figures were estimates.

A database has been created at NFA to store these data for easy retrieval and amendment whenever there is new information. This database is used as a monitoring tool and updated regularly to record achievements towards total elimination of encroachment.

NFA has built both at district and national level a number of partnerships in the fight against encroachment. Major partners include security organs charged with law enforcement both at national and district levels, journalists and NGOs. A UPDF Lt. Col has been attached to NFA as a Coordinator to assist NFA on security matters associated with management of forest reserves. At district level, most RDCs have been instrumental in mobilizing efforts for voluntary vacation of CFRs.

Encroachment Planting

Encroachment planting was carried out in some of the areas vacated by encroachers as shown in the *Table 4.10*.

Table 4.10: Replanted areas after encroachers vacated

CFR	District	Encroachment planting (ha)	Species
Kyamugongo	Hoima	24.5	Pine
Wambabya	Hoima	40	M. eminii
Eria	Moyo	54	T. grandis
Era	Moyo	1	T. grandis
Otze East	Moyo	30	A. africana
Enjeva	Arua	30	Pine
Atigo	Kaberamaido	7	T. superba
Pingire	Soroti	35	Pine
Kyampisi	Mubende	2	M. eminii
Kasa	Mubende	37.8	T. superba/ M. eminii
Abera	Gulu	20	Pine
Budongo	Masindi	30	M. eminii/ Mahogany
Lukuga	Mubende	40	Pine
Total		**351.3**	

Source: NFA Field Reports

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4.4 Wildlife resources

Tourism for export has proved a viable low production cost, high value direct earning and relatively more sustainable industry between 1995 and 2001. Growth oscillated between just over 150 000 and 200 000 tourists. Significantly since 2002, the tourist visitations registered a high increase of 25 percent per annum between 2003 and 2004 as number of tourist visitors soared to 360 000 from 200 000 over a two year period. At a rate of US$ 700 expenditure per tourist, this generated total revenue earnings of US$ 0.637 Billion over the period of three years (MTTI, 2005).

4.4.1 Introduction

In the National State of the Environment Report for 2004/05, it was noted that conservation and the resistance to conservation were the driving forces influencing the management and use of the wildlife resource (NEMA, 2005). Wildlife constitutes an important resource for Uganda as a source of food and material, recreation, tourism, nature study and scientific research. Uganda's wildlife occurs in both protected areas and outside protected areas. As of 1994, protected wildlife areas consisted of national parks, game reserves, controlled hunting areas and games sanctuaries. In all, there are 39 protected areas managed by the Uganda Wildlife Authority.

Wildlife conservation was strengthenened by the coming into force of the 1995 Uganda Constitution with *Section 27* which specifically states, "*the state shall create and develop parks and rserves to protect the biodiversity of Uganda*". It is important to note that wildlife is found both within protected areas (PAs) and outside protected areas. Within PAs the two classifications are Wildlife Reserves and National Parks (NP). The wilidlife management areas have three divisions and these are the Wildlife Sanctuaries; Wildlife Use Rights Areas; and Community Wildlife Areas (CWA). Although there has been a lot of effort both from international developmet partners and at the national level to ensure efficient management of wildlife reserves, many challenges remain. For example, high levels of poverty and population pressure have contributed to the encroachment of a number of National Parks and Wildlife Reserves.

The Wildlife Act vests ownership of wildlife with the state but makes provision for people to own any wildlife that had been lawfully taken. Part VI of the Wildlife Act provides for six different categories of "*use rights*". The assigning of use rights is intended to conserve wildlife through sustained extractive use (Moyini and Masiga, 2006). The different wildlife use rights are: class A wildlife use right: Hunting; class B wildlife use right: Farming; class C wildlife use right: Ranching; class D use right: Trading in wildlife and wildlife products; class E wildlife use right: Using wildlife for educational or scientific purpose including medical experiments and developments; and class F wildlife use right: General extraction (Moyini and Masiga, 2006).

Table 4.11: Protected wildlife areas as of 1994

Status/Name	Year established	Area (Km^2)
A. National Parks		
Queen Elizabeth	1952	1,978
Murchison Falls	1952	3,860
Kidepo Valley	1962	1,442
Lake Mburo	1982	260
Rwenzori Mountains	1991	996
Mgahinga Gorilla	1991	25
Bwindi Impenetrable	1991	330
Semliki Forest	1993	220
Mt. Elgon	1993	1,146
Kibaale	1993	766
Sub-total		**11,023**
B. Game Reserves		
Ajai		58
Bokora Corridor		2,056
Bugungu		520
Karuma		820
Katonga		208
Kibale Forest Corridor		560
Kigezi		330
Kyambura		157
Matheniko		1,604
Pian-Upe		2,314
Toro		554.88
Sub Total Game Reserves		**9,281.88**
C. Controlled Hunting Areas		
Buhaka		17.73
East Madi		1,749.40
Kaiso Tonya		226.56
Kanema		240.61
Katonga		2,272.97
Lipan		898.56
Napak		224.51
North Karamoja		1,676.04
Sebei		2530.84
Semliki		503.19
South Karamoja		8,971.64
West Madi		831.23
Sub Total		**35,143.28**
D. Game Sanctuaries		
Dufile, Otzde and Mt Kei		489
Entebbe		52
Jinja		8
Kazinga		207
Malaba		31
Zoka Forest		207
Sub Total		**966**
E. GRAND TOTAL		**56,414.16**

Source NEIC (1994)

4.4.2 Pressures on wildlife resources

Human-wildlife conflicts **-** Loss of habitat is perhaps the most serious negative factor and is certainly the most difficult to halt and reverse. For example, in Mt. Elgon National park, 8 percent (89.68km^2) of the national park habitat is encroached on. The perennial enmity between human beings and wild animals continues to present stiff challenges for managing the Protected Areas. Given the high population growth in the country, many communities have ended up establishing farms and settlements very close to the boundaries of the Protected Areas resulting in destruction of crops by wild animals especially elephants, hippos and buffaloes. This has prompted the communities to either poison them or become antagonistic towards conservation Programmes. Poisoning was especially rampant in Queen Elizabeth National Park where people live inside the national park in fishing villages. Wild animals have always been hunted down whenever they entered the lowlands of Mahyoro Sub County in Kamwenge. These include hippopotamuses, lions and buffaloes. Elephants occasionally use the area as a corridor to link from Kyambura to Queen Elizabeth National Park and Kibale National Park, in which course they destroy crops leading to conflicts with the locals. Some interventions such as scare shooting proved ineffective as elephants got used to bullet sounds. Other interventions such as digging trenches, though effective, are very expensive.

Illegal grazing in the national parks - Communities neighboring the protected areas continued to defiantly graze their domestic animals inside national parks, and in most cases seemed to prefer paying the fines to obeying the law. Large populations of livestock inside the national parks make it difficult to prevent cross-infection between wildlife and domestic animals. Moreover, the presence of domestic animals in the national parks gives a very negative impression to the tourists. Cattle incursion and illegal grazing in Protected Areas occurred in Kamwenge district. Several arrests in Katonga and Dura were made and livestock released upon payment and receipt of fines. (Kamwenge DSOER 2005) In Queen Elizabeth National Park cows estimated in hundreds have invaded the park by Ugandan pastoralists. (Per. com. Mr. Nuwe Boscow, UWA)

Anthrax scourge in Queen Elizabeth National Park - Hippos in Queen Elizabeth National Park suffered an anthrax epidemic between October 2004 and February 2005, which left over 300 of them dead. Government’s timely financial assistance helped to avert the possibility of a catastrophic situation.

Poaching - Poaching is a serious problem in the wildlife areas. For example; in Moyo district, Elephants and black rhinoceros used to live within the district but now they are extinct. The hippo also reduced almost to the point of extinction.

The main pressures behind poaching include: the meat from wild animals for food and cash income; tusks of particularly elephants and rhinoceros. Poaching has caused the decline in number and even extinction of some wildlife in these areas.

4.4.2 Wildlife population trends in Uganda, 1960 – 2005 [4]

Wildlife populations in Uganda boomed in the years prior to the 1970s, which made Uganda a favourite tourist destination. These populations were decimated during the turbulent period between the 1970s and early 1980s mainly due to lawlessness. With the onset of peace and restructuring since 1986, Uganda's wildlife populations are slowly and steadily recovering. Based on the surveys that have been conducted periodically over the years, the populations indicate an increase in trends of the major wildlife species throughout the country especially in the National Parks.

Table 4.13 shows population trends of some key species across the country since 1960 to 2004 while figures 1 and 2 show trends in individual Protected Areas (PAs); Murchison Falls, Queen Elizabeth, Lake Mburo and Kidepo Valley Conservation Areas. Figure 1, shows that the buffalo population in Murchison Falls National Park that had dropped from 30 000 in the 1970s to just 1 610 by 1991 (95 per cent reduction), has now risen to 11 004 (Rwetsiba et al, 2005) indicating an increase of 583.5 percent.

Other key wildlife populations have increased too in Murchison Falls National Park and in other PAs as well. For example following Sommerlatte and Williamson (1995), Lamprey and Michelmore (1996), Lamprey (2000), Rwetsiba *et al* (2002) and Rwetsiba *et al*., (2005), in Murchison Falls elephant population have increased by 156.7 percent; Hippos by 40.5 percent; Uganda Kob by 46.6 percent and giraffe by 145.0 percent since 1995. In Queen Elizabeth National Park the population of elephants increased from 1 008 in 1995 to 2 497 by 2004, topi increased from mere 94 individuals to 440 individuals by 2004, waterbuck from 1,861 in 1995 to 3 382 by 2004, warthog from 1 174 to 1 880 while the population of the Uganda kob remained relatively stable.

The population of hippos in Queen Elizabeth National Park increased from 2 958 since 1995 to 3 400 by 2000 and dropped to 2 632 by 2004 due to anthrax epidemic that hit the hippo population that year. Similar population trends do apply to other Pas, as indicated in figure 2 in cases of Kidepo and Lake Mburo Conservation Areas. The impact on wildlife resources is such that the once restricted to small 'safe havens' during the time of lawlessness and extreme poaching pressure, have now spread again to major resource areas throughout the protected areas. The increasing wildlife trends can be attributed to the conservation efforts by Uganda Wildlife Authority and other stakeholders. However the populations of some species are still low and fluctuating. This could be attributed to various factors such as diseases and poaching. Nevertheless, the Uganda Wildlife Authority is keen on getting all the population trends upwards.

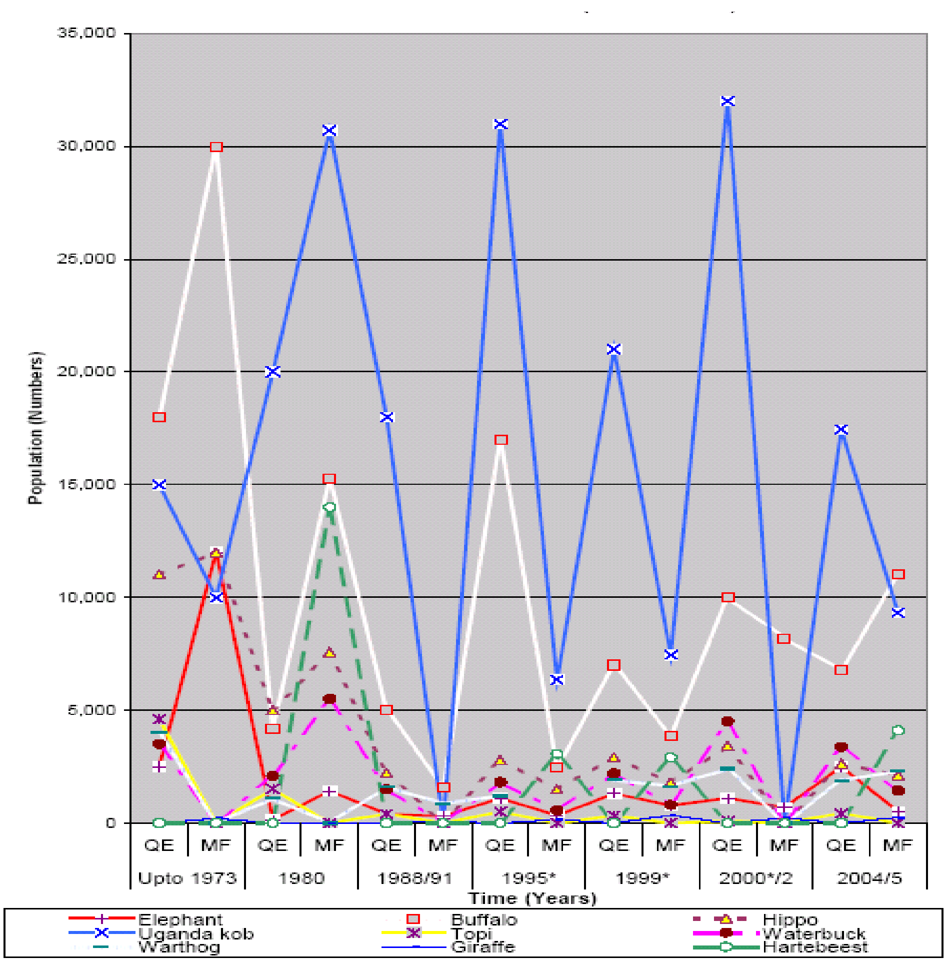
[4] *By Aggrey Rwetsiba: Monitoring and Research Co-ordinator, December 2005.*

Table 4.12: Changes in the population of some selected large mammal species in Uganda from the 1960s to 2003

Species	1960s	1982/3	1995-96	1999 - 2003	Status in Uganda
Elephant	30,000	2,000	1,900	2,400	Population low, but slowly increasing
Black rhino	400	150?	0	0	Extinct in Uganda
White rhino	300	20?	0	0	Extinct in Uganda
Burchell's zebra	10,000	5,500	3,200	2,800	Population low, possibly still decreasing
Hippopotamus	26,000	13,000	4,500	5,300	Population increasing slowly
Rothschild's giraffe	2,500	350	250	240	Population low but stable
Buffalo	60,000	25,000	18,000	17,800	Population stable, decline in QENP offset by increases in MFNP
Hartebeest	25,000	18,000	2,600	3,400	Population increasing slowly
Topi	15,000	6,000	600	450	Population decreasing
Impala	*	19,000	6,000	3,000	Population low, may now be increasing slowly
Waterbuck	10,000	8,000	3,500	6,000	Population increasing
Uganda kob	70,000	40,000	30,000	44,000	Population increasing
Bright's gazelle	1,800	1,400	100	50?	Very rare
Roan	700	300	15	7	Very rare, precarious
Oryx	2000	200	0	0	Extinct in Uganda
Eland	4,500	1,500	500	450	Population low, may still be decreasing
Derby's eland	300	?	0	0	Extinct in Uganda

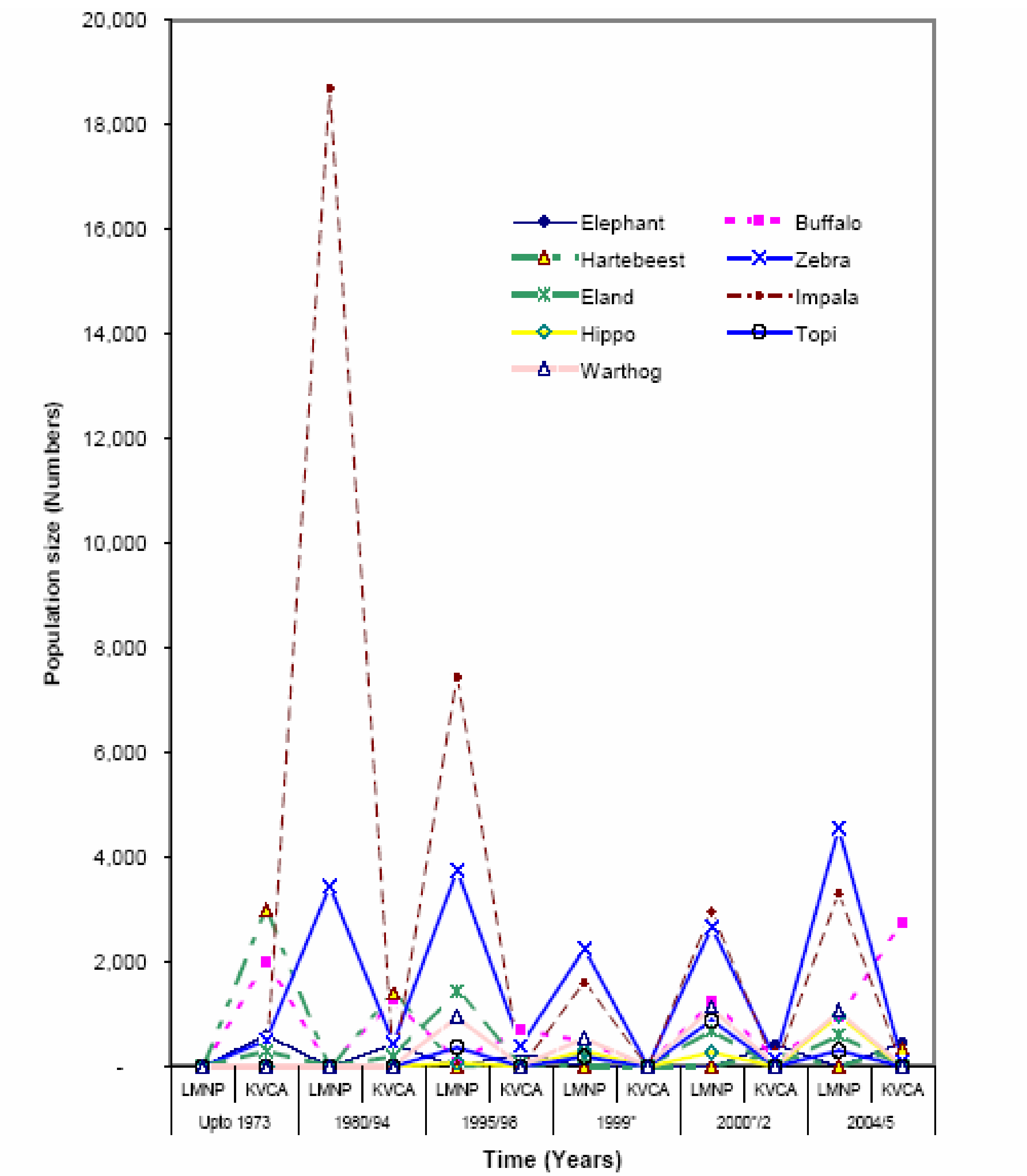
Source: Game Department reports and aerial surveys as indicated in this report. These are species for which reliable previous estimates are available, from which to determine trends. Numbers are approximate.

Figure 4.12: Population trends of major wildlife species in Queeen Elizabeth and Murchison Falls National Parks (1970 to 2006)



Source: (UWA, 2005)

Figure 4.13: population trends of major wildlife in LMCA and KVCA (1970s to 2005)



Source: (UWA, 2005)

4.4.3 Responses

Re-location and translocation programmes have been initiated in partnership with NGOs to enhance crashing populations, strategic management interventions/programmes that include anti poaching, boundary marking, community conservation, monitoring and research, and tourism development among others to address threats to wildlife conservation in Uganda. A brief description of specific activities implemented in response to the pressures includes the following:

- The Animal Capture Team transferred a 60-year-old crocodile, which measured 4.6 meters, from Bugiri District to a crocodile farm in Buwama on Masaka Road owned and managed by Uganda Crocs Ltd.

- Consultative meetings were held with various local governments regarding the management of wildlife outside Protected Areas. A sensitisation campaign was carried out in the different districts to enable them to develop Wildlife Management Plans, which they would then incorporate into their District Development Plans.

- UWA worked closely with different local governments to undertake vermin control activities especially with Kampala City Council. Vermin control is the responsibility of local governments.

- As one of the measures to prevent crop raiding particularly by elephants, trenches were excavated along the boundaries of Kibale National Park, Kyambura and Kigezi Wildlife Reserves. Trenches have proved effective in containing crop raiding.

- UWA through community conservation department uses conservation education and awareness as an important strategy whose ultimate aim is to promote positive attitudes, knowledge and change of behavior of the neighboring communities and the general public. Specifically, conservation education aims at implementing public awareness education and communication campaigns and programs to make the public aware of the needs and benefits of wildlife conservation. Through the community conservation unit, UWA is formulating conservation education and awareness programs both at natural and protected area level. (UWA 2005). Uganda Wildlife Authority has adopted a participatory approach involving local communities and all other stakeholders. Both in Kibale and Queen Elizabeth National Park, UWA has tirelessly handled and managed a number of community sensitization meetings to address conservation problems as constitutionally required of it. (Kamwenge DSOER 2005).

- UWA has started collaborative management (CM) to help offset some of the lost opportunity costs of local communities and better justify conservation as a form of land use. According to UWA philosophy, CM stands on the virtues of multiplicity and diversity in resource management and builds on complimentarity of distinctive roles of different stakeholders. Collaborative management has been very successful especially by linking human rites and responsibilities and fostering social justice and redressing power imbalances. This has been possible by using renewable general management plans (GMPs) and memorandum of understanding (MoU) that respond to various needs rather than established fixed rules. (Per. Com Mr. Nuwe Boscow, UWA)

- To create community incentives to promote wildlife conservation a community Protected Area institution was formed and was facilitated with 20% gate entry fees to implement community projects in parishes surrounding the park. Private individuals and companies in Mbarara have been encouraged to set up developments within Lake Mburo National Park. For example; Mantana African safaris was managing a luxury-tent camp within the park and the lakeside restaurant was under private management. (Mbarara DSOER 2005).

Security and Law Enforcement - The Law Enforcement Unit was re-organised in 2003 to ensure enforcement of wildlife laws and guarantee security and safety in the Protected Areas. Apart from the threat of rebel activities near or around the Protected Areas, many criminal activities such as poaching and encroachment affect many conservation areas.

Implemented Activities: - A joint force of 650 UWA and UPDF personnel codenamed Special Wildlife and Tourism Protection Force (SWIFT) was trained for four months in wildlife management, and thereafter deployed in all the Protected Areas. An average of 500 patrols and surveillance operations were conducted every month in all the Protected Areas. These resulted in the capture of various items such as pangas, wire-snares, hoes, bows, axes, spears, spades, hooks, hunting nets, belts, handsaws and ammunition. During the year, at least 743 people were arrested for various offences including poaching, encroachment, and possession of illegal equipment within the national parks. Of those arrested 133 were convicted and either fined or given prison sentences. The rest were cautioned and educated on the values of conservation.

Translocation of wild animals - As a management tool, the translocation of wild animals from one national park to another or from outside has become one of the priorities especially in attempts to revive the wildlife populations in the country.

Between February and June 2005, Rhino Fund Uganda and Uganda Wildlife Authority worked with Kenya Wildlife Services (KWS) to translocate four white rhinos from Kenya to Uganda. The rhinos are currently kept at the Zziwa Ranch in Nakasongola District. The decision to keep the rhinos at Zziwa Ranch is in line with UWA's policy to work with the private sector in managing the country's wildlife resources.

During the year eleven elands were successfully translocated from Lake Mburo National Park to Kidepo Valley National Park. Though a wild fire in February 2005 caused the elands to escape from the boma and scatter. Attempts to get them back have so far proved futile. However, the elands have been regularly sighted within the park.

Ensuring wildlife health - The year 2004 saw the onslaught of anthrax in Queen Elizabeth National Park resulting in the death of 303 hippos. Anthrax also hit Lake Mburo National Park resulting in the death of 71 zebras within just a few months. Uganda Wildlife Authority worked very closely with the National Task Force to control the hippo deaths and to prevent the scourge from spreading to humans. The Commissioner for Livestock Health and Entomology from the Ministry of Agriculture and Chair of the Task force, Dr. Nicholas Kauta, played a leading role while The European Union (EU) and the World Bank (WB) provided the necessary funding. The Ministry of Works provided some equipment.

- Towards the end of 2004, the Uganda Kob in Toro Semuliki Wildlife Reserve suffered from a bacterial infection. UWA together with the Assistant Commissioner for Disease Control in the Ministry of Agriculture Animal Industry and Fisheries (MAAIF) promptly held meetings with the pastoral communities in Rwebisengo and advised them to vaccinate their livestock. This was meant to break the transmission cycle of the bacterial organisms from livestock to wildlife and vice-versa.

- The PACE wildlife disease survey was successfully done during the first quarter of 2004/2005, and the laboratory results showed that buffaloes in Kidepo Valley National Park, Queen Elizabeth National Park, Murchison Falls National Park and Lake Mburo National Park all tested negative to Rinderpest and Foot and Mouth diseases (UWA 2005).

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4.5 Mineral resources

4.5.1 Introduction

The Mining Act, 2003, defines a mineral as any substance whether in solid, liquid or gaseous form occurring naturally in or on the earth formed by or subject to a geological process, but does not include petroleum, water or building materials (GOU, 2003). Minerals or geologic resources within the boundaries of a nation are recognized by the government as a property of the state and not of any individual or institution even if the individual or institution owns the land rights on which the resources occur. The Ministry of Energy and Mineral Development (MEMD) is mandated to establish, promote the development, strategically manage and safeguard the rational utilisation of energy and mineral resources for social and economic development (GOU, 2003).

4.5.2 Mineral production

A variety of minerals are currently produced in the country. They include; cobalt, gold, gypsum, limestone and pozzolanic materials among others. In 2005, there was a significant increase in the mineral sector activities (*Table 4.4*). The Non-Tax Revenue collected was Ushs 2,800 million in 2005 compared to Ushs 1,200 million in 2004. The value of mineral production also increased to Ushs 176,000 million from Ushs 157,000 million in 2004. The increase is attributed to the investor friendly Mining Act, 2003 which became operational in December 2004. The licensing status dropped from 221 licenses in 2004 to 150 in 2005. This is attributed to the expiry of special exclusive prospecting license (11) and exclusive prospecting license (79) which is now not applicable under the Mining Act 2003 (MEMD, 2005).

Table 4.13: Mineral Production in Uganda for 2004, 2005 and 2006

Commodity	Units	2004	2005	2006
Cobalt	tonne	459	637.84	334.78
Gold	kg	1447	46.00	0.008154
Gypsum	tonne	181.22	285.31	93.03
Iron Ore	tonne	0.0	208.530	N/A
Kaolin	tonne	537	55.00	N/A
Limestone	tonne	228 775 .87	540 755 559	234 909
Columbite /Tantalite	tonne	0.376	0.273	0.016
Tin	tonne	2.7	0.00	0.013
Wolfram	tonne	79.919	45.11	22.583
Vermiculite	tonne	2 688	2 574	1 840
Pozzalanic materials	tonne	134 643 .97	138 932.65	120 044.14
Volcanic ash	tonne	NA	5 052.89	N/A
Synetioc Aggregate	tonne	NA	4 519.00	2606
Beryl	tonne	207	19	N/A

Source: **DGSM (2006)**

Mineral production reported depends on returns received as per July 2006NA = Not Available

X = mineral production for Jan – June

As a result, in 2005, there was increased production of limestone and pozzalanic materials which led to more cement production in the country hence increase in royalty. But the production of some minerals like gold, cobalt and wolfram was less than that of 2004, contributing little to Non-Tax Revenue. This was because one major wolfram mine was under receivership and; Cobalt price had fallen below economic recovery and consequently production was suspended. The increased production nd revenue from cement production, however, outweighed the dclines elsewhere, resulting in the improvement in sector incomes.

4.4.2 Mineral exports

There was less production and consequently less mineral exportation in 2005 compared to that of 2004 (*Table 4.5*). However, the revenue realised were higher. This was because of the improved commodity prices especially for gold. The 30 per cent increase in the price of gold was sufficient to push the revenues from the sector upwards, even though the quantity of other mineral sold declined.

Table 4.14: Mineral exports as per permits issued

Mineral	**Export (in tons)**		**Total Value (in '000 UGX)**	
	2004	**2005**	**2004**	**2005**
Gold	7.18	5.92	151,879.46	164,137.15
Vermiculite	5,979.00	2 35	2,032.86	800.02
Diamonds (G)	0.00	9,122.52	0.00	56.94
Cobalt	459.035	252.73	27,521.33	11,036.28
Wolfram	37.688	5.04	42.21	5.64
Columbite /Tantalum	0.045	0.05	0.675	0.75
Tin	5.00	0.00	12.50	0.00
Beryl	6.00	0.00	3.60	0.00
Total			**156,723.44**	**176,037.18**

Source: MEMD, 2005

Non-Tax Revenue (NTR)

Non–Tax revenue collection increased form Ushs 1,162 million in 2004 to 2,842 million in 2005. This was due to the implementation of a friendly Mining Act 2003, which came to effect from 14th December 2004; and introduced import fees and rationalised mineral rents and fees.

Table 4.15: NTR assessed and reported collected (Jan –Dec 2005)

	Description of fees	**Amount in Ushs**	
1	Prospecting license fees.		9 300 000
2	EL fees and Rents		75 310 000
3	Location fees and rents		12 250 000
4	ML/SML fees and rents		54 802 556
5	Blaster's Certificate		2 000 000
6	Mineral Dealers license fees		50 050 000
7	Royalties		1 925 147 376
8	Import fees		711 616 941
GRAND TOTAL		2 842 276 873	

Source: MEMD, 2005

4.4.3 Mining and the environment

Mining is one of the economic activities carried out in Uganda under the guidance of the Department of Geological Survey and Mines. Given the fact that most of these minerals naturally occur in the environment, there is a great potential of altering the normal functioning of the environment through human endeavours to harness different mineral resources in different parts of the country. It should be noted that environment acts as a source of raw materials for the mining industry and a sink for wastes generated during the mining process (MEMD, 2005).

Mineral deposits as well as valuable rocks are formed through geologic processes that operate over long geologic periods measured in millions of years. Hence on human time scale these geologic resources are non renewable. Exploitation of the resource should therefore take into account not only the present but also the future generation. This calls for the conservation of the geologic resources both in terms of quantity mined and caring for the environment through proper mining practices.

Mineral resources include those deposits that exist in reality but have not yet been discovered. Many valuable minerals are known to occur in association with others which are valuable. In the process of mining minerals, care should be taken to examine the deposit for other valuable minerals which could be exploited as by-products of the mining operation.

4.4.4 Some of the environmental impacts caused by mining operations

4.4.4.1 Vegetation clearance

Most of the mining activities in Uganda are carried out by artisanal and small scale miners who employ crude, indiscriminate and inappropriate methods of mining. This usually calls for clearance of the surface vegetation and the subsequent excavation to locate the mineral ore. Even after the mining activity has taken place, there is little effort to have such areas reclaimed. This is very common in illegally mined areas (MEMD, 2003).

4.4.4.2 Disposal of solid wastes

The nature of handling and disposing of mine tailings, especially the potentially toxic, is still poor in the country. For example, between 1956 and 1982 Kilembe Mines Limited stockpiled about 1 million tones of cobalt –ferrous pyrite concentrates as by-product. On oxidation, the pyrite produced sulphuric acid and heavy metals that corroded the environment and resulted in a scorched /erosion trail of about 150 hectares in the Queen Elizabeth National park which affected the growth and development of plant and animal life in the park (UNDP, 2005).

4.4.4.3 Noise pollution

Workers in underground and surface mines are often exposed to high noise levels, for example by drilling equipment, loaders, diesel locomotives and trucks. This may result into occupational hazards as continuous exposure to intense noise may cause hearing loss (NEMA, 2005).

4.4.4.3 Vibration

The main vibration problem in mines arises from the use of hard pneumatic tools. Localised vibration may affect workers leading to; neurovascular alterations in the hands, bone alterations, muscular weakness and muscle atrophy.

Mining activities may also result in the development of semi-urban areas around mining sites as people scramble for employment opportunities in such areas. This results into increased population which does not correspond to the land carrying capacity of that area.

4.4.4.4 Airborne particles

Airborne dust is a hazard in underground and surface mining operations. Dust from mining operations essentially contains the same composition as the material which is mined. Therefore, health hazards resulting from exposure to such dust are related to their chemical composition and for certain types specifically to their mineralogical composition.

4.4.5 Responses

4.4.5.1 Avoiding negative environmental impacts

Article 108 of the Mining Act, 2003 provides for environmental impact assessments and environmental audits. According to the requirements, every holder of an exploration license or a mining lease should carry out an environmental impact assessment of his /her proposed operations in accordance with the provisions of the National Environment Act Cap 153.

Article 109 of the Mining Act, 2003 also emphasises environmental protection standards that should be included in every exploitation license or mining lease granted under the Mining Act 2003, a condition that ensures the prevention and minimisation of pollution of the environment in accordance with the standards and guidelines prescribed under the National Environment Act, Cap 153 (GOU, 2003).

Concerning disposal of wastes, the Mining Act, 2003 article 115 also provides that no minerals shall be disposed of in any manner whether for the purpose of sampling, analysis or otherwise Except,
a) With the written consent of the commissioner
b) In accordance with the terms of mineral right concerned
c) As other wise permitted by or under the Act.

4.4.5.2 Sustainable Management of Mineral Resources Project (SMMRP)

This is a five year project which commenced in August 2004. The objective of SMMRP is to assist in capacity building and regulatory reform, improve small-scale and artisanal mining, establish environmental and social performance of current and future mining in Uganda, as well as embark on acquisition of geological data and development of information on mineral resources potential and the development of requisite physical infrastructure (MEMD, 2005).

One of the project's five components involves the establishment of an environmental social management frame work being implemented by the environmental unit in the Department of Geological Survey and Mines. The roles of the unit among others include; conduct assessment, prevention and monitoring environmental effects resulting from mining. The unit also ensures that existing and yet to be established mining projects country wide conform to set environmental standards in order to minimise or eliminate adverse effects on the environment.

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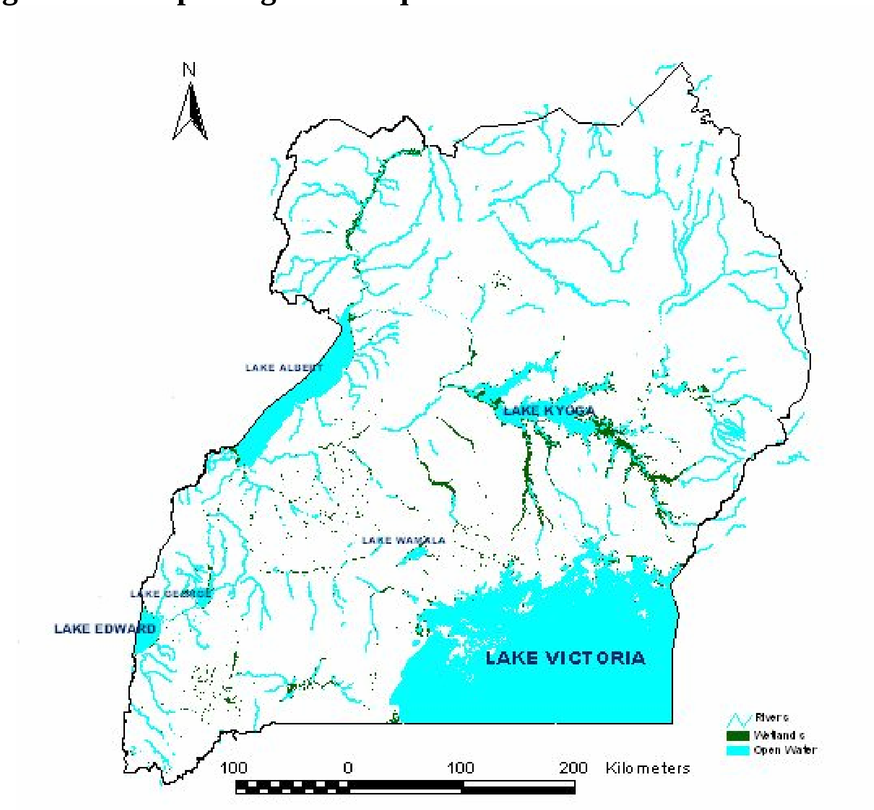
5.0 AQUATIC RESOURCES

5.1 Introduction

Uganda's aquatic resources consist of the fresh water systems of the country, rivers, lakes, and underground water systems and wetlands. Of Uganda's cover areas of 241 500 km^2, 15 percent is freshwater open bodies while 13 percent is covered by wetland. Rainfall is the principal contributor to surface water bodies. Indeed human settlement and the livelihood use is influenced by rainfall and water availability (UN Water, 2006; Ssemwogere, 2005)

Figure 5.1: Map of Uganda's aquatic resources



Source: NEMA 2007

The major threat to the national aquatic resources is over abstraction of surface water resources which caused significant change in the flow regimes and water quality of many rivers, leading to negative impacts on aquatic biota and subsequent losses of ecological function and health (UN-Water, 2006).

5.2 Wetlands resources

Wetlands occupy 29 000 km^2 (13 percent) of the total area of the country. The complexity of Uganda's wetlands can be described as follows: In the south and west, of the country, they form an extensive low gradient which is steep with V- shaped valley bottoms with permanent wetland edges. In the East, wetlands exist as a net work of small, vegetated valley bottoms in slightly undulating land shape (NEMA, 2005).

5.2.1 Value of wetlands in Uganda

Many of Uganda's wetlands are used for crop cultivation. The wetlands provide water required for irrigated crop cultivation and deposit sediments and nutrients that maintain soil fertility. Wetlands are also a source of papyrus. The papyrus provides income in three ways: the papyrus may be sold by harvesters to artisans such as thatch and mat makers; they may be used to produce rough low cost mats for sale and the harvesters may use the papyrus to produce fine higher-cost mats. Wetlands in Uganda are often used for brick making. Wetlands have also been used for fish farming.

Table 5.1: Economic value of the Nakivubo Urban wetland

Wetland benefit	**Economic value (US$/year, 2002)**
Crop cultivation	60,000
Papyrus harvesting	10,000
Brick making	17,000
Fish farming	3,000
Water treatment and purification	700,000- 1,300,000

Source: Schuyt (2005)

Wetlands also provide a vitally important, water treatment and purification. Large amounts of water enter the wetlands. The waste include: detergents, hidoricents, oil, acids, nitrates, phosphates and heavy metals. The wetlands treat and purify this water before it is passed onto the lake or connecting river (Schuyt, 2005).

5.2.2 Case studies from Apac Iganga, Kisoro and Mpigi districts

5.2.2.1 Apac district

Eighteen percent of the land area of Apac district is under wetlands, both seasonal and permanent wetlands. The wetlands resources include drainage basins, the main systems that supply the River Nile basin, the associated major wetlands to the systems and the nature of rivers and other water sources to the wetlands. These wetlands are found to be occupying the low lying plains with wide valleys.

Wetland flora and fauna in Apac district

The flora in the wetlands of Apac district consists of stand off cyperns, papyrus, *vossia cuspidate* with *typha domigensis* common along Lake Kwania and Victoria Nile shores, mostly as monoculture stands. Mosaic stands of wetlands are found along Okole River, the Tochi river system (Olony – Alee - Amon and some of their tributaries.)

The fauna consists of Sitatunga and red bucks in the main systems of Okole, Tochi, Victoria Nile Rivers and Lake Kwania. Throughout the permanent and seasonal wetlands lizards and marsh mongoose are common.

The most common type of fish includes catfish, lung fish, tilapia and clarais observed in major wetlands. Fishing, especially of tilapia is common in all wetlands of the district with the greatest activity in the permanent wetlands.

Wetlands in Apac district can be classified into six categories:

- Fish water emergent reed. These include: lacustrine swamps like at the shore of Lake Kwania; Riverine and associated flood plain swamps along Victoria Nile; and Valley swamps in part of Okole and Tochi river systems.

- Fresh floating leafed but rooted vegetation. These are dominated by Nyamphasa species and they are common in Okole, Tochi, Victoria Nile and Lake Kwania systems.

- Fresh water surface floating vegetation dominated by *Pistia stratioptes* and *Eichlornia crassipes* found in Lake Kwania and Victoria Nile.

- Seasonal flooded herbaceous wetlands with variable species compositions that include *Ehinochloa, Loudetia*, *Cydodon* species, and *Oryza* species.

- Fresh water Riverine Forests. These are found in Okole and Tochi river systems, the major species include *Phoenix*, *Acacia*, *Combretum*, *Albizia*, *Erythrina* and *Aaichorena*.

- Seasonally flooded grasslands especially *Acacia terminalia* predorminant in Abalokweri and Ber auno.

5.2.2.2 Iganga district

Wetland resources in Iganga district covers 30 percent of 77,763 km^2 of the 2,538km^2, covering the geographical area of Iganga district and the new Namutumba district. The main wetland systems in the district drain to Lake Kyoga, these are Lumbuye, Naigombwa and Mpologoma, which all drain northwards. Iganga's seasonal wetlands are usually flooded in the peak rainfall months, however, they are exposed to extreme pressure from agriculture (i.e. paddy rice and sugar cane growing). Permanent wetlands are deeply water logged and difficult to work with human labour, these largely drain into Lake Kyoga. The dominant plants in these wetlands include papyrus species, Acacia species, Phoenix species, *Phraganites* species, *Sorghastrum* species and *Cyperus* species. Fauna in the wetlands of Iganga District include velvet monkeys, fish and a diversity of birds.

The most outstanding environmental issue with regard to wetlands in Iganga district is the extensive draining of wetlands for cultivation. It is estimated that about 64 percent of the total seasonal wetlands have been reclaimed increasingly for rice production and sugar cane growing. As a result of the perennial reclamation of wetlands, there has been a reduction in the number of permanent streams, disappearance of permanent springs, low ground water yield in the wells, permanent change in land use, intensified conflicts amongst different users, and soil fertility exhaustion in some parts of wetlands.

Wetlands degradation has led to extensive vegetation depletion in Iganga district due to agricultural conversion, deforestation and burning. Deforestation for wood and crafts material is wide spread in the district. Another hazard is wild fires which become rampart during the dry season triggering off replacement of the natural vegetation. The result has been a considerable loss of values and attributes of the wetlands.

5.2.2.3 Kisoro district

In Kisoro district, there are five different types of wetlands permanent wetlands dominated by grasses; seasonal wetlands dominated by grasses; permanent wetlands dominated by papyrus and/or other sedges; permanent wetlands modified into farmlands and seasonal wetlands also modified into farmlands.

Table 5.2: Wetland types

Class	Area km^2	Proportion (%)
Permanent wetland dominated by grasses	1.98	7.9
Seasonal wetlands dominated by grasses	0.76	3.0
Permanent wetlands dominated by papyrus/and or other sedges	8.08	32.1
Permanent wetlands modified into farmland	12.05	47.9
Seasonal wetlands modified into farmlands	2.28	9.1

Source: Kisoro District Wetland Inventory Report (2004)

The network of wetlands systems in the District include: Lake Edward wetlands system which drains into Lake Mutunda and Mulekhe and part of Kigeya – Ruhuhuma that drains into Lake Bunyonyi. The other wetlands in the district include: Muregyege, Kyajenge (Chajengi) and Karwa wetlands draining into Lake Mulehe. Ruhezamyanda

(Ruhezaminda), Gitundwe, Mulindi, Ndibagera and Nyarutovu wetlands drain into Lake Mutanda. Nyakisozi and Kabande wetland systems located in Nyarubuye sub-county are the only wetland – closed systems in the district.

Wetlands uses in Kisoro

Given the water shortages suffered in the district, hydrological values of wetlands are the most recognised in Kisoro district. In rural areas gravity flow schemes and purified water cannot be accessed. Wetlands are regarded as the main source of sufficient and clean water.

Wetlands redistribute nutrients through the import and export of nutrients. When it rains organic matter from different sources of plants and animal origin is received, accumulated and redistributed by floods to other areas. In Kisoro district, wetlands act as breeding and nursery grounds for fish and other organisms. It is recognised that fish yields in the wetlands and Lakes highly depend on the status of wetlands for food and cover. Indeed, due to the destruction of wetlands in most parts, fish yields have drastically reduced. Wetlands are also important for papyrus and other sedges that provide building materials, fuel and medicine. Products from dry papyrus such as crafts, fuelwood and thatching material are sold on market days. Clay from Kabande wetlands has been used for pot and stoves, which are common in biweekly markets.

5.2.2.4 Mpigi district

Wetlands resources in Mpigi district cover an area of 719 sq. km; the permanent wetlands lie in the fringes of the Lake Victoria and the seasonal wetlands are formed in forest areas and grasslands. All the wetlands in Mpigi district form into one major system, the Lake Victoria drainage system.

Table 5.3: Drainage systems in Mpigi district

Wetland name	Area (km^2)	Type	Location/sub-county
Buyinja	50.5	P	Maddu
Degeya	2.7	P	Mpigi
Kabasuma	10.5	P	Kyegonza
Kalungi	8.0	P	Kammengo/Budde
Kasemulamba	3.9	P	Nkozi/Kituntu
Katonga	273.4	P/S	Maddu/Kabulasoke/Ngando/Kituntu/Nkozi
Kibimba	134.0	P	Kyegonza/Kabulasoke
Kibukuta	23.5	P	Buwama/Nkozi/Kituntu
Kinyika	2.6	P	Kituntu/Nkozi
Muyanga	25.1	P	Ngando/Kituntu/Bbulo/Kyegonza
Nabakazi	47.2	P	Mpigi/Mubende boundary
Nakyetema/Lutindo	32.0	P	Kammengo/Mpigi
Nawandiga	22.0	P	Budde/Buwama/Kammengo
Sembula	24.5	P	Ngando/Kabulasoke/Kyegonza
Kibiga			Buwama
Mutokowe			Buwama
Kabengere			Mpenja
Namulondo			Kyegonza
Kamirango			Kyegonza

*P permanent; S Seasonal
Source: Mpigi DSOER (2004)

Wetlands Flora and Fauna of Mpigi district

The wetlands flora and fauna of Mpigi district comprise of papyrus; the main wetlands being dominanted by *Raphia* species, palms and *Calamu* species (i.e. rattan species), *Albizia* species, *Piptadeniastum* species and *Celtis* species on the fringes of the forested areas. Seasonal wetlands have a similar, but much smaller populations, species as the permanent wetlands, however, they are dominated by spear grass scattered with thickets and palms (Mpigi DSOER, 2004).

The fauna include Sitatunga and Bushbucks, although the population is generally moderate to low. There are plenty of monkeys. The monkeys include the red-tailed and black and white colobus monkeys. Fish consist of cat fish, lung fish and tilapia, the crested crane is the most common bird in the wetland of Mpigi district.

5.2.3 Pressures on the wetlands resources in Uganda

- Uganda's wetlands face enormous pressures largely from citizens wishing to convert them for agriculture production. The pressures vary by region and location. For instance wetlands in urban areas are likely to be dumping sites for wastes and, in some regions, to be converted for peri-urban agriculture. Wetlands in rural areas are likely to be used when a particular crop such as paddy rice horticultural produce have become major income earners (UNEP/NEMA, 2007).

Overall it would seem then that wetlands in rural areas may have a reduced probability of degradation compared to those in urban areas.

- The principal supply of renewable fresh water for human use comes from an array of wetlands, including lakes, rivers, swamps and shallow ground water aquifers. Fish and fishery products are particularly important ecosystems service derived from inland waters. Wetlands provide an important service by treating and detoxifying a variety of waste products. Wetlands are important tourism destinations because of their aesthetic value and the high diversity of the animal plant life they contain. They also play an important role in the regulation of global climate by sequestering and releasing significant amount of carbon (NA, 2005). In Uganda the declining condition of wetlands has placed the ecosystem service and livelihood of the people who depend on them at risk.

- Kisoro district consists of some intact wetlands in protected areas such as Mgahinga Gorilla National Park, Bwindi Impenetrable National Park and Echuya Forest Reserve. However, areas outside the protected areas such as Nyaborongo and Murango to the north of the district are heavily degraded.

- Drainage of wetlands for agricultural production has been reported since the 1940s in the Gutundwe, Murugyege and Nyarutovu wetlands. Cultivation up to the lake shores has led to siltation reducing the size of fish breeding grounds in Mutanda and Mulehe Lake. Wetlands are cultivated with crops such as sweet potatoes, Irish potatoes, beans, cabbages and sorghum.

- Over harvesting of swamps for papyrus and clay have also contributed to wetland degradation.

- Some wetlands have been converted by draining swamps to create more land for cattle farming. After the encroachment and depletion; secondary vegetation such as cyperus developed and now dominates many wetlands consequently affecting the wildlife habitat.

- In many wetlands as well, assumed ownership of wetlands by individuals has denied free access to wetland resources and hence reduced the benefits to the majority. This has compromised efforts and made it almost impossible to conserve some wetlands.

- All over the world Uganda inclusive, degradation and loss of inland wetlands and species is driven by infrastructure development e.g. building of dams, land conversion, water withdrawals, pollution, over harvesting, the introduction of invasive alien species and global climate charge (NA, 2005). In the case of Uganda, additional pressures come from policy and management challenges, ownership, the transboundary nature of resources, and political interference. A lot of these pressures are connected to each other.

- As the population grows; the demand for more agricultural land is expected to increase. In 1991, out of 16.7 million people close to 89% (14.8 million people) lived in areas occupying 8.4million hectares of subsistence farmland; by 2002, the population of Uganda was 24.7 million of whom close to 85% lived in rural areas.. Land cover including wetlands has come under pressure for conversion into farm holdings. The population of illegal settlers in the wetlands is estimated to be over ten thousand with major concentrations being in Kitintale Zone b11, in Nakawa division and Namuwongo Slums in Makindye division.[2]

- Wetlands are also under extreme pressure due to economic development activities including residential development which is affecting several wetlands, notably Nsooba Bulyera, Kiyanja Kansanga, Kyetinda, Mayanja, and Nakivubo in Kampala district.[4] All the seasonal wetlands have been reclaimed and the people have even resorted to degrading critical wetlands such as Kinawataka, Nakivubo and Kansanga. In Nakivubo wetland, the original area of intact wetland vegetation (mostly papyrus) of 4.4km^2 was reduced to 2.8 km^2 in 1991, 1.9 km^2 in 1995 and 1.3 km^2 in 2000. Current estimates indicate the size to be less than 1 km^2. [2]

- Problems also result from the narrow, sectoral approaches taken to economic development, perverse economic subsidies that don't consider the link between ecosystem services and human livelihoods, or poorly formulated responses to poverty. Unsustainable exploitation of wetlands is often the result of poor uni–sectoral planning and lack of recognition of the ecological, hydrological and economic functions and values associated with intact wetlands. [7]

- As a result, water ways, water quantity and quality, and the micro climate have been altered, with potential consequences for crop production, wetland resource use and public health. In other areas, wide spread conversion to rice has taken place but the initial high yields are not sustained, while the traditional dry season grazing areas in some cases may have suffered long term damage. In the urban centers, wetlands have been filled in for industrial development and housing with adverse hydrological consequences (flooding) for those living down stream, while in the peri-urban areas, encroachment and over harvesting of plant resources have damaged the water purifying capacities of wetlands, putting public health at risk.[4]

5.2.4 Measures being taken by relevant government authorities

- As a contracting party to the Ramzar convention, the Government of Uganda has taken a number of steps to implement the convention. These include the designation of Lake George as a Ramzar, creating awareness at the national, districts and local level, inventory of wetlands data collection and research on values and functions of wetlands.Meanwhile more work is on going.

- Government through Wetlands Inspection Division in the ministry of water lands and Environment has been assisting communities in the development of community based Wetlands Management Plans. This has been piloted in districts of Kumi, Pallisa, Kabale and Masaka. So far, 23 Management Plans have been developed and implementation of 10 of them is on going in the Rushebeya wetland in Kabale, Chahafi, Kandeche, and Naruzinga in Bushenyi, Ngoto in Kanungu, Olechoin Kumi; Kyojja and Nabugabo in Masaka.

- The Wetlands Inspection Division has also publicised wetland resources use guidelines to provide guidance to those who intend to carry out regulated activities in wetlands. These include guidelines for: wetlands edge gardening, for small holder paddy rice activity in seasonal wet lands, for sand and clay mining areas and for the rehabilitation of clay and sand mining areas, for fish farming and seasonal wetlands.

- Government has also started the process of gazzetting of wetlands of critical importance for strict protection (i.e. not to allow any human activity) starting with those in Kampala district. The process started with Nakivubo wetland located in Nakawa division, and this will be followed by Kinawataka and Kansanga wetlands.

- Research on critical wetland values such as purifiers of waste water has increased the understanding on their functions and values. In the case of Nakivubo wetland in Kampala, this increased understanding on the wetlands is one of the reasons why the process to gazette Nakivubo is being considered. There is the realization that without the preservation of the vital wetlands flood control and water purification function, the quality of water for Kampala city in Lake Victoria, which is also the source of water for Kampala city will deteriorate and lead to the increase in water treatment costs.

- NEMA in collaboration with the lead agencies, district and communities has been piloting the use of "*the Ecosystems Approach*" in the restoration and management of fragile areas including wetlands, river banks and lake shores. This approach is being piloted in the districts of Jinja, Kalangala, Mbarara, Ntungamo, Kapchorwa, and Kisoro.

- NEMA in collaboration with lead agencies, districts and the police have also started with the exercise of evicting encroachers on wetlands and eventually restoring them to their original status. The process has been successfully carried out in the following areas:

    - Kinawataka, / Kamwokya wetlands systems located between Kampala and Wakiso districts along Jinja Road where a market was removed in August 2004.[2]
    - In Agu Wetlands (Ngora sub county) and Kodike wetlands (Kobwin Sub county) located in Kumi district where illegal settlers in wetland were evicted in September 2004

- In Awoja wetlands (Gweri subcounty) and Abuket wetlands (kyere subcounty-Sere county) located in Soroti district where illegal settlers in wetlands were evicted in September 2004;
- Rufuha wetlands system located in Rwekiniro sub county in Ntungamo district where diary farmers have been evicted from the wetlands leaving it as public grazing land;
- In Kyerungu wetland located in Karungu sub county Bushenyi district where individual dairy farmers have been evicted, some arrested and prosecuted and wetland restored;
- In Nyinedungu wetland located in Ibanda Town Council Mbarara district.

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5.3 Water resources

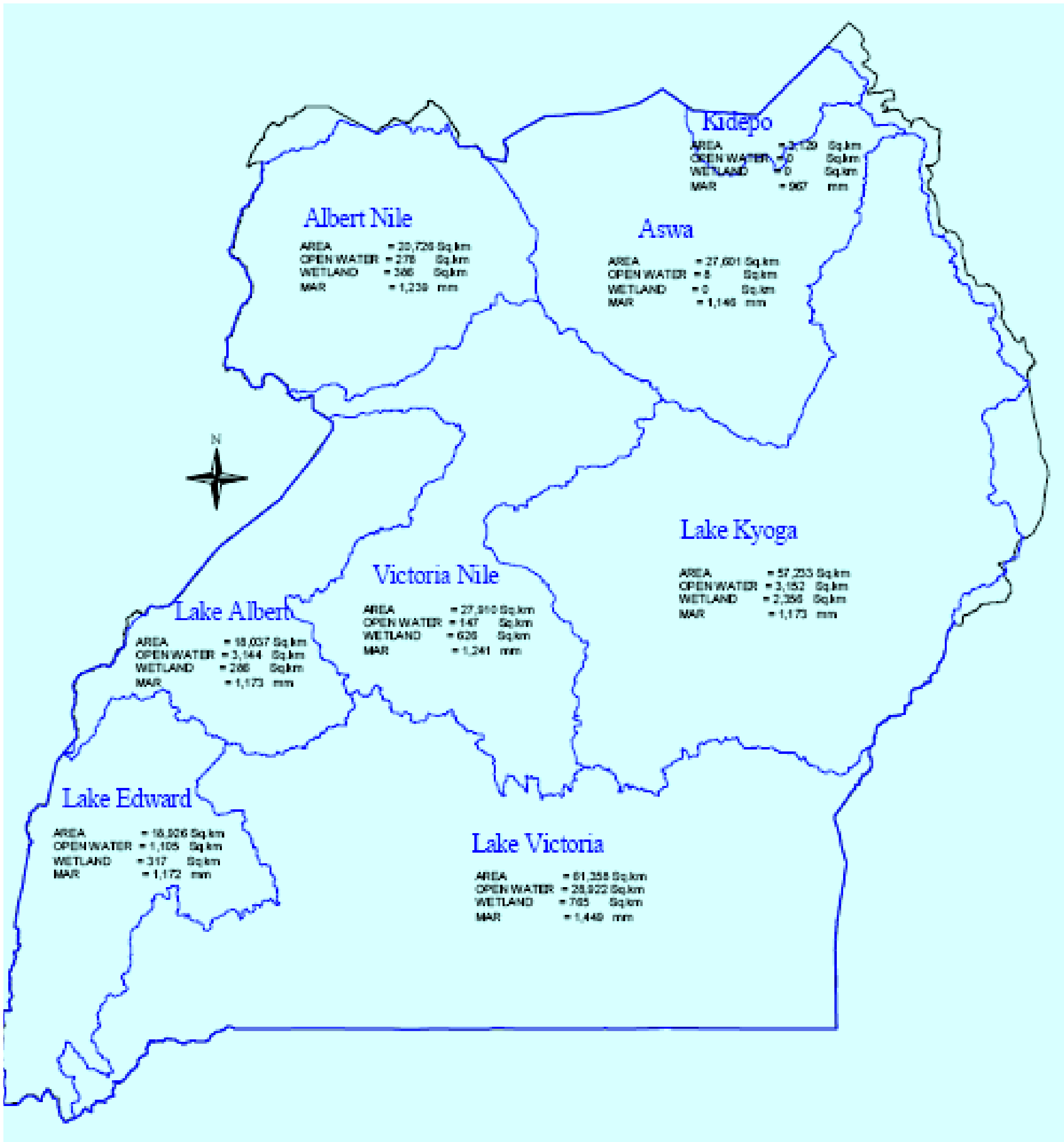
Services derived from water resources, including sanitation, and water for drinking, cooking and irrigation are essential to life and health, economic development, and human dignity (World Bank, 2006). Water is one of the priority sectors of Uganda and it directly impacts on the quality of life of the people and the overall productivity of the population (UN Water, 2006). Uganda is relatively well endowed with water resources with Lake Victoria as the largest fresh water resource in Africa and the second largest in the world. It is considered as one of the most shared resource of the East African Community (EAC). Most regions have plentiful rainfall. On an average, the country receives rainfall of 2 100 mm annually falling over two main seasons; the primary season that runs from March to May with peak in April and secondary season covers September to December with the peak in November (Hydro climatic study, WRMD). The objective of the water resources management is to attain an integrated sound water resources management practices for sustained linkages in the ecological framework as well as economic and health benefits.

5.3.1 State of water resources

5.3.1.1 Surface Water

Save for a small portion in the northeast of the country drained by Lake Turkana, most of Uganda is drained by the White Nile Basin (UN Water, 2006). Uganda is divided into eight sub-basins, which drain into the Nile, Lake Victoria, Lake Kyoga, R. Kafu, Lakes George and Edward, Lake Albert, R. Aswa, Albert Nile and Kidepo Valley (UN-Water, 2006). Lake Victoria is Africa‘s largest fresh water lake. It is one of the most important shared natural resources of East Africa. It stretches to the common boarders of Kenya, Tanzania and Uganda with catchments extending to Burundi and Rwanda. The lake features the world’s largest fresh water fishery and provides for local consumption as well as exports. It has a critical importance for the region as a source of income, hydropower, food, portable and agricultural water transport and tourism. The catchment is valued for its socio- economic potential and as a global centre of aquatic diversity.

Figure 5.2: Major drainage sub-basins in Uganda



Source: UN-Water (2006)

The major basins included in the Directorate for Water Development (DWD, 2006) inventory of water resources were the Lake Victoria, Lake Kyoga, Lake Albert, Albert Nile, and Lake Edward, merging some of the small sub-basins (*Table 5.4*).

Table 5.4: Yields of the various river basins over the year

BASIN	Station	Station mean	Annual yield BCM1	
	Name	Long term	2004	% Age
L. VICTORIA	Rwizi	0.181	0.186	103
BASIN	Katonga	0.082	0.044	53
	Bukora	0.289	0.245	85
	Kagera	4.298	2.558	60
	Kakinga	0.009	0	4
	Sio	0.334	0.277	83
	Kisoma	0.015	0.021	136
		Overall		63
LAKE KYOGA	Munatwu	2.402	1	42
	Namatala	0.843	0.5	54
	Mpologoma	5.766	1.2	22
	Malaba	5.114	3.7	72
	Abuket	2.432	0.1	3
	Agu	2.931	0.3	12
	Kapiri	3.786	1.1	29
	Namalu	0.091	0.1	73
	Sironku	1.279	0.7	56
	Simu	1.115	0.8	71
	Sipi	1.042	0.6	55
	Sezibuk	0.662	0.3	46
		Overall		38
LAKE ALBERT	Kafu	5.563	5.6	100
	Tochi 11	2.758	1.6	60
	Mayanja	2.794	1.5	55
	Nkusi	1.432	1.3	87
	Waki 11	0.902	1.2	133
		Overall		83
ALBERT NILE	Nyagak	1.742	2.1	123
	Ora 1	4.047	7.1	175
	Ora 11	1.041	0.9	90
	Enyau	1.742	2.1	123
		Overall		132
LAKE EDWARD	Mpanga	1.332	0.7	51
	Mpanga	4.528	3.1	68
	Nyamugasani	2.488	1	42
	Kyambura	2.498	2.2	88
	Mitono	4.833	5.7	117
		Overall		83

Source: DWD, 2006

a) Water quality

Water quality is a very important consideration for all water use for humans, for animals, for crops and even for industry. With regard to water quality in reservoirs and lakes, an understanding of stratification and effects is essential.

b) Decline in water quality

Water quality degradation can be defined as a measurable decline in the quality of the resource for an intended use, which may be domestic, industrial, agricultural recreation, etc (Nsubuga, 1994). Each intended used has specific quality requirements. Nevertheless, six major problems have been identified in the country as responsible for the total decline. These are: heavy siltation of rivers and dams, domestic sewage, industrial effluent discharges and mining activities solid waste.

Over the past decades, the natural qualities of water courses have been altered by the impact of various human activities and water uses. Most pollution situations have evolved gradually until they eventually became apparent and measurable. Recognition of a pollution problem has therefore usually taken time, and application of the necessary control measures has taken even longer.

5.3.1.2 Ground water resources

There are no good water aquifers in Uganda, and thus the collection and analysis of good water data are related to small-scale rural water supplies from local aquifers in the basement complex. About 8 129 boreholes were drilled by 1990. But it has been estimated that 20,000 more may be required in addition to other water supply sources (Kruger, 1990).

Uganda's ground water resources have sustained a gradual decrease in the water level, which has been attributed to the fall of water level due to abstraction (WRMD 2006). Consequently, the fall in water levels is more pronounced due to the ongoing decline in the rainfall received and abstraction. Ground water resources are heavily dependent on the amount of rainfall received with the water level in the wells following the rainfall patterns. Monitoring of such wells is however linked to the fact that they are not optimally located. Some existing wells used as monitoring stations lack comprehensive drilling and contraction data. They are also limited by insecurity for instance in Northern Uganda, which hinders the network operation in those locations.

According to the (WRMD 2006), routine monitoring for ground water has been going on in 13 boreholes countrywide. These boreholes are located in districts of Mukono, Mbarara, Kotido, Apac, Rakai, Kasese, Palisa, Hoima and Rukungiri. Some statistics of water quality in these sources is shown below.

Table 5.5: Indices of water quality for ground water in Uganda

Parameter	EC	P^H	Turb	Colour	Hardness	T.Iron	No-3	F^-	Total coli form	E. Coli
Min	109	5.6	0.0	0	40	0.03	0.056	0.12	0	0
Medium	414	6.6	3.63	4.4	145	0.27	1.58	0.24	6	0
Mean	804	6.6	27	28	162	1.91	1.56	0.34	42	0
Max	890	7.4	70.6	65	319	6.68	3.1	0.67	100	0

Source: WRMD 2006

5.3.2 Pressure on water resources

Water resources in Uganda and indeed in many African countries are prone to degradation mainly because they are traditionally a common property, utilized by anybody but in practice owned by nobody. Secondly, water environments occupy the lowest topography in a given area where agents of environmental degradation often expose them to access virtually from the entire catchments. Consequently management of aquatic resources in Uganda has not been effective at safe guarding the water environment and fisheries resources from the resultant threats.

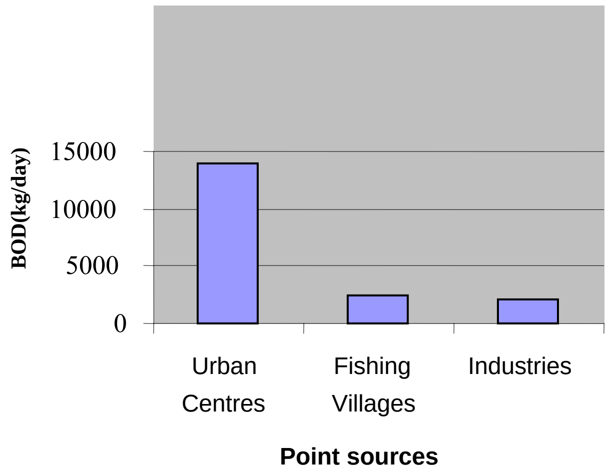
Many lakes in Uganda are threatened in one way or the other mainly by fall out from various human activities notably poor land use practices, dumping of excessive nutrients and toxic wastes into the lakes, species introductions and over fishing (Bugenyi, 2001).

In Uganda, Lake Victoria and, to a less extent Kyoga are the most affected. Research by local and visiting scientists at the fisheries research institute at Jinja has revealed dramatic indicators of detrimental change in the physical, chemical and biological parameters of the open water environment of Lake Victoria compared to the situation in the 1960s.

Pollution is becoming an increasing problem in Uganda’s lakes and rivers. Recent studies have shown that 72 percent of Lake Victoria’s pollution is contributed by urban centres, 13 per cent by industries and 15 per cent by fishing villages. Kampala accounts for 65 per cent of the total BOD load from urban centres. Pollution loading into the inner Murchison Bay in the last 10 years has resulted in a 50 percent increase in water treatment at Gaba Water Works. Most industries have no pre-treatment facilities at their premises; hence they do not meet national standards for discharging effluents into the receiving environment.

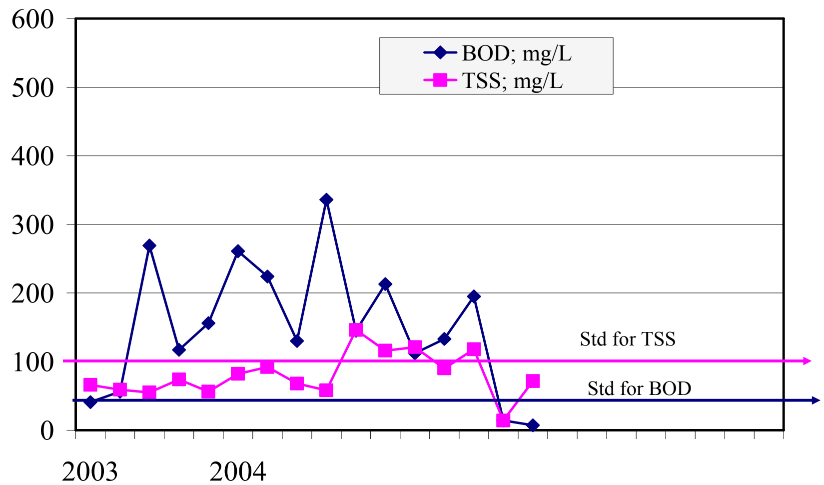
It has been established that annually 49 500 tons of nitrogen and 5 700 tons of phosphorus are loaded into the lakes through non-point sources from atmospheric deposition and river catchments (DWD, 2006).

Figure 5.3: Comparative pollution loading from point sources of Lake Victoria



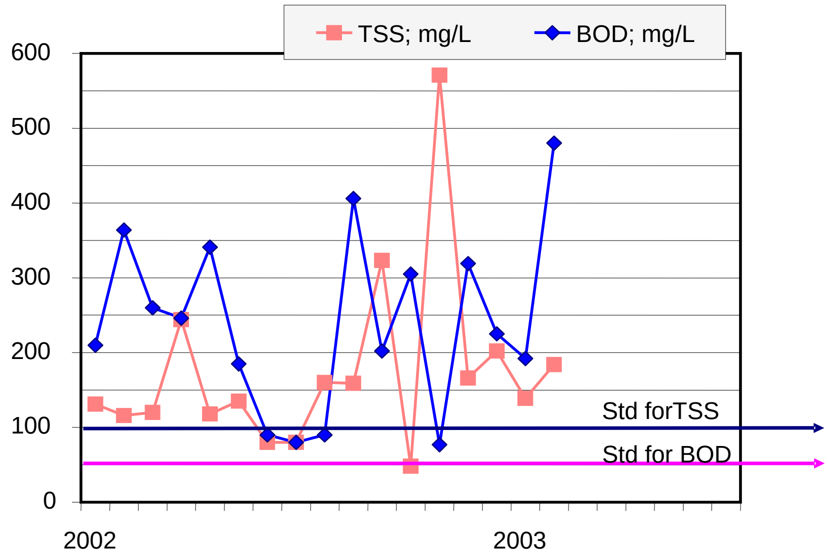
Source: LVEMP, 2005.

Figure 5.4: Comparative pollution loading from point source in Lake Victoria



Source: LVEMP, (2005b)

Figure 5.5: Additional comparative pollution loading from point source in Lake Victoria



Source: LVEMP, (2005b)

5.3.3 Sources of pollution

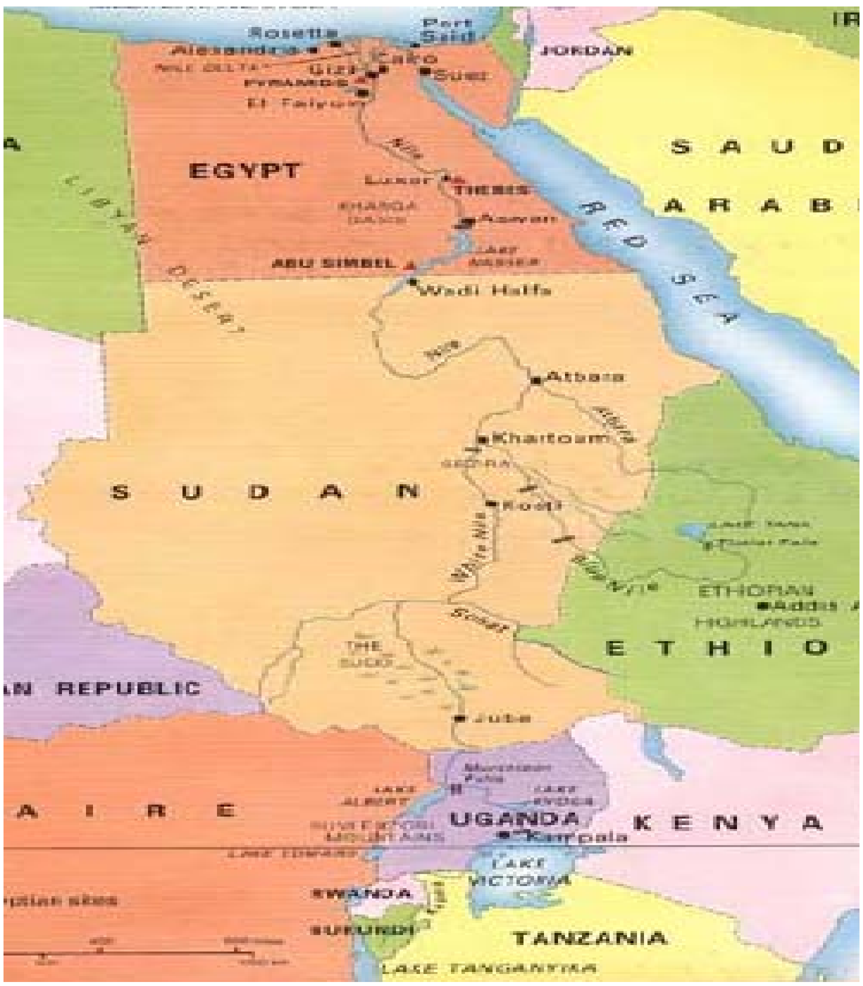
Several towns and settlements have sprung up along the Lake Victoria shoreline, which has led to a population build up ranging from 50 000 to 1 000 000 or more. The major of these settlements and towns have no facilities to treat their sewage and organic wastes. These are released direct into the lake or into streams and surrounding wetlands in untreated or particle treated state thus causing massive deoxygenating of the artery. Several industries are operated in these towns such as fish processing plants, textiles, food and beverages, breweries as well as garbage disposal business. Effluent from most of these industries is released into the lake either untreated or partially treated. Many of the towns also release untreated sewage and domestic wastes direct into the lake. *Measurements done through the LVEMP have indicated pollution loading per day of Nitrate- Nitrogen at 28; Ammonia- Nitrogen at 47; Phosphate-Phosphorus at 7; COD at 700; BOD at 190; Copper at 17 and Chromium at 08.*

The pollution impact sites in Uganda are located in towns of Mbarara, Masaka, Kampala, Jinja, Mbale and Kasese. These sites are mainly located on rivers and streams receiving municipal and industrial effluent discharges.

5.3.4 Water scarcity in Uganda

Compared to other countries in the region, Uganda is fairly water secure. Of about 180 countries ranked by the United Nations, Uganda was ranked 115th above other countries in the Nile Basin such as Kenya which ranked 154th, Ethiopia 137th, Egypt 156th, and Sudan 129th. The causes of water scarcity include: climatic changes, droughts, famines, reclamation of existing wet lands, the increasing population growth, the increasing usage of water, decreasing water volumes and increasingly water demand (Taha, 2007).

Figure 5.6: The Nile Basin countries and neighbours



Source: Nile Basin Research Programme (2007)

Nonetheless, estimates indicate that 60 percent of the pastoral households in Uganda, especially those in uganda's *Cattle Corridor*; lack of water for domestic and livestock use. Scarcity of water in the cattle reduces agricultural productivity, promotes nomadism, breeds socio-political conflict, and worsens the spread of livestock diseases (UN-Water, 2006).

5.3.5 Access to improved water supplies

5.3.5.1 Water for the urban poor in large (NWSC towns)

Some of Uganda's poorest people live in urban areas. They tend to be further marginalized than the rural poor, as they are not able to engage in subsistence agriculture (DWD, 2005). The water supply services to peri-urban and the urban areas have continuously been a major challenge for the government and are hindered by:

- Population increase, which tend to out pace the rate of infrastructure development.
- Lack of physical and structural plans and settlements hence making it difficult to extend services to the areas.
- Low income levels which hinder private connection policy and specific projects.

5.3.5.2 Kiosks and public stand posts for the urban poor

Currently the NWSC provides cheaper water for the urban poor through the kiosk or public standpipe system. During the period 2000-2005 a total of 1,079 new water kiosks and public stand posts were erected (83 in 2000/01; 68 in 2001 /02; 277 in 2002/03; 383 in 2003/04 and 269 in 2004 /5). The growth in stand posts is not sufficient to meet the demand for water services in the poorer areas due to problems including management and overcharging by stand post operators.

5.3.6 Tariffs

The current NWSC tariffs have been designed so that the better-off pay more than the poor (*Table 5.7*) but it should be noted that the actual cost to the consumer is higher than the tariff. The stand pipe price is a subsidized rate of UShs 521 per m^3. Due to the uniform tariff structure across the NWSC towns, there are cross subsidies. The smaller areas with higher unit costs of water production are subsidized by the larger towns with lower unit costs of production. The tracking study (MWLE, 2005) also examined the tariff structures for urban water supplies.

Table 5.7 NWSC Tariff structures 2004/2005

Customer category	**Tariff (Ushs 1 m^3)**
Public stand pipe	521
Domestic	806
Institutions and Government	993
Commercial<500 m^3 /month	1,379
Commercial < 500-1500 m^3 /month	1,421
Commercial > 1500 m^3/ month	1,324
Average commercial	1,373
Average water tariff	964

Source: MWLE, 2005

Box 5.1 Tariff structure comparison

NWSC charges Ushs 521 per m^3 for public stand pipes, Ushs, Ushs 993 per m^3 for institutions and for government departments. Commercial category rates are fixed at Ushs 1,324, 1,379 and 1,421 per m^3 depending on the volumes consumed. All these rules are VAT exclusive (MWLE, 2005).

In comparison, most of the small towns charge Ushs 1,000 per m^3. However, in some towns (with more stand posts than yard taps), the rate at stand posts ranges from Ushs 1,500 to 2,500 per m^3 (U Shs 30-50 per 20 litres). This implies that the population is small towns pay more water than populations in large (NWSC) towns. Poor people who fetch water from the stand posts pay more than the relatively higher income earner who can afford yard taps. This defeats the aim if government subsidizes water for customers in large towns, it could be argued that subsidies should be extended to the poor in small towns to make water affordable and hence contribute to the overall objective of provision of clean water to all people. More detailed in tariff comparison is shown below:

A water tariff comparison between large towns and small towns in Uganda (MWLE, 2005)

Classification	Lower limit	Upper limit
Large (NWSC) towns	Ushs 521- public stand pipes	Ushs 806 for private connections to households
Small towns	Ushs 1,000- public / yard taps	Ushs 1,500 -2500 – stand posts in selected towns.

MWLE (2005) points out that the tariff structure used in small town s is based on volumetric charge which, when multiplied by the volume of water consumed in a charging period, gives rise to the charge for the period in question. The tariff is fixed per unit volume. Economic efficiency and environmental criteria both suggest that this element should, ideally, recover all the costs in the long run. This practice differs from the in creasing block terrify (IBT) structure, applied by the NWSC, based on the lower upper volumes of consumption per charging level. IRTs are often called “life line” or social tariff and are created with the inlet of protecting g the poor.

Under an IBT, the first block of water used is provided to a household at a low price, often below the cost of service of provision. Another water charge is the connection charge – this is a one –off and normally up –front charge, for connecting a customer to the public water supply and /or sewage systems.

Source: MWLE, 2005

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5.4 Fisheries

Fisheries activities provide an important source of livelihood for many people in Uganda. The most important source of fish in the country is lake Victoria with a share of 58 per cent of Uganda's fish catches, followed by lake Kyoga with 16 percent (UBOS, 2006). Fish and fish products have been the second highest export revenue earner in Uganda after coffee between 2002 and 2005. Moreover, the share of fish exports, of total exports, reduced from 18.8 per cent in 2002 to 17.6 per cent in 2005. Between 2002 and 2006, Uganda's fisheries exports increased from US$ 78.15 million to 142.69 million, an 82.5 per cent increase.

Table 5.8: Uganda's ten leading exports by value, 2001 – 2005 (US$ '000)

Commodities	**2001**	**2002**	**2003**	**2004**	**2005**
Coffee	97,652	96,626	100,233	124,237	172,942
Fish and Fish products	78,150	87,945	88,113	103,309	142,691
Other products	44,952	46,714	77,193	114,507	183,935
Gold and Gold compounds	49,293	60,342	38,446	61,233	73,072
Tea	30,031	31,293	38,314	37,258	34,274
Cotton	13,434	9,519	17,755	42,758	28,821
Tobacco	32,096	45,262	43,042	40,702	31,486
Rose and Cut flowers	14,750	17,828	22,080	26,424	24,128
Petroleum Products	12,252	10,749	27,901	27,904	32,015
Maize	18,339	10,609	13,724	17,896	21,261

Source: UBOS (2006)

Uganda's fisheries largely rely on the natural water bodies of lakes and rivers, which make up about 18 percent of the country's surface area. The major fisheries include: Victoria, Kyoga, Albert George and Edward, the over 160 minor lakes in addition to rivers and wetlands. The fisheries Department estimates that the country has potential to produce about 250 000 metric tonnes of fish annually on a sustainable basis. (UBOS 2006). By 2006, Uganda's fisheries and aquaculture contributed about 14 000 tonnes of fish (MAAIF/NPA, 2006).

From current estimates of the major fisheries resources, especially Lake Victoria, indicate that there has been a decline in the volume of fish as a result of the increased catch per unit effort, use of small sized gill nets, the prevalence of algal blooms; occurrence of toxic algal types; eutrophication; prolonged periodic stratification; off shore and in shore conflicts (UNEP/NEMA, 2006). Prior to the 1960s, Lake Victoria boasted of a fish biodiversity similar to that of Malawi and Tanganyika with 400-50 species of fish most of which were the Cichlids against non-Cichlids which were only 50 species. (LVFO, 2005). Current observations, from commercial catches, indicate that the species composition of Lake Victoria stocks has been reduced to three main species fishery of Nile Perch, Rastreneobola niloticus Degas/Omena/Mukene and Oreo Chronis niloticus.

Indications are that 20 species of fish have been depleted in Lake Victoria in only the last 40 years (LVFO, 2006).

5.4.1 Increased demand for fish

In order to maintain present *per capita* fish consumption levels of around 10 kilograms per year by the year 2015 when a population of 32 million is forecast, 320 000 tonnes of fish will be required (MAAIF 2004). Uganda has a recommended maximum export allowable per year at 60 000 tonnes of food fish hence 380 000 tonnes of fish will be required by 2015 to meet both the domestic and the export requirements. This implies that an increase of 160 000 tonnes of fish production above the 2001-cacth levels of 220 720 will be necessary by the year 2015.

Such an increase in production of food fish is considered feasible if aquaculture or fish farming production is dramatically increased in the next 15 years. This should be coupled concomitantly with improvements in the conservation and management of capture fisheries through stock rebuilding, targeting of under exploited fish stocks, more rational harvesting practices and under application of fish food technology to reduce harvest losses (MAAIF 2004).

5.4.2 Fish production

Fish production in Lake Victoria has the following characteristics:

- Fish production is carried out by artisanal fishermen. They include fishing unit owners, renters and boat crew.
- Fishing unit [boat] owners normally await the return of their boat[s] on beaches where they check on catches, oversee catch sales and payment of the crew, and consider input needs such as fuel, net or boat repair.
- An average of 3-crew members work on a boat.
- The most common method of paying crew is to divide the catch value into agreed upon portions after deducting cost of expenses.
- Personal savings are the main source of capital within the communities. Very few operators have taken advantage of formal credit, mainly from the Poverty Alleviation Project, Micro Finance Schemes, *Entandikwa* [a political credit unit] and private individuals in that order.
- The main problems resulting in poor repayment of the loans taken include: high interest rates, short repayment periods and occurrence of the calamity during the loan period, e.g. theft of gear.
- Migration in search for better catch or market has remained a common practice, hindering fishers’ access to the various credit schemes.

5.4.5 Fish catch

Uganda’s fish catches fluctuated significantly over the last few decades (MAAIF, 2005) as a result of a number of factors including improved monitoring control and surveillance, catch recording and yield, fluctuation in fishing effort, or the temporary virtual collapse of certain fisheries for ecological and other reasons such as the use of fish poisoning on Lake George. The maximum-recorded catch was 245,000 tones in 1990. The overall trend in fish catches has been upward over the period 1961-2002. However the sustainable yield for some speeds on certain lakes may have already been reached.

Table 5.9: Fish catch by water body (thousand animals) 2001-2005

	2001	**2002**	**2003**	**2004**
Lake Victoria	131.8	136.1	175.3	253.3
Lake Albert	19.6	19.4	19.5	56.4
Albert Nile	n.a	n.a	5.6	6.4
Lake Kyoga	58.4	55.6	32.9	68.5
Lake Edward and Kazinga channel	6.4	5.2	5.9	9.6
Other water	4.5	5.6	8.3	40.6
Total	**220.7**	**221.9**	**247.0**	**434.8**

Source: MAAIF (2006)

Table 5.10: Estimated annual total fish catches tonnes and beach value of the catches in the Ugandan part of Lake Victoria presented by district and species

	Nile perch		Tilapia		Mukene		Dagaa		TOTAL	
District	Catch(t)	value Mll.shs	Catch(t)	Value Mll.shs	Catch(t)	Value Mll.shs	Catch(t)	Value Mll.shs	Catch(t)	Value Mll.shs
Busia	287.7	502.2	308.2	294.1	150.4	24.4	30.7	34.0	777.0	854.6
Bugiri	8,786.2	15,340.6	2,492.0	2,377.4	9,722.5	1,575.0	866.7	1,116.7	21,867.4	20,409.7
Mayuge	6,8744	12,002.7	4,453.7	4,248.8	5,822.0	943.2	605.2	750.5	17,755.3	17,945.1
Jinja	581.7	1,015.7	700.4	668.2	0.8	0.1	22.9	21.3	1,305.9	1,705.4
Mukono	25,138.9	43,892.5	9,026.6	8,611.4	30,214.1	4,894.7	2,038.4	2,575.4	66,417.9	59,973.9
Kampala	515.7	900.5	307.9	293.7	53.0	8.6	19.3	18.2	895.9	1,220.9
Wakiso	3,498.4	6,108.3	2,325.0	2,218.0	3,457.9	560.2	318.2	394.4	9,599.5	9,280.8
Mpigi	1,666.1	2,909.1	1,870.8	1,784.8	757.1	122.7	133.3	145.4	4,427.3	4,961.8
Masaka	2,218.6	3,873.8	2,792.1	2,663.6	1,297.1	210.1	148.2	173.6	6,456.0	6,921.1
Kalangala	9,049.0	15,799.5	4,235.5	4,040.7	17,089.7	2,768.5	1,152.2	1,453.2	31,526.4	24,061.9
Rakai	1,530.3	2,671.9	436.1	416.0	201.2	32.6	39.5	39.5	2,207.1	3,160.0
Total	**60,147.0**	**105,016.7**	**28,948.**	**27,616.6**	**68,765.9**	**11,140.1**	**5,374.6**	**6,722.1**	**163,235.7**	**150,495.5**

Source: NAFIRRI (2006)

Table 5.11: Predicted total annual catches and beach value of all species

	All fish spp (t)	**Beach Value (US$)**
Kenya	130,486	87,096,546
Tanzania	485,119	195,361,196
Uganda	163,236	83,574,418
Total	**778,840**	**366,032,160**

Source: NAFIRRI (2006)

5.4.6 Aquaculture

Uganda has vast aquaculture potential whose development holds the key to increasing fish production. Fish farming in Uganda was introduced in the 1950s. Over the following decades governments promoted fish farming in various ways, often concentrating on the ponds. Adoption by farmers has been uneven throughout the country, partly reflecting deviating government or NGO efforts, partly testifying to the unequal technical and economic potential of aquaculture in Uganda.

5.4.6.1 Small-scale aquaculture current status

It is estimated that there are 10,000 to 20,000 operational small-scale fishponds in Uganda. In addiction there may be about 10-30% more ponds that are not operational. The reason of this is shortage of funds. Most of the small-scale ponds are operated on the 'low out put' principle. This means that ponds are stocked after constructions but no other inputs in terms of feeds and fertilizers are added. Fish are harvested when there is a household need for fish. The production potential for these ponds is approximately 1kg per m^2 per year on a natural basis implying that only 10% of the production is currently realised (MWLE 2003).

Although Uganda has the potential for development of agriculture through provision of adequate water from natural water bodies (mainly wetlands and streams), development of fishponds for both small and large-scale aquaculture is hampered by the lack of local skills in aquaculture and relatively less relative interests by investors in pond aquaculture (as compared to capture fisheries). There is therefore need for deliberate government effort to upgrade skills in order to promote pond aquaculture to levels where production can meet both domestic and export markets.

5.4.6.2 Gender issues in aquaculture

Women participate at all stages of the aquaculture production cycle. Their involvement is highest in routine labour tasks such as feeding and fertilizing. Their participation is lowest in other activities. (NARO 2003)

Table 5.12: Gender and aquaculture characteristics in Uganda

Task	Men (%)	Women (%)	Children (%)	Hired labour (%)	Extension staff (%)
Pond construction	75	24	25	56	8
Pond maintenance	74	23	26	18	3
Purchasing fingerlings	76	14	2	-	35
Stocking	71	13	6	4	46
Purchasing seeds	85	25	6	-	13
Feeding	82	59	44	4	1
Fertilizing	79	38	33	5	2
Harvesting	78%	23%	32%	17%	25%
Selling	60%	17%	8%	2%	1%

Source: NAFIRRI (2006)

5.4.6.3 Major challenges for development of aquaculture in Uganda

Inadequate knowledge on breeding and stocking techniques from some key species, inadequate feed and seed supply in competitive prices, and unattractive environment for investments in large-scale bureaucracy are some of the challenges faced in developing the aquaculture.

5.4.7 Annual fish production

Annual fish catches in Uganda have increased steadily since the 1960s (*Table 5.13*),characterised by significant declines in the 1970s and a further steady rise through the 1980s, 1990s up todate. Since 2004, the fish catches in Uganda are estimated to increase from 249,000 metric tonnes to 712,000 metric tonnes in 2006.

Table 5.13: Annual fish production 1961 - 2006

1961-1975		1976-1990		1990-2006	
Year	**Catches (tons)**	**Year**	**Catches (tons)**	**Year**	**Catches (tons)**
1961	25.5	1976	11.1	1991	118.0
1962	23.4	1977	15.7	1992	120.4
2963	24.4	1978	14.2	1993	135.0
1964	24.4	1979	12.0	1994	103.0
1965	24.4	1980	10.0	1995	103.0
1966	6.0	1981	17.0	1996	106.0
1967	38.2	1982	13.0	1997	106.0
1968	40.5	1983	17.0	1998	105.0
1969	46.1	1984	44.0	1999	104.0
1970	41.7	1985	54.6	2000	133.1
1971	38.1	1986	56.8	2001	131.8
1972	33.9	1987	93.2	2002	136.1
1973	32.5	1988	107.1	2003	175.3
1974	24.5	1989	132.4	2004 (Esti.)	249.0
1975	16.9	1990	119.9	2005 (Esti.)	416.0
				2006 (Esti.)	721.0

Source: Department of Fisheries Resources, MAAIF (2006)

5.4.3 Pressure

5.4.3.1 International market growth

Because of increasing demand for fish locally and internationally, there is urgent need to generate resource rent along the real chain through a system of extracting royalty as has been successfully used in the united Republic of Tanzania. Alternatively, the rent can be capitalized in terms of access rights. Modernisation of the fishery industry towards greater efficiency in resource exploitation requires some trade offs with commensurate equity concerns for resource dependent communities. (LVFO, 2005).

The rapid rise in fishing pressure has increased over fishing, trans- boundary conflicts and delivery of fish of poor quality. This is clearly pointed out by the high number of fishermen in the three countries. By 1998, Kenya had 38 340 fishermen, 11 515 fishing craft and 143 registered landing sites. Uganda had nearly 35 000 fishermen whilst Tanzania had 120 000 fishermen operating in Lake Victoria by 1999.

Concerns have been raised in the press over the fisheries in Lake Victoria being at a verge of collapse. It is recognised that scramble for fisheries resources is driven by economic factors related to Nile perch (*Lates niloticus*) value chain. The International market for Nile perch currently requires a supply of over 300 000 tonnes in un- processed raw material. (LVFO, 2005). The rapid increase in the population growth rate 2.5 to 3.5 per annum of the catchments population in the riparian states has increased the demand for fish catch.

These riparian states enjoy tremendous contribution derived from fisheries resources. However, these benefits are largely skewed towards markets side and the boom has not trickled down to most of the poor fisheries. Cunningham and Bastock (2005) asserted that social success requires that fish resources contribute to the social welfare in a manner considered to be equitable influenced by the political process in respective fisheries. Empowerment of communities throught beach management unit (BMU) will in the long term secure benefits and provide positive livelihoods out comes for rescue of dependent communities.

5.4.3.2 Prevalence of diseases in fishing communities

As pointed out in the strategy for reducing the impact of HIV/AIDS on fishing communities, fishing communities mainly located around the major lakes plus the Victoria Albert Niles tend to be isolated and lack services such as water health care, education, and sanitation.

There is a worrying and serious concern due to the fact that there is a high incidence of disease particularly HIV/AIDS, malaria, bilharzia among fishing communities. But there are also other diseases which are prevalent among fishing communities which include dysentery, cholera, diarrhoea, and typhoid.

5.4.3.3 Deterioration in water quality

The decline in fish catches and fish biodiversity, the disappearance of fish species the deterioration in fish habitats and breeding grounds have been partly attributed to by the deterioration in water quality of Lake Victoria as a result to increased pollution loads from both point and non point sources (LVFO 2005). Clear signs at algal productivity have been on the increase since the 1960s; a more than four times increase in algal biomass; a more than three times decline in water transparency; dominance of blue green algal; development of anoxic conditions affecting up to 40 per cent of the lake waters for prolonged periods and the doubling of phosphate concentrations in the lake waters.

BOD has been estimated at 23 550 tons per year, total nitrogen at 155 580 tons per year while total phosphorus has been measured at 32 050 tons per year. The sources of these nutrients are reported to be the catchments, atmosphere, industry and municipal wastes that hence coursed further degradation of the lake.

5.4.3.4 Water hyacinth.

The re-invasion of aquatic weeds in particular the water hyacinth and catchments degradation is reportedly raising concern. The weed is able to perforate extremely fast and is able to double its population every 5 to 15 days under favourable temperatures and high nitrogen and phosphorus nutrients concentrations (UBOS, 2006.).

Other capture fisheries production constraints include: Open access of fisheries; use of destructive fisheries gears and methods; ost-harvest losses (10-30 percent of the catch) due to poor handling, processing and storage; and inadequate investment skill.

5.4.4 Impacts of fisheries resources

5.4.4.1 Fisheries and rural livelihoods

In Uganda, most of the fisher folk communities live on land that does not belong to them. This builds some degree of insecurity of tenure and therefore negatively impact on community development. The low rate of literacy (national average 54 percent) is one of the major handicaps to participation of communities in fisheries activities. This calls for the need to invest public education and community management programmes. In general the direction of change towards the industrialisation and modernisation of the fisheries sector promotes the replacement of the individual and family fishing enterprises by large and more community operators where this can be achieved in a sustainable manner.

5.4.4.2 Fisheries and biodiversity

Fish species contributes greatly to aquatic biodiversity in Uganda. However, since the introduction of the Nile perch in Lakes Victoria and Kyoga there have been concerns over the declining fisheries biodiversity. There is therefore a need to regulate future introduction of fish and other aquatic species across water bodies (MAAIF 2004).

5.4.5 Response

The government of Uganda through the Fisheries Policy aims at maintaining stable fish production, improved domestic consumption, fish exports and modernising fish communities to achieve human development indicators. To achieve these aspirations the government through the Ministry of Agriculture Animal Industry and Fisheries is implementing programs for improved fish management, research and development (MAAIF, 2004). There is also a tripartite Lake Victoria Environment Management Project established to ensure improved productivity of Lake Victoria and the Aquaculture Research and Development Institute at Kajjansi that trains technical staff. (LVFO, 2006).

Other government interventions under the policy include: provision of resources to upgrade landing sites and quality control laboratories to meet the international standards, provision of resources to strengthen the Uganda Bureau of Standards and the Inspectorate Section of the Fisheries Department. In addition the policy has led to introduction of a number of courses relevant to the fisheries sector in the fisheries institution. (UBOS, 2006)

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6.0 CROSS-SECTORAL RESOURCES

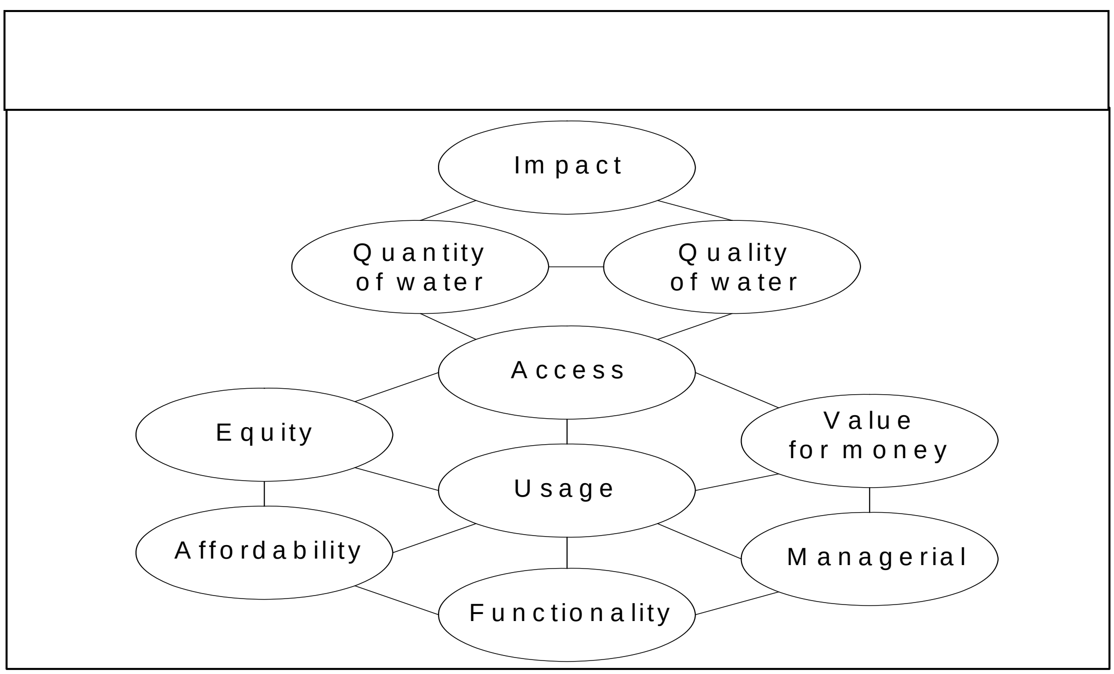
6.1 Safe water and sanitation

6.1.1 Introduction

The major institutions responsible for water and sanitation programmes in Uganda are the National Water and Sewerage Corporation (NWSC) responsible for the provision of safe water and sanitation in urban areas; government departments under different ministries e.g. the Directorate of Water Development (DWD) under the Ministry of Water and Environment (MoWE); local governments; non-governmental organisations (NGOs); community-based organisations (CBOs); development partners and the private sector (DWD, 2005).

Regardless of whichever institution is responsible for the provision of safe water and sanitation, the single vision is to provide sufficient safe water and sanitation facilities for everyone in order to ensure better health among the population. In pursuit of this vision, the aforementioned institutions together with key stakeholders generated ten key themes from the 2003 Water and Sanitation sector report (*Figure 6.1*). From the themes, the "golden" indicators were established to measure performance of the water and sanitation sector.

Figure 6.1: Key performance themes for the water and sanitation sector



Source: MWE (2006)

Prior to the development of the above performance themes, considerable high quality information was available, but it tended to focus more on infrastructure development and overall expenditure. While the 2004 water and sanitation sector performance report used eight indicators to analyse performance, the 2005 and 2006 reports added two more indicators; gender and community management bringing the total of performance indicators to ten (*Table 6.1*).

Table 6.1: Water and sanitation sector 'golden' indicators

Performance Theme	'Golden' indicator	
Water access/use	1	% of people within 1.5km (rural) and 0.2km (urban) of an improved water source
Functionality	2	% of improved water sources that are functional at the time of a spot-check
Value for money	3	Average investment cost per beneficiary of new water and sanitation schemes
Sanitation access/use	4	% of people with access to (and use of) improved and basic latrines / toilets
Quantity of water	5	% increase in cumulative storage capacity of water for production
Water Quality	6	% of water samples taken at the point of collection or discharge that comply with national standards
Equity	7	Mean parish deviation from the district average in persons per improved water point
Hygiene access/use	8	% of people with access to (and use of) hand-washing facilities
Gender	9	% of water and sanitation committees where at least one woman holds a key position
Community management	10	% of water points with actively functioning water and sanitation committees

Source: MWE (2006)

In order to meet the targets set under each thematic area, different institutions have been charged with different roles and responsibilities (*Table 6.2*).

Table 6.2: Institutional roles and responsibilities

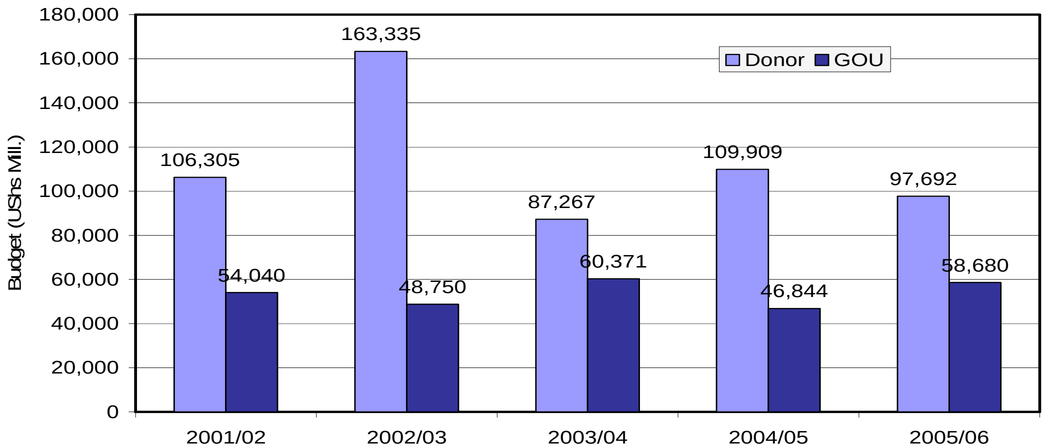
Institution	Responsibility
Ministry of Finance, Planning and Economic Development (MFPED)	Mobilising and allocating funds; coordinating donor inputs
Ministry of Water and Environment (MWE)	Initiating national policies; setting national standards and priorities for water development and management
Directorate of Water Development (DWD)	Lead agency responsible for managing water resources. Coordinates and regulates all water and sanitation activities and provides support services to Local Governments (LGs).
Planning and Quality Assurance Department (PQAD*)* of the MWE	Monitoring and evaluation of water and sanitation sector development programmes.
National Water and Sewerage Corporation (NWSC)	Operates and provides water and sewerage services in 19 large urban centres assigned to it.
Ministry of Health (MoH)	Responsible for hygiene promotion and household sanitation.
Ministry of Education and Sports (MES)	Responsible for hygiene promotion and sanitation in primary schools. Promotion of rainwater harvesting for hand washing after latrine use.
Ministry of Gender, Labour and Social Development (MGLSD)	Responsible for gender responsiveness and community development/mobilisation. Assists the sector in gender responsive policy development, and supports Districts to build staff capacity to implement sector programmes.
Ministry of Agriculture, Animal Industry and Fisheries (MAAIF)	Spearheads agricultural development, including the use and management of water for production (irrigation, animal production and aquaculture). It liaises with MWE in the implementation of water for production programmes.
Local Governments (districts, towns, sub-counties)	Are empowered by the Local Governments Act (1997) to provide safe water and sanitation. Receive grant funding and may mobilise local resources for implementing rural safe water and sanitation (RUWASA) programmes and to support small town SWS. Appoint and manage private operators for urban schemes outside the jurisdiction of NWSC.
Non-Government Organisations (NGOs) and Community Based Organisations (CBOs)	Complement Government in water and sanitation sector service delivery in terms of finance and implementation.
Private Sector	Private firms undertake design and construction in the water and sanitation sector under contract to LGs or central government.
Communities	Are responsible for demanding for, planning, contributing, operating and maintaining most rural safe water and sanitation facilities.

Source: MWE (2006)

6.1.2 Sector financing

Like other sectors in the country, limited and undependable funding has affected the timely implementation of water and sanitation activities. *Figure 6.2* indicates the water and sanitation sector budget trend for the years 2001-2006.

Figure 6.2: Water and sanitation sector budget trend 2001-2006



Source: MWLE (2005)

6.1.3 Rural water supply and sanitation coverage

Access to safe water supplies in rural areas has increased steadily over the years. During 2004/05 and 2005/06 it increased from 57% to 61% (MWE 2006). This increase has been attributed to subventions into the water and sanitation sector in the form of District Water and Sanitation Condition Grants (DWSCG) and contributions from the NGOs. By 2005, 771 springs, 100 shallow wells, 514 boreholes, 462 Gravity Flow Scheme (GFS), 1,362 Rain Water Harvesting (RWH) facilities and 7 valley tanks were constructed (MWLE 2005). These enabled the provision of clean and safe water to over an estimated 680,000 people. Furthermore, through the central rural projects, a total of 8 Rural Growth Centres (RGCs) and 7 Internally Displaced People (IDP) camps were also provided with piped safe running water. *Table 6.3* indicates the provision of piped water to IDP camps and *Table 6.4* Summarises IDP piped water schemes accomplished in 2004/05.

Table 6.3: Provision of piped water in IDP camps

District	IDP Camps	Camp Population	BH[1]	Piped water schemes	*Collaborating partners*
Katakwi	46	171,452	51		*CCF, ACTIONAID,CWW,LWF SHI*
Soroti	14	91,012	4	NWSC	*Concern World Wide*
Kaberamaido	3	4,242	9		*Baptist Mission*
Apac	24	25,576	9	3	*CPAR, CARITAS,CCF*
Gulu	34	489,802	125	5	*ACF, AMREF, UNICEF*
Kitgum	19	269,007	65	4	*AVSI, IRC, OXFAM,WFP,UNICEF*
Lira	67	141,084	33	3	*IRC*
Pader	13	235,166	38	4	*UNICEF, IRC, WFP, UAF,*
Total	***220***	***1,427,341***	***334***	***19***	

Source: MWLE (2005). Note: [1]Borehole.

Table 6.4: Summary of IDP piped water schemes completed in 2004/05[1]

District	Camp name	Design Population	Budget (UShs)	Expenditure[2] (UShs)	Per Capita cost	Average per capita supplied[3]
Lira	Bar Legi	3,887	125 200 000	467 695 800	54 939	15l/p/d
Lira	Okwang	4,626	104 315 300			
Apac	Ojwii	9,500	150 000 000	150 000 000	15 789	15l/p/d
Gulu	Unyama	15,196	131 145 800	149 999 850	9 871	15l/p/d
Pader	Pader T.C	19,698	116 148 000	229 536 964	11 653	15l/p/d
Kitgum	Akwang	11,270	230 949 700	230 949 700	10 106	15l/p/d
Kitgum	Lagoro	11,582				
Total		66,882	857 758 800	1 228 182 314	18 363	

Source: MWLE (2005).

Note:

[1]Design and construction of piped reticulation water supply system including supervision

[2]At the tender stage, standard designs were envisaged. However, these were not appropriate for all situations and arrange of designs had to be utilised. This increased the expenditure in several cases.

[3]Calculated as follows [Yield (m^3/h) x no. of hours pumped (12 hours)]/[design population]

6.1.4 Safe water coverage in rural growth centres

Centres whose population is between 500 and 5,000 people have been designated as Rural Growth Centres (RGCs). While their growth and viability make them important economic and social development hubs, RGCs are often potential sources of contamination to protected water points. To eliminate or reduce contamination, mitigation measures have to be put in place. These have so far been accomplished by the provision of protected springs and piped water supply systems.

With the support of district local governments, the RGC scheme started with the selection, design and construction of 56 safe water points in 56 RGCs (at least one per district). During 2003/04 and 2004/05, six schemes were established of which three were completed. Similarly, in 2004/05, another eight more schemes were inaugurated and 4 were completed the same year (MWLE 2005).

Table 6.5: Summary of RGC schemes completed in 2004/05

District	RGC	Design Population	Expenditure (UShs)	Per Capita cost
Adjumani	Ciforo	4,021	508 160 566	126 377
Mubende	Kasambya	5,822	530 583 300	91 137
Kamwenge	Mahyoro	5,296	444 964 010	84 013
Nakasongola	Migera	4,967	427 205 550	86 007
Arua	Nyadri	4,931	484 260 422	98 211
Moroto	Matany	6,784	344 074 838	50 718
Nebbi	Nyapea	7,206	577 590 400	80 153

Source: MWLE (2005)

6.1.5 Urban water sub-sector

The urban water sub sector is a programme for improving water supplies in small towns. The programme has already registered successes within a short time of its implementation. For instance, during 2005/06 financial year, 15 schemes benefiting over 116,000 people were completed while 6 schemes got completed the previous financial year (MWE 2006).

Table 6.6: Summary of small towns schemes completed in 2004/05

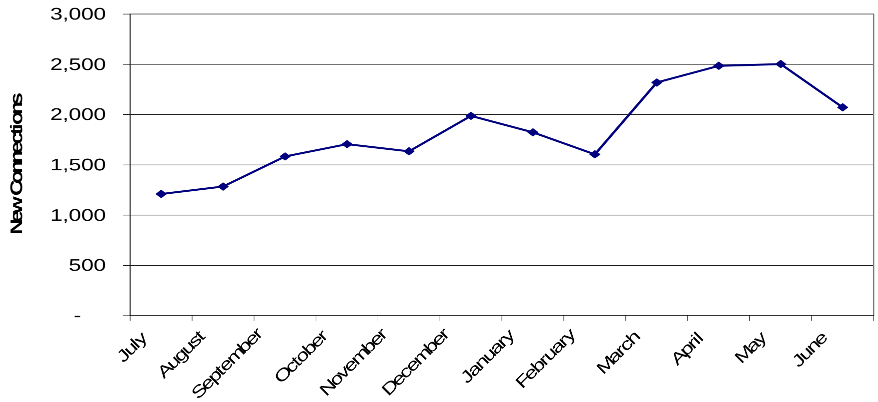
District	Initial Pop.	Design Pop.	Expenditure (UShs)	Per Capita Cost
Adjumani		34,935	196 698 441	5 630
Moyo	13,123	25,235	621 750 925	24 638
Katakwi	8,348	10,686	1 060 245 928	99 218
Kyenjojo	7,928	14,278	1 531 671 611	107 275
Masindi	21,090	39,200	5 896 175 153	150 413
Laropi	4,531	5,073	622 851 249	122 778
Total	**55,020**	**129,407**	**9 929 393 307**	

Source: MWLE (2005)

6.1.5.1 Water coverage in large towns

In large towns, NWSC assumes the daily per capita of water consumption is 60 litres per household. Thus, coverage is estimated by taking the total amount of domestic water billed (daily average), divided by the assumed per capita consumption. Based on this assumption and calculation, the overall water coverage in the 18 large towns, served by NWSC, now stands at 68%. Coverage increased by 3% per annum between 2001 and 2003 and dropped to 2% in the last two years. The reduction in the rate of coverage in the last two years was attributed to the difficulty in extending water services to the more sparsely populated areas. The number of new connections has been very small in some of these areas. Despite this, overall, there was growth in new connections over the financial year 2004/05. For example, a total of 22,218 new connections were made at an average of 1,800 connections per month (*Figure 6.2)*. This brought the total number of connections to 123,046 exceeding the target of 110,000 (MWLE 2005).

Figure 6.3: Monthly new connections in large (NWSC) towns in 2004/05



Source: MWLE (2005)

6.1.5.2 Water coverage by town

Service coverage for water in large (NWSC) towns increased from an average of 65% in the year 2004 to 68% by June 2005 (NWSC 2005). *Table 6.7* shows the urban water supply and sewerage coverage in 15 out of the 19 large (NWSC) towns. Eight of these towns (Jinja/Njeru, Entebbe, Mbale, Masaka, Mbarara, Gulu, Kasese and Fort Portal) including Kampala City have a coverage greater than or equal to the average NWSC coverage while the towns of Tororo, Lira, Kabale, Arua, Bushenyi/Isaka and Soroti fall below the average. The NSDS (2000) found that access to in-house piped water services in urban households was 9%, while access within and outside the compound constituted, respectively, 12.5% and 27.3% (MWLE 2005 pg 39). However, there has been a steady growth in coverage of water supply in the large (NWSC) towns *Figure 4.5*

6.1.5.3 Water for the urban poor in large (NWSC) towns

Water supply services to peri-urban areas and to the urban poor continue to be a major challenge for the government due to:

- lack of physical and structural plans for settlements hence making it difficult to extend services to these areas;
- population increase which tends to outpace the rate of infrastructure development; and
- low household income which limits private connections and payment of services.

Despite the above challenges, NWSC has continued to extend safe water services to the urban poor. Some of the strategies that have been adopted by the NWSC to address these challenges, among others, have been the provision of water kiosks and public stand posts, levying preferential tariffs, and the development of simplified connection policy and specific projects.

Table 6.7: Water supply and sewerage coverage as at 30th June 2005

Town	Total.No.of ctions	Pipe Network (Kms)	Targeted Population	Population Served	%Served (water)	%Served (sewerage)
Kampala	74,777	1138.9	1,302,138	872,433	67%	7%
Jinja/Njeru	9,158	261.8	146,786	115,961	79%	26%
Entebbe	6,375	158.1	60,429	41,092	68%	4%
Tororo	2,414	74.4	45,938	30,320	66%	7%
Mbale	4,756	156.8	73,714	50,126	68%	28%
Masaka	3,601	122.4	63,527	49,551	78%	9%
Mbarara	4,956	109.6	75,577	61,217	81%	6%
Lira	2,908	126.5	108,942	67,544	62%	2%
Gulu	2,166	80.9	135,167	97,321	72%	5%
Fort Portal	2,373	122.6	42,080	30,298	72%	2%
Kasese	2,123	61.3	63,499	49,720	78%	0%
Kabale	2,063	106.7	49,300	27,115	55%	11%
Arua	2,218	86.1	51,749	24,839	48%	0%
Bushenyi/Ishaka	1,011	54.9	24,942	9,727	39%	0%
Soroti	2,147	72.1	41,553	14,959	36%	2%
Total	123,046	2,733.1	2,284,374	1,542,222	68%	8%

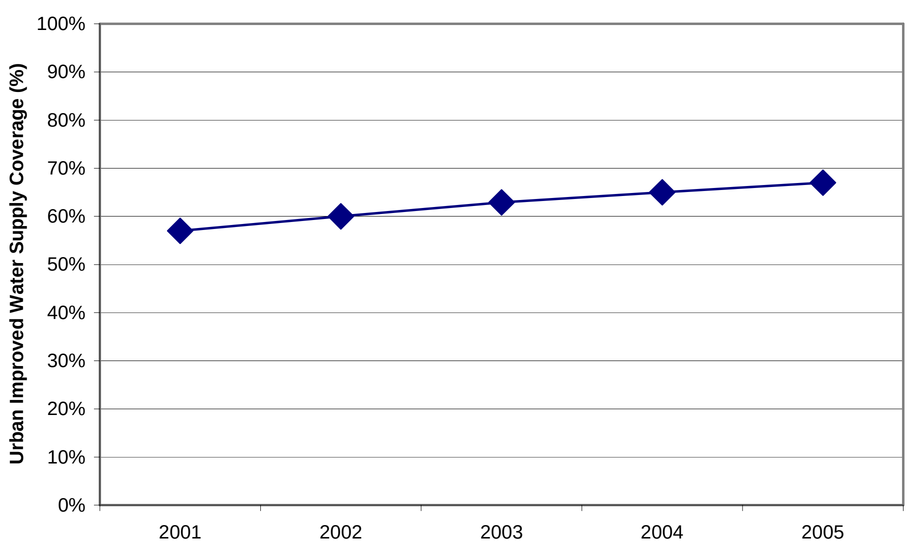
* Population figures are derived from the 2002 population and housing Census Provisional Results (UBOS 2003)

Note: *Population coverage is based on the following number of persons served per connection:*

Domestic………………………..……….8 Persons/household/connection
Standpipe……………………………....25 households (each 8 persons)
Institutions: Small towns………….100 persons/Institution per connection
Medium towns………500 persons/Institution
Large towns………1,000 persons/Institution

Source: NWSC (2005)

Figure 6.4: Water supply coverage in large (NWSC) towns



Source: MWLE (2005)

6.1.5.4 Preferential tariffs

Tariffs in all large towns where NWSC is running the operations of the water schemes have the final water prices per unit subsidised. Subsidies are user-friendly depending on income levels (i.e., the rich pay more than the economically disadvantaged population (*Table 6.8*).

Table Table 6.8: NWSC tariff structure 2004/5

Customer Category	Tariff (USh/m^3)
Public Standpipe	521
Domestic	806
Institutions & Government	993
Commercial < 500m^3/month	1,379
Commercial 500-1500m^3/month	1,421
Commercial >1500m^3/month	1,324
Average Commercial	1,373
Average Water tariff	964

Source: MWLE (2005)

6.1.5.5 Simplified connection policy (2005/06)

This policy guarantees every customer within 50 meters radius from the water distributing point either free or subsidised connection. The one-year of its implementation has resulted in the doubling the number of new subscribers from a range of 1,000 to 2,000 per month.

6.1.6 Specific projects

i) External Services Expansion

The contracts signed between the NWSC with its external counterparts; the Nairobi City Water and Sewerage Company Ltd and the Dar-es-Salaam Water and Sewerage Corporation (DAWASCO) respectively to provide, commercial services and management/operational advisory services led to an extraordinary performance by the NWSC in the year 2005/06. The "sky is the limit" being the ultimate goal, the corporation has signed memoranda of understanding with water companies in Ghana and Zambia to provide similar services this year.

ii) Decentralisation of Kampala water supply

For efficient delivery of water supply and sanitation services by NWSC, all the 13 zones in Kampala have been equipped to carry out full operational services (e.g. making new connections, main extensions, leak control and billing), which were formally centralised.

iii) Customer care improvement

In the financial year 2005/06, the NWSC embarked on improving its customer care. A number of innovations to improve customer care were introduced and these included, among others, direct debit system and over-the-counter bill payment agreement with commercial banks, which have enabled customers to pay their bills through the banking institutions (MWE 2006). Consequently, this has reduced the time spent by customers queuing to pay their bills in respective NWSC's billing centres.

iv) Small towns

Taking population as a parameter to designate an area as urban or a town, places that have population of between 5,000 - 15,000 people are regarded as small towns in Uganda. Consequently, all district headquarters and/or RGCs fall in this category. In order for some of these small towns to be served by the NWSC, several criteria have been used in their selection and these include, among others, the following:

- status of existing piped water supply (none, old dilapidated system, outstripped capacity);
- water resource feasibility /development potential (extension of bulk transfer, gravity-fed, groundwater, surface water, conventional treatment, severe resource availability);
- financial viability potential (customer potential, large commercial activity, presence of industries and institutions);
- maximum impact highest number of people supplied and least cost investment (utilisation of idle capacity by extension to satellite towns, rehabilitation of system infrastructure, densification of water connections); and
- equity (regional distribution, un served poor within towns etc.)

Despite the above clear selection criteria of small towns that should benefit from the services of the NWSC, quite a good number of these towns including some district headquarters still have no water and sanitation services by the NWSC. Limited financial resources, few development partners, little political will and directive and, further, the creation of more new districts seem to stifle efforts by the NWSC to extend services to these areas (MWE 2006).

Efforts to improve water availability to the poor and enhance extension of water in small towns, however, are visible. For example, a total of UShs 1421 151 000 was given as a conditional grant to small towns this financial year 2006/07 (MWE 2006).

6.1.7 Hygiene and sanitation

The National Environmental Health Policy (NEHP) defines environmental sanitation as *"the safe management of human excreta and associated personal hygiene, the safe* *collection, storage and use of drinking water, solid water management, drainage and protection against vermin and other disease vectors"* (MWE 2006 p.77).

Hygiene and sanitation, which currently are components under the safe water supply and sanitation sector, have the following indicators to measure their progress:

- percentage of people with access to improved sanitation (house hold and schools); and
- percentage of people with access to and using hand washing (UWASNET 2006).

Table 6.9: Targets and achievements of the urban water supply sub-sector

Item	Achievement June 2004	Achievement June 2005	Target (Financial Year 2005/06)	Achievement June 2006
Small towns				
NRW (%)	24.4	22.1	18.0	22.0
New Connections	1,259	2,444	4,000	2,652
Total no. of connections	12,372	16,061	17,000	16,550
Water Produced million m^3	2.67	2.77	2.0	2.5
Staff per 1000 connections	47	31	-	28
Collection efficiency	91	86	78	83
Revenue Ushs billion	1.595	2.07	2.796	1.979
Mains Extension (km)	37.62	75.78	90.00	83.47
Large towns				
Coverage (%)	65	68	70	70
NRW (%)	37.6	33.8	30.0	29.7
New Connections	-	-	27,968	28,521
Total no. of connections	100,475	123,046	151,041	152,138
Water produced million m^3	55	58	58.2	58.1
Staff per 1000 connections	10	9	8	7
Metering Efficiency (%)	97	98	99	99
Collection Efficiency (%)	101	89	95	90
Revenue Ushs billion	42.6	53.7	57.6	58.0
Mains Extension (km)	268.2	294.5	138.0	104.2

Source: MWE (2006)

6.1.7.1 Latrine coverage

According to the MWE (2006), latrine coverage increased from 57% in the year 2003/04 to 58% during the financial year 2005/06. Coverage, however, is varied across the country. Rukungiri District, with 95% coverage, leads in the country while Kabong and Kotido districts trail with coverage of 2% each (*Table 6.10*).

Table 6.10: Latrine coverage in selected districts

Districts	% Coverage
Rukungiri	95
Kampala	94
Kanungu	90
Ntungamo	88
Pader	16
Moroto	10
Nakapiripirit	3
Kotido	2
Kabong	2

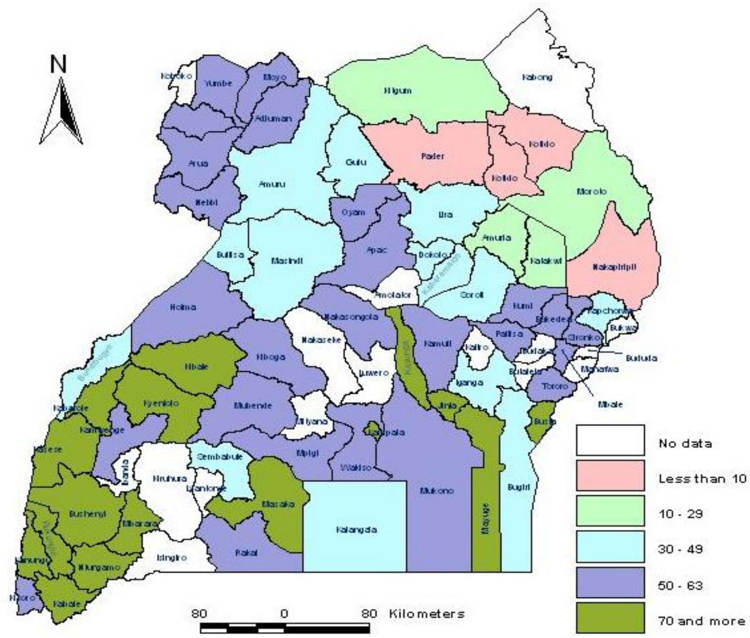
Source: MWE (2006)

Despite varying proportions in latrine coverage a cross the country (Figure (map), some districts have reported increases in latrine coverage of over 5% during this financial year 2005/06. This could be attributed to intensive home improvement campaigns, stringent enforcement of hygiene and sanitation by-laws and more NGO funding intervention in hygiene and sanitation activities (MWE 2006). However, in the districts where the funding of sanitation programmes and enforcement of by-laws were limited and weak, coverage declined. For example, latrine coverage in Busia and Kibale respectively, plummeted by 2% and 5% (MWE 2006).

6.1.7.2 Sewerage service in large (NWSC) towns

During the financial year 2004/05 the corporation continued with the quest to ensure, within its limits, that sewerage services were provided in an efficient and cost effective way. To this effect, a total of 7.2 km of sewer mains and 262 new sewer connections were, respectively, extended and installed (*Table 6.11*). In addition, there was reduced incidence of sewerage spillages in towns served by the NWSC.

Figure 6.5: Latrine coverage



Source: NEMA 2007. Data from Ministry of Health 2005

In areas where the conventional methods of human excreta disposal (through pit latrines and water borne systems) are limited, efforts are being made to expand latrine coverage by promoting the use of Ecological Sanitation (EcoSan) toilets. EcoSan toilets are suitable in difficult situations where soils are rocky; always water logged and/or have sandy loose structure making it cumbersome to dig pits. EcoSan technology has received, in recent years, widespread attention particularly, among the fishing villages and IDP camps. Increased awareness of its use is being promoted through workshops, drama, newspapers and leaflets. According to MWLE (2005), a total of 3 348 EcoSan toilets have been constructed throughout the country.

Table 6.11: Trends of sewerage connections

Year	**200l/01**	**2001/2002**	**2002/2003**	**2003/2004**	**2004/2005**
New sewerage connection	85	95	104	153	262
Total sewerage connections	13,010	13,105	13,209	13,362	13,624
% Growth	1	1	1	1	2

Source: NWSC (2005)

6.1.7.3 School sanitation

A school sanitation and hygiene survey (SHS) carried out in 2005 involving a total of 8 088 pupils and students from 416 primary and post primary schools, revealed a pupil/student to latrine ratio of 61:1. The survey also showed that children and students with physical disabilities were not catered for in the latrine designs, and some latrine facilities lacked privacy, had wet and dirty floors with walls often smeared with faeces. The survey further revealed an inconsistent use of hand washing facilities after latrine use due to lack of water. It was also noted that only 19 per cent of the schools had access to adequate water supply within a 0.5 km distance. The findings of the survey have prompted the Ministry of Education and Sports (MoES) to develop a strategic framework for sanitation and hygiene in schools for the years 2006 up to 2010 to address the situation (MWLE, 2006).

6.1.7.4 Disease burden associated with poor hygiene and sanitation

Diarrhoeal diseases are always associated with poor sanitation and hygiene. Areas where sanitation facilities are insufficient are always prone to such diseases. Nonetheless, research shows that the hygiene practice of hand washing with soap reduces the incidence of catching diarrhoea by more than 40 per cent (WELL 2004) and the risk of contracting cholera and dysentery by 50 per cent (Luby et al 2005).

According to the MoWE (2006), 75 per cent of Uganda's disease burden is preventable since it is primarily caused by poor personal and domestic hygiene and inadequate sanitation facilities.

By the turn of this new millennium, the infant mortality rate in Uganda was standing at 88 deaths per 1 000 live births while the mortality rate of children under the age of five years was at 152 deaths per 1 000 births. Unfortunately, some of the underlying causes of these high mortality rates are poor hygiene and sanitation (MFPED 2004b).

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6.2 Biodiversity

Uganda is located in an area where seven of Africa's distinct biogeographic regions or phytochoria converge (White, 1983). Given that Uganda is location in a zone lying between the ecological communities that are characteristic of the drier East African Savannas and the more moist West African rain forests, combined with high altitude ranges, the country has a high level of biological diversity *Table 6.12.* Updates on the 2001 SO7 assessment include less known taxa such as Fungi (Ipulet and Ryvarden 2005), Fish, Earthworms and others. Because of various threats, several species are included on the IUCN Red lists (*Table 2*). Table 6.12: Numbers of Ugandan species in taxonomic groups

Table 6.12: Species in Uganda

Taxon	**Total no. of species in Uganda**	**% Global species**	**Globally threatened species in Uganda***			
			CR	**EN**	**VU**	**Total**
Amphibians	86	1.7			14	10
Birds	1012	10.2	1	10	48	15
Butterflies	1242	6.8				
Dragonflies	249	4.6				
Ferns	386	3.2				
Fish	501	2.0				49
Flowering plants	4500	1.1	4	15	22	40
Fungi (Polypore)	173	16	?	?	?	?
Liverworts	275	4.6				
Mammals	345	7.5	1	4	5	28
Molluscs	257	0.6				10
Mosses	445	3.5				
Reptiles	142	1.9		20	25	1
Termites	93	3.4				
Other invertebrates						17
Total						170

*CR=critically endangered, EN=endangered, VU=vulnerable
Source: Pomrey and Mwima (2002)

Recent survey reports reveal the occurrence of 18 783 species (NEMA, 2006). Although the country covers just 241 551 square km and accounts for only 0.18 per cent of the world's terrestrial and freshwater surface, Uganda harbours:

- 4.6 per cent of the dragonflies,
- 6.8 per cent of the butterflies,
- 7.5 per cent of the mammals, and
- 10.2 per cent of the bird species globally recognized (*Table 1*).

Uganda has more species of primates than any other part of similar area on Earth. For example, Kibaale National Park, covering 760 Km^2 has 12 species of primates. In two Ugandan forests (Bwindi Impenetrable and Kibale National Parks), Ipulet (in prep.) recorded 173 species of Polypore Fungi, which is 16 per cent of the total number of species known from North America, Tropical Africa and Europe. Some components of biodiversity in Uganda (e.g. below ground biodiversity) are poorly known. Although there are works on this group, they are still at initial stages carried out mainly by universities and research institutes.

Table 6.13: IUCN Red lists species

Taxon	**Plants**	**Animals**
EX- Extinct	0	34
EW- Extinct in the Wild	0	4
Subtotal	0	38
CR- Critically Endangered	3	27
EN- Endangered	4	31
VU- Vulnerable	33	72
Subtotal	40	130
LR/cd- Lower Risk/conservation dependent	1	18
NT- Near Threatened (includes LR/nt-Lower Risk/near threatened	8	64
DD- Data Deficient	1	41
LC- Least Concern (includes LR/lc-lower risk, least concern	10	1,562
Total	**60**	**1,853**

Source: Pomrey and Mwima (2002)

Over time, a large proportion of the vegetation of Uganda has been modified by cutting, cultivation, and burning, grazing and other anthropogenic activities and as such, many vegetation types have been significantly reduced in quality and range. The National Biomass Study (1996) shows the extent of this change and what remains. The situation has no doubt deteriorated further from the natural state since 1996.

Analysis of biodiversity in Uganda relies on either the National Biomass Study map with 13 landscapes categories (FD, MWLE, 2003) or the earlier analysis by Langdale-Brown et al. (1964) which determined 22 main vegetation types (with 96 subtypes) in Uganda. This second approach, which is now due for revision, is the one used in the detailed wildlife protected area system plan of the Uganda Wildlife Authority (1999).

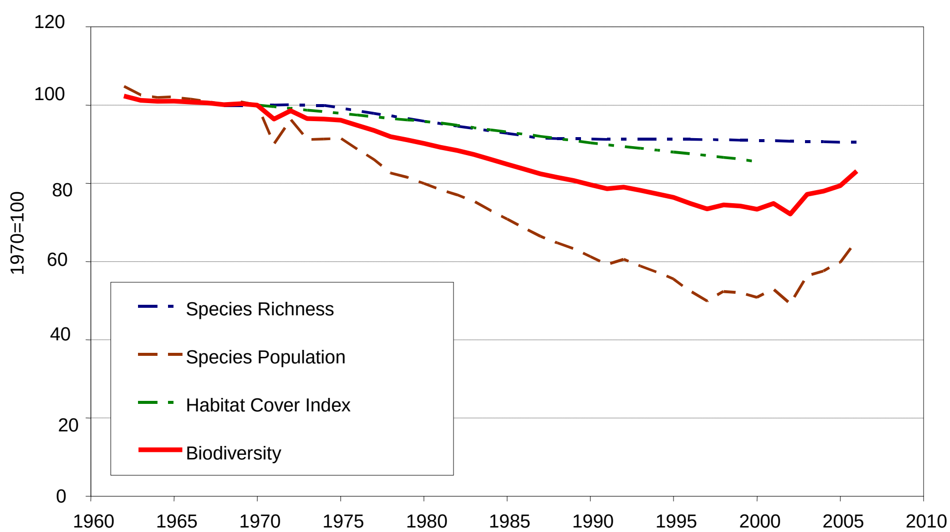
In terms of biodiversity conservation, it is the remaining naturally vegetated areas that contain the bulk of the species and ecosystems of particular concern. Many of these remaining natural areas are found only where they have been protected from human encroachment and other disturbances in officially designated protected areas or areas of protected private/public land. The remaining natural areas of Uganda include various subsets of forests, wetlands, grasslands/savannas and open water. Specifically, these natural areas that are critical and unique and require conservation are the Albertine Rift, Lake Victoria, Sango Bay ecosystem and the dry montane forests.

6.2.1 Declared and proposed protected areas and their status

The network of gazetted protected areas in Uganda is managed by the Uganda Wildlife Authority (UWA) or the National Forest Authority (NFA). These are serving to conserve a significant portion of biodiversity and remaining tropical forests in Uganda. Generally, animals are found in Protected Areas (PAs) as well as areas outside PAs. Within the wildlife PAs there are two classifications that include; Wildlife Reserves and National Parks. Uganda has 10 National Parks, 13 Wildlife Reserves, 10 Wildlife Sanctuaries and five Community Wildlife Areas which are managed by UWA and represent approximately 13 per cent of the total area (Table 4). For ease of management and in favor of the landscape approach, the UWA has grouped its estate into seven Conservation Areas.

Forests and woodlands cover a total of 4.9 million hectares, which is about 24 per cent of the total land area. Tropical High Forests (THF) cover 924 208 hectares, forest plantations cover 35 066 hectares and woodlands cover 3,974,102hectares. Of the 4.9 million hectares, 30 per cent are in protected areas (Forest Reserves, National Parks and Wildlife Reserves) and 70 per cent are found on private land. Protected Areas (PAs) contain the country's Permanent Forest Estate (PFE), which is 1.9 million hectares. Of this, Central Forest Reserves (CFRs) cover 1 265 742 hectares. The National Forest Authority (NFA) manages the central forest reserves. The forests on private land are in many cases being over-harvested, degraded and converted to other uses, while the forests in national parks are inaccessible for provision of forest products. Therefore, CFRs constitute the primary source of forestland that is available for a variety of uses. However, the current status expressed as the biodiversity index is indicated in *Figure 6.2.1* below.

Figure 6.6: Uganda biodiversity index



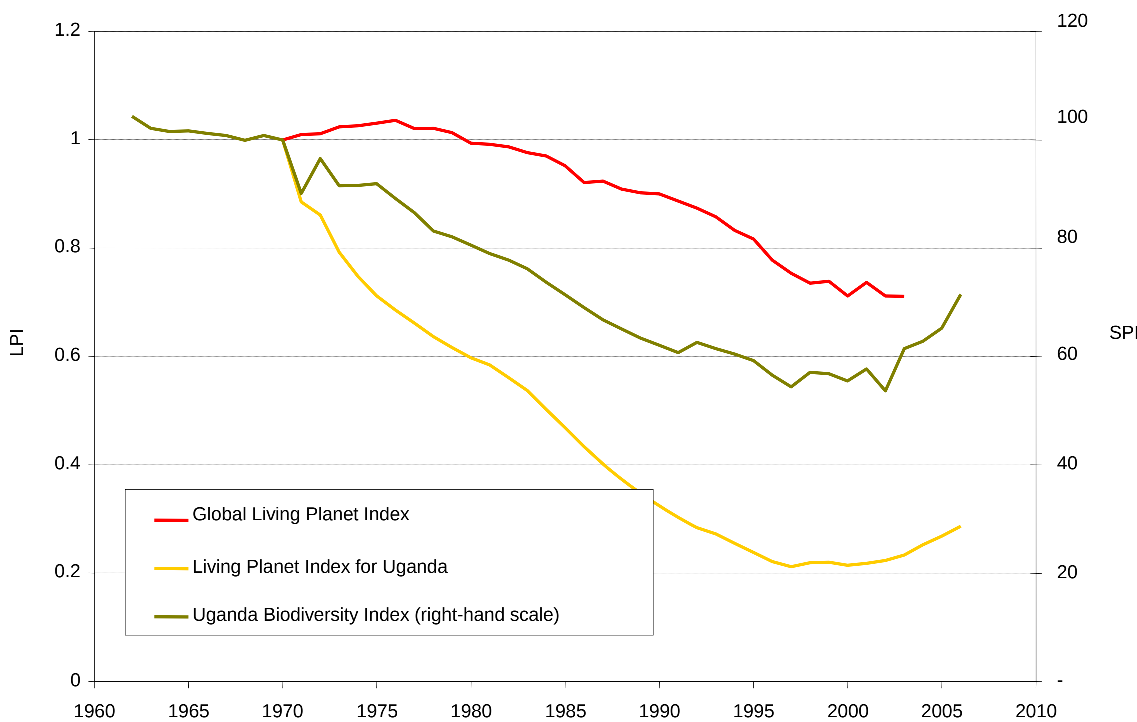
Source: Derek Pomeroy and Herbert Tushabe (2006)

If the extent of forest cover (including tropical high forests and woodlands) is taken as a proxy for Uganda's biodiversity, then the country has registered a significant loss. Drastic changes in the forest cover have taken place in Uganda during the past century. In 1890, forests covered approximately 10 800 000 hectares or 52 per cent of Uganda's surface area. By 1996, forest cover had declined to about 20 per cent. Tropical high forest cover declined from 12 per cent of the total land area in 1900 to 4 per cent by 2000 (FD, MWLE, 2003).

6.2.2 Threats to biodiversity and causes of biodiversity loss

The principle threats to biodiversity in Uganda continue to exist, including habitat loss, modification and alteration along with unsustainable harvesting, pollution and introduction of alien species. The decline of fish species in Lake Victoria is considered to be the largest documented loss of biodiversity ever inflicted by humankind on an ecosystem (Witte et al., 1999). The rate of biodiversity loss in Uganda is high and was calculated in 2004 to be 10-11% per decade. While these figures are high, they are below the 1.0 per cent yearly loss that has been recorded for the planet earth as a whole. Current figures compared to the global living planet index are shown in *Figure 6.6.*

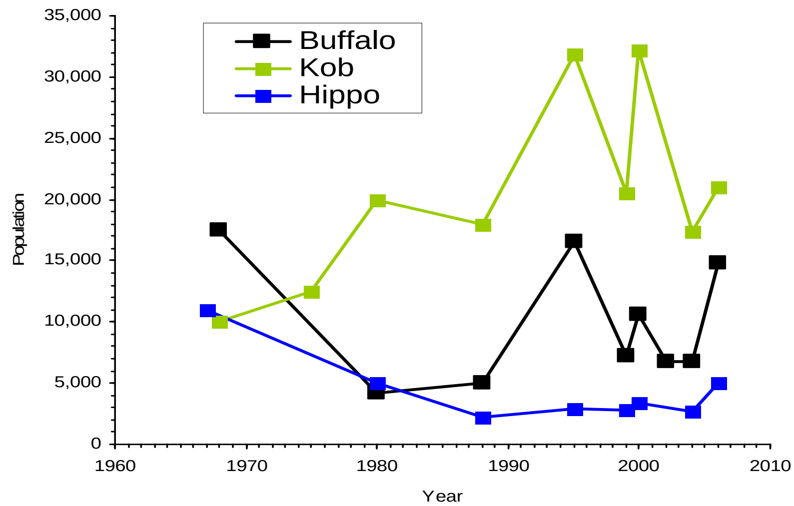
Figure 6.7: Uganda and global biodiversity indices



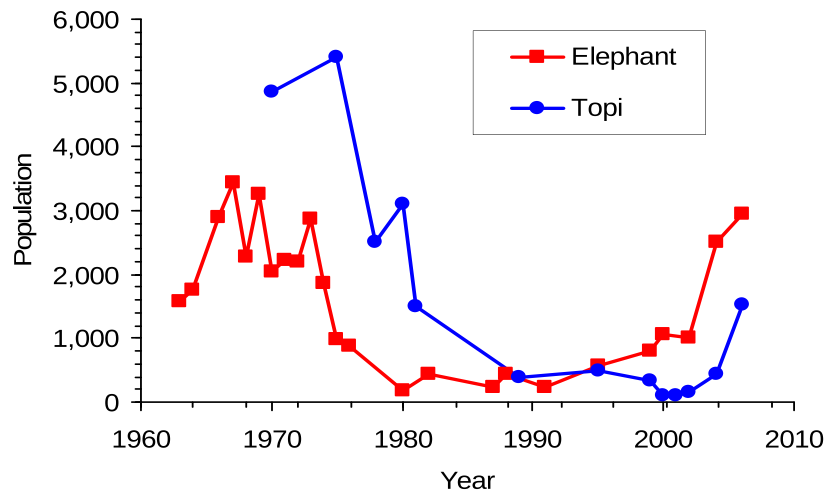
Source: Derek Pomeroy and Herbert Tushabe (2006)

The historical loss of species is high in Uganda, and the negative trends continue to manifest themselves. Many major mammal species, such as rhinos, cheetahs, and Oryx were extirpated during Uganda's decades of internal strife between 1970 and 1990. Bird and fish species continue to decline in number and distribution throughout the country. Most of the remaining large animals are confined to protected areas, where their numbers are small but stable or decreasing still. However, in a few cases (e.g. the mountain gorillas, elephants and kob), the trends show some increase partly because of the increased attention (Pomeroy and Tushabe 2006).

Figure 6.8: Population trends of selected herbivores



(a)



(b)

Source: Pomeroy and Tushabe 2006

Threats to biodiversity have both direct and indirect causes. Four of the five principal direct threats to the conservation of global biodiversity are considered to be the major causes of the loss of biological resources in Uganda. These are:
i) habitat loss/degradation/fragmentation, ii) unsustainable harvesting and over-exploitation of living and non-living resources, iii) invasion by introduced species, and iv) pollution/contamination. However, these proximate causes to biodiversity loss in Uganda are not the root of the problem. A closer examination of the direct causes that threaten species, ecosystems and ecoregions in Uganda identifies poverty and rapid population growth as the major factors behind biodiversity loss. There are, however, very few long term studies/monitoring programs to keep track of trends in biodiversity with regard to threats thereto. Monitoring programs for various taxa could be conducted efficiently if integrated as part of long-term studies of universities and research organizations.

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6.3 Tourism

The strength of tourism in Uganda is the unspoilt wilderness areas, the gorillas, the rich culture and the special combination of nature and culture. Uganda's tourism attractions consist of the following elements; nature and scenery, South Western Mountains (Bwindi Impenetrable National Park, Echuya Bamboo Forest and Mgahinga National Park); North Eastern Mountains (Kidepo Valley National Park), Mount Elgon, Ssese islands, the craters of Queen Elizabeth National Park and the specific features of scenic interest like the Murchison falls, Semliki hot springs, Kyambura gorge etc (Kyerere 1997).

Uganda has an extra ordinary variety of landscapes from arid savannas to swamps, lakes, tropical forests and high mountains. Over the last 40 years, Uganda has established a network of National Parks and Wildlife Reserves to protect its wildlife and special landscapes covering 10 per cent of the country. Consequently, nearly 80 per cent of the tourism sector in Uganda depends on wildlife, with tourists visiting national parks to see gorillas and other wild animals, climb mountains, track chimpanzees and see waterfalls (UWA 2005).

Uganda has 10 national parks, 10 wildlife reserves and seven wildlife sanctuaries, some of which are acclaimed as being among Africa's best. The country's main wildlife attraction for foreign visitors is the rare mountain gorilla, found in Bwindi Impenetrable National Park and Mgahinga Gorilla National Park, both in the southwest of the country. Many other species of primates can also be seen, including chimpanzees and monkeys. Kibale National Park alone contains 12 different types of primate, while Rwenzori National Park is regarded as one of the most spectacular in Africa.

In the 1960's, Uganda was the main tourist destination in Eastern Africa and tourism became one of the country's main economic sectors. However, during the period of turmoil in the 1970's and 80's, wildlife was hunted virtually to extinction in many protected areas and the tourism infrastructure was looted and destroyed (MTTI 2003).

Tourism has been held back by the problem of insecurity and the poor image of Uganda as a tourist destination. Several recent incidents involving tourists have resulted in Uganda or parts of it being listed as unsafe areas by key embassies such as the American, German and British embassies. As a consequence, tourism investments and marketing initiatives have been severely hampered by the events and the consequent embassy advice (MTTI & ICB-PAMSU 2002).These events, as well as other events like the outbreak of Ebola and the killings of the Kanungu sect have fuelled the negative image of Uganda as a tourist destination and the shadows of the past civil war and unrest have not faded away yet.

6.3.1 Challenges

The tourism industry is still faced with a number of challenges. For example, the institutional capacity of both the public and private sectors is still inadequate to initiate tourism development. Tourism promotion and marketing activities have been quite limited because of insufficient government funding combined with the poor financial situation of the private sector.

Communities have not played a significant proactive role in respect of protection of natural and cultural resources in Uganda. In many areas forests have been cut down, wetlands have been drained and there has been widespread poaching of wildlife (MTTI 2003).

6.3.2 Recent initiatives

In 1991, initiatives were taken to provide a strategic plan for the redevelopment of the sector through a UNDP/WTO financed tourism master plan for Uganda. The plan, finalized in 1993, formulated a new strategy for tourism development which should reinstate tourism as one of the key economic activities in the country within a 10 year period (MTTI & ICB- PAMSU 2002). The national tourism policy has also been formulated and it seeks to assist in efforts to promote the economy and livelihood of the people essentially through poverty alleviation by encouraging the development of sustainable quality tourism. It also seeks to market Uganda as a favoured tourist destination for ecotourism in a country renowned for its biodiversity, cultural richness and hospitable people (MTTI 2003).

The objective of the national tourism policy is to define a new way forward for tourism development, leading to an increase from present level of tourist arrivals from about 200 000 to 500 000 in ten years.

The 2004-2008 marketing strategy has also been formulated and is intended to provide a framework to enable Uganda to maximize the potential for tourism in the country by following a strategic approach to the markets offering the best potential while at the same time undertaking a structured approach to product and market segmentation and diversification.

The marketing strategy is based on market research and the consultative engagement of key stakeholders, principally the Ministry of Tourism, Trade and Industry, the Uganda Tourist Board, the Uganda Wildlife Authority and, most especially, the private sector as represented by the Uganda Tourism Association, the Association of Uganda Tour Operators and other industry groups.

For the period 2005-2009, this strategic plan will aim to;

- increase Uganda's share of visitors to Southern Africa, most especially share of holiday and other discretionary visitors, thereby achieving a rate of tourism growth bigger than that in neighbouring destinations;
- increase tourism earnings at a rate faster than the volume thereof, by making longer the average length of stay and increasing the average daily expenditure;
- generate positive publicity for the destination in all key markets; and
- secure and increase the incidence of Uganda products included by tour operators.

Uganda has also signed a memorandum of understanding with the People's Republic of China granting Uganda approved tourist destination status by the Chinese government. The memorandum was signed on 4th April 2005 and it followed an agreement between the Government of Uganda and that of the People's Republic of China in 2004. the essence of the memorandum was that China declares Uganda an approved tourist destination for Chinese tourists for organized group travel to Uganda (Tindigarukayo. J. *per comm.*).

6.3.3 Trends

Despite all the shortcomings, there has been a clear increase in tourist arrivals since 1997 (as reflected in the table below). The total number of arrivals recorded in 2005 was approximately 467 728 compared to 512 378, and 304 656 in the year 2003 (UTB, 2006). Most visitor arrivals in the country are from Africa, which accounted for 79 per cent in 2004. These arrivals were mostly from Kenya, Tanzania and Rwanda. Europe contributed 10 per cent of the total number of arrivals mostly from the United Kingdom and Germany. Those from the Americas were mainly from the United States of America (UBOS 2005). Recent visitor statistics are indicated in *Table 6.3.1*.

Table 6.14: Tourist arrivals from 1990 to June 2006

Year	Total Arrivals
1990	54 672
1991	66 750
1992	92 736
1993	111 292
1994	147 308
1995	159 911
1996	176 042
1997	175 073
1998	194 790
1999	189 348
2000	192 754
2001	202 012
2002	254 212
2003	304 656
2004	512 378
2005	467 728
2006 (incomplete)	229 792

Source: UTB 2006

6.3.3.1 Ecotourism

Ecotourism involves visiting natural areas with the objectives of learning, studying or participating in activities that do not bring negative effects to the environment; whilst protecting and empowering the local community socially and economically. It is nature-based and it aims at attracting small numbers that are high spenders. This promotes destination quality and sustainability. Tourism is rapidly changing as nature, heritage and recreational destinations become more important, and as conventional tourism is forced to meet tougher environmental requirements thus ecotourism is becoming increasingly popular.

Table 6.15: Visitor statistics to national parks for the years 2000 to September 2006

Protected Area	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Murchison Falls National Park	23,169	23,578	27,825	39,262	46,033	39,133	20,332
Queen Elizabeth National Park	8,743	14,855	27,814	34,608	41,843	48,720	33,160
Kidepo Valley National Park	2,285	2,470	1,443	1,049	818	758	668
Lake Mburo National Park	8,443	9,616	11,587	11,692	15,118	16,181	9,155
Rwenzori Mountain National Park	0	117	250	331	592	906	746
Bwindi Impenetrable National Park	3,983	4,517	5,075	4,902	5,768	9,012	7,545
Mgahinga Gorilla National Park	2,518	2,205	2,598	2,722	3,337	1,910	1,806
Semuliki National Park	0	77	802	1,179	1,755	1,949	1,370
Kibale National Park	1,149	1,846	4 899	5,998	5,463	6,490	5,248
Mount Elgon National Park	1,872	2,024	3,234	3,594	3,610	3,751	2,352
Total	**52 162**	**61 305**	**85 527**	**105 337**	**124 337**	**128 810**	**82 433**

Source: UWA 2006

Table 6.16: Number of visitors to forest ecotourism sites (Mabira, Mpanga, Budongo (Busingiro & Kaniyo-Pabidi), Kalinzu and Kasyoha-Kitomi (2000-June 2004)

Year	Number of visitors
2000	6 050
2001	5 884
2002	5 482
2003	6 995
2004	4 154

Source: NFA 2006

Table 6.17: Revenues from forest ecotourism sites i.e. Mabira, Mpanga, Budongo (Busingiro & Kaniyo-Pabidi), Kalinzu and Kasyoha-Kitomi (2000-June 2004)

Year	Revenue (Uganda Shillings)
2000	29,784,700
2001	25,348,100
2002	24,303,700
2003	38,548,950
2004	19,280,700

Source: NFA 2006

Some national parks also practice and emphasize ecotourism. These include Bwindi Impenetrable National Park, Mgahinga Gorilla National Park and Kibale National Park and *Table 6.3.5* below shows the visitor figures to these national parks.

Table 6.18: Park visits for ecotourism

Protected Area	2000	2001	2002	2003	2004	2005	2006
Bwindi Impenetrable National Park	3,983	4,517	5,075	4,902	5,768	9,012	7,545
Mgahinga Gorilla National Park	2,518	2,205	2,598	2,722	3,337	1,910	1,806
Kibale National Park	1,149	1,846	4,899	5,998	5,463	6,490	5,248
Total	**7,650**	**8,567**	**12,572**	**13,622**	**14,568**	**17,412**	**14,599**

Source: UWA 2006

The ecotourism strategy for Uganda has been formulated and its objective is to transform and present Uganda's nature-based tourism activities as ecotourism-favoured products and services, acceptable to national and international markets, with due consideration of the ecological and social dimensions while ensuring the economic viability of the enterprises therein.

The National Forestry Authority (NFA) has also developed an ecotourism strategy to address specific issues and concerns identified under the tourism development plan.

There are a number of CFRs, that undoubtedly have features and attractions that are of real interest to domestic and international tourists and which can be exploited on a non-consumptive and sustainable basis. These attractions include the scenic qualities of forests themselves and the wide diversity of plants, primates, birds and butterflies and other wildlife (Langoya *et al*, 2006).

In recognition of the need to develop these sites more integrally, NFA with support from EU initiated and recently completed a three year tourism development plan for six sites in Kalagala falls, Budongo (Kaniyo-Pabidi, Busingiro), Mabira, Mpanga and Kalinzu CFRs.

The objectives for NFA's ecotourism business are to;

- undertake ecotourism as a viable business venture;
- involve the private sector in tourism development and marketing;
- create employment for the local communities;
- create revenue sharing avenues between NFA, the private sector and the local communities; and
- enhance the corporate image of NFA at both local and international levels.

6.3.3 Tourism receipts in Uganda

Tourism plays a very important role in Uganda's economic development. The World Tourism Council predicted that Uganda would generate US$ 839 900 000 of economic activity from tourism in the year 2005. During the same period, tourism was expected to account for 9.2 per cent of GDP and generate 420 064 jobs totalling 7.3 per cent of employment in the country. *Table 6.3.6* is a summary of tourism revenue and expenditure for the years 1996-2005.

Table 6.19: Tourism receipts in Uganda, 1996 – 2005

Tourism payments	**Year**									
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
International tourism receipts (US$ millions)	117.39	135.00	144.42	151.41	165.17	165.43	171.49	184.18	255.80	232.62
International tourism expenditures (US$ millions)	-	-	-	-	-	-	-	-	133.34	109.63

Source: MTTI 2006

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6.4 Energy resources

6.4.1 Introduction

The goal of Uganda's energy policy is to meet the energy needs of Uganda's population for social and economic development in an environmentally sustainable manner (MEMD, 2002). The energy policy recognizes that Uganda has abundant opportunities to develop its energy resources, especially hydroelectric power and biomass. But these sources of energy have not been adequately developed. The policy also recognizes that energy development and environmental damage are intricately related. The policy recognizes the need to mitigate both the physical and social environmental impacts created by energy development, especially hydroelectric power.

The Ministry of Energy and Mineral Development is developing a renewable energy policy, which reinforces the government's overall energy policy. The renewable energy policy arose from the need to overcome bottlenecks encountered in the implementation of the energy policy in particular and the power sector reform in general such as the absence of a clear financial and economic framework for encouraging private sector investment in the sector (MEMD, 2006a). The new policy (renewable energy policy) aims to increase the use of renewable energy so that its proportion (excluding biomass) represents up to 7.55 per cent of the total energy consumption by the year 2015.

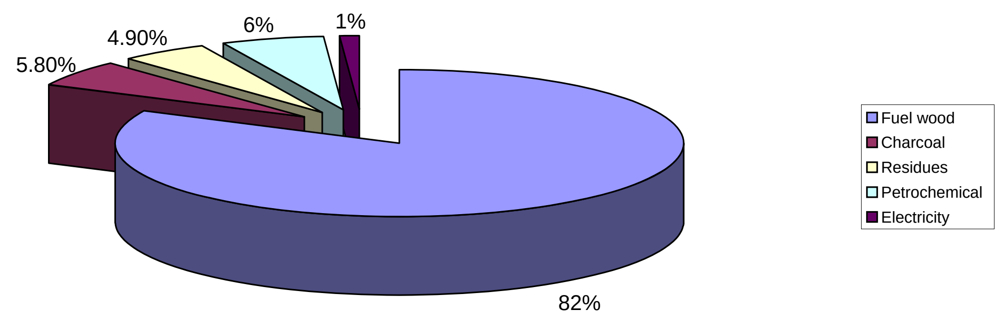
6.4.2 Energy resources and consumption

Uganda has an abundant variety of potential energy resources from solar, biomass, hydro, petroleum, wind, and geothermal. The energy sources that have been exploited so far include *biomass* (fuel wood, charcoal and agricultural residues), *petroleum products* (gasoline, kerosene, aviation fuel diesel, fuel oil and liquid petroleum gas/LPG) and *hydro power*. The national consumption of these three energy sources averages 93 per cent, 6 per cent and 1 per cent respectively (MEMD, 2005a). Petroleum products are 100 per cent imported.

The energy sector statistics indicate a high consumption of biomass energy with about 97 per cent of households in the country heavily dependant on biomass energy resources (NAPE 2005). The majority of households and commercial eating places, country-wide, rely on firewood and charcoal for cooking and heating.

In 2005, the hydropower potential of Uganda was estimated at over 2 000 MW. However, only about 10 per cent of this potential is currently utilized. The rest has not been exploited although government is in advanced stages of increasing hydropower with another hydropower station, the Bujagali Hydroelectric power station. The total energy consumption in 2005 was estimated as 8 954 508 Tonnes of Oil Equivalent (TOE). The energy consumption per capita was 330.2 kilogram of Oil Equivalent (kgOE); and commercial energy consumption per capita was 23.5 kilogram of Oil Equivalent (kg OE) (MEMD 2005a).

Figure 6.9: Energy consumption proportions, 2005

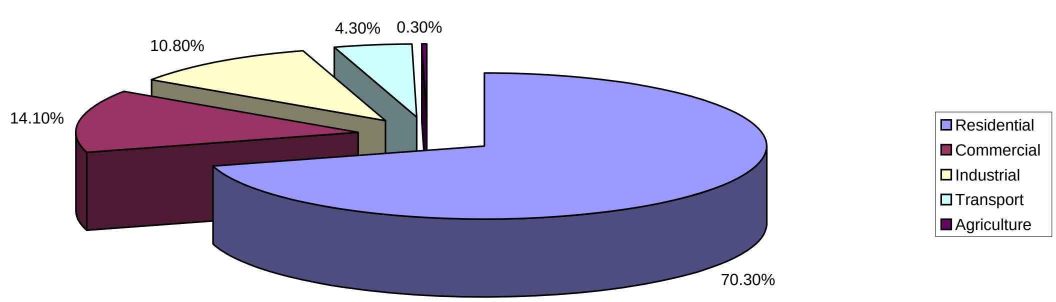


Source: MEMD 2005a

Only five per cent of Uganda's population (approximated at 28.4 millions), has access to grid electricity; that is 293 004 households of the 5 511 735 households in Uganda. The access to grid electricity in rural areas is about 4 per cent with a total of about 3.9 million rural households not connected to the grid. Currently, Uganda has one of the lowest per capita electricity consumption rates worldwide at 22 kilowatts per year in the region (MEMD 2006b).

Over two thirds of the power in Uganda is consumed in residences; 14 per cent in commercial buildings in both urban and rural areas; 10 per cent of the power is used by industries and the remainder is shared between the transport sector (4 per cent) and the agriculture sector (0.3 per cent) below.

Figure 6.10: Energy consumption by sector, 2005



Source: MEMD 2005a

Over the past decade, there has been an increase in the per capita income resulting into an increase in the demand for electricity both in the rural and urban areas. The electricity demand has been estimated to be growing at a rate of 8 per cent per annum, creating a need for increased power generation (MEMD, 2006b).

However, as demand for electricity grows bigger, the production and supply of electricity has stalled and in some cases fallen below the required levels (MFPED, 2006). As a result, the set levels of macro economic growth, and GDP growth of seven per cent per annum, were not achieved (MFPED, 2006). As such, many communities in Uganda still rely on biomass as the principal source of energy and imported petroleum for lighting. In effect, the rate of deforestation has had to increase to cater for the growing demand of energy as there are no substitutes and a considerable amount of the national income is spent on importing petroleum for domestic lighting and heavy fuels to produce electricity to meet the industrial power deficit.

Table 6.8: Basic patterns of energy consumption in East African countries

Population				**Energy Consumption**		**Electrification**	
	Total	**Urban**	**Rural**	**Biomass**	**Modern**	**Urban**	**Rural**
Kenya	31.9	10.5	21.1	70	30	46	4
Rwanda	8.1	0.5	7.6	90	10	48	1
Tanzania	36.5	12.0	24.5	90	10	38	2
Uganda	24.4	3.0	21.4	93	7	8	1
Total	100.9	26.0	74.9	92	14	40	5

Source: UNDP/GTZ 2005.

6.4.2 Biomass

Biomass comprises firewood, charcoal and agricultural residues; and it plays a very significant role in Uganda's energy scenario constituting 93 per cent of total energy consumed in the country. Almost all the energy used to meet basic energy needs for cooking and water heating in rural and most urban households, institutions, and commercial services is derived from biomass (MEMD 2006a). Total biomass demand for households in the year 2006 was estimated at 22 million metric tonnes. The cottage industries account for about 20 per cent of total biomass use, which is about 5.5 million metric tomes, bringing the total biomass demand to about 27.7 million metric tonnes.

The trade in biomass fuels contributed to US$ 20 millions per annum, to the national economy in terms of rural incomes and tax revenues. In addition, biomass fuel trade employs close to 200 000 people and saves the country foreign exchange equivalent to US$ 160 millions per annum in terms of oil products which would otherwise be imported. Presently, a deficit of 85.25 metric tonnes of the biomass balances exists in several districts in Uganda. The worst hit districts are Kampala, Iganga, Tororo, Pallisa, Mukono, Masaka, and Jinja.

Table 6.9: Woody biomass demand by region (tones/year)

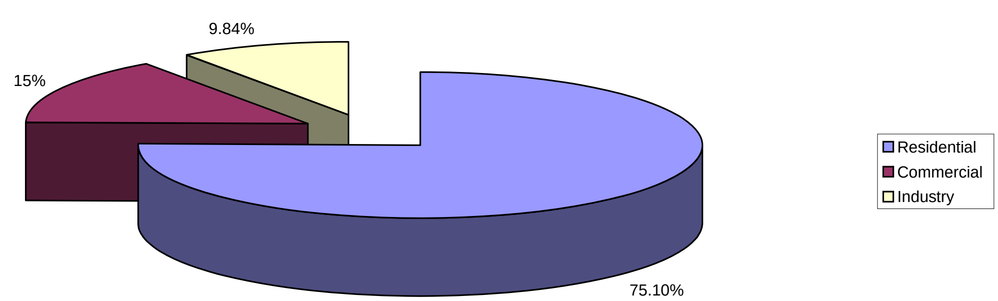
Region	Household demand	Cottages demand	Total demand
Central	6,515,211	1,628,803	8,144,013
Eastern	5,382,940	1,345,735	6,728,675
Western	5,305,470	1,326,367	6,631,831,836
Northern	5,023,164	1,255,791	6,278,955
Total	22,226,784	5,556,696	27,783,479

Source: MEMD 2006a.

6.4.2.1 Firewood and charcoal

Firewood is the main source of energy for small and medium scale industries and commercial activities including bakeries, tea drying, tobacco curing, lime, brick making, fish smoking, jaggeries and so on (MEMD, 2006a). For instance, for every one kilogram of processed tea, one kilogram of wood is required. This means that an equivalent of about 20 million metric tonnes of wood is consumed annually by the tea processing industry alone (MEMD, 2005a).

Figure 6.11: Biomass utilisation by sector



Source: MEMD 2005a

Wood fuel, comprising both firewood and charcoal, is the biggest source of energy for residential, commercial and institutional cooking. The limited availability of electricity whose coverage is 9 per cent projected to reach 13 per cent by 2010 (MEMD, 2006a), and the high prices of petroleum products are stimulating increased demand for biomass fuels in both the industrial and other user sectors (MEMD 2005a). The per capita firewood consumption is 680 kg/year (MEMD, 2005a), driven largely by the cost saving practices of households, where fuel wood (charcoal) is preferred to more expensive forms of energy such as electricity and petroleum products. The urban demand for charcoal is increasing at a rate almost equal to that of the urban population increase. Currently, charcoal consumption is estimated at 613 kilo-Tonnes (kT) providing about 7 Tera-Watt-hours/year (TWh/year).

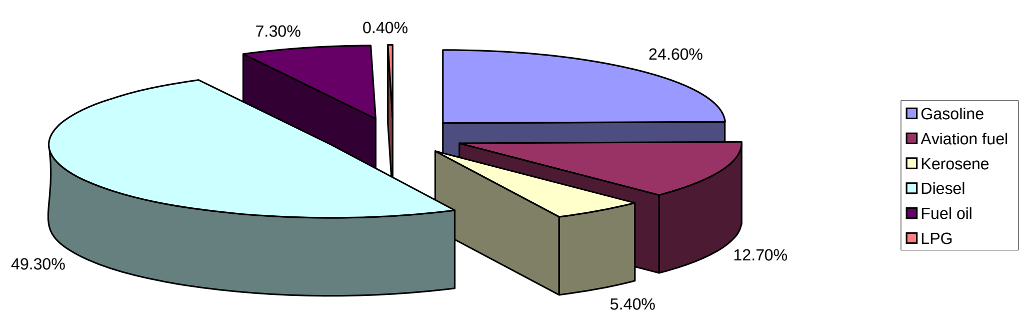
6.4.2.2 Wood fuel conversion technologies

Wood fuel conversion technologies in use (wood stoves and brick kilns) in Uganda today are very inefficient. The emphasis of the technologies has been on increasing the efficiency of domestic biomass energy use both to sustain resources and reduce indoor air pollution. Several initiatives to introduce better technologies have been made by government and the private sector particularly training in fuel efficient stone stove and kiln construction and wood fuel harvesting from farmed plantations. These practices are aimed at reducing degradation of natural forests and their biodiversity. However, affordability, efficiency and adoption of the technologies are still very low. One such initiative is the SEUHI project, which was established and funded from 1998 to improve the efficiency of household charcoal stoves and to popularize the usage of these stoves in selected districts in Uganda. The SEUHI project was partially financially supported by the Royal Netherlands Government which contributed US$ 298 488 to the total planned expenditure of US$ 390 000 and the gap was to be met by the government of Uganda. The project addressed the poor conversion efficiency of wood fuel-using technologies including household stoves; while for the industrial sector, the project addressed the low rates of improved business energy technology adoption. Particular outputs tackled improvements in stove and kiln design, construction and materials selection, and their operation and maintenance for possible maximum fuel efficiency. SEUHI carried out training of trainers programs in the design and construction of improved efficient mud stoves thus building capacity in the sub-sector (Opio 2003).

6.4.3 Petroleum energy resources

Petroleum is the main form of non-renewable energy used in Uganda. The main petroleum products consumed are gasoline, aviation fuel, kerosene, diesel, fuel oil and liquid petroleum gas (LPG) (MEMD, 2005a).

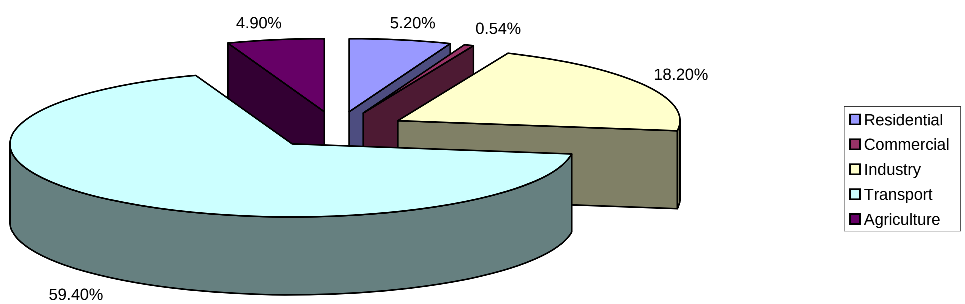
Figure 6.12: Petroleum consumption, 2005



Source: MEMD 2005a

The total sales of petroleum products in Uganda rose from 646 839 m^3 in 2004 to 681 249 m^3 in 2005, which represents an increase of 5.3 per cent. Consumption of petroleum products is sector specific; gasoline and aviation fuel are consumed by the transport sector, kerosene is consumed by the residential and commercial sectors, fuel oil and LPG are consumed by the industrial sectors and diesel is consumed by the industrial, transport and agriculture sectors.

Figure 6.13: Consumption of petroleum products by sector



Source: MEMD 2005a

The consumption of the three major white products namely petrol, diesel and kerosene rose from 496 603 m^3 in 2004 to 533 464 m^3 in 2005. Consumption of the three in 2005 was as follows: Petrol 174 054 m^3, diesel 319 574 m^3; and Kerosene 39 836 m^3. A total of 49 oil companies operate in Uganda, enhancing market competition in the petroleum industry; with multinational companies having the major market share of 80 per cent.

Since 2000, petroleum products especially diesel are used in the generation of thermal electricity. This has resulted in an increase of diesel consumption by 50 per cent from 319,600 m^3 in 2005/6 to 470 000 m^3 in 2006/7, while the other oil products maintain a steady growth of 5 per cent. Agrreko International Projects Ltd operates a 50 MW thermal power plant at Uganda Electricity Transmission Company Ltd, Lugogo yard.

Domestically, thermal generators are scattered all over the country with no proper inventory on the extent of their use. Commercial use of thermal generators is already taking place in upcountry towns of Arua, Nebbi, Paidha, Moyo, Moroto and other towns in the North-West, North and North-East where there is no supply of the hydro electricity from Jinja.

There is a particularly high consumption of kerosene in the rural areas, especially in homes. This is mainly for purposes of lighting due to lack of electricity. In major towns, natural gas provides another alternative source of energy for cooking. Monitoring of downstream petroleum sector is expected to commence with the establishment of a petroleum supply department by the Ministry of Public Service.

Uganda has been encouraging active oil and gas exploration concentrated mainly in the Albertine Graben area. Hardman Resources Ltd of Australia and Energy Africa Ltd/ Tallow Oil who hold exploration rights in the Northern Lake Albert basin have drilled some exploratory wells and oil has been discovered in Kaiso- Tonya Area-Hoima district.

6.4.4 Hydro power energy resources

Electricity consumption accounts for 1.0 per cent of the total amount of energy used in Uganda (MEMD, 2005a). This figure has reduced from 1.1 per cent in 2003, and is attributed to the prolonged drought that was experienced in 2005/06 and which reduced the effective generation capacity to 125 MW from the installed hydro power generation capacity of 300 MW for the two main hydropower stations at Jinja and 17 MW for other smaller hydropower plants (MEMD, 2006; MFPED, 2006).

Major sites constructed are Nalubale and Kiira with 180 and 80 MW capacities commissioned respectively in 1954 and 2000. The other smaller operational hydropower stations include Maziba in Kabale, Kuluva in Arua, Kaganda, Mobuku 1 and 2 in Kasese and Kisiizi in Rukungiri. At present, approximately 10 per cent of the national potential is being utilized.

Although the electricity grid covers Kampala city and other major urban centres, rural areas settle the largest population yet only 4 per cent has electricity supply. However a total of 267 rural electrification schemes have been accomplished since 2000 all over the country. About 37 per cent of the consumption is from domestic consumers, 48 per cent from industrial and 15 per cent from commercial and general consumers. The number of customers in each category is as shown in the table below.

Table 6.10: Ugandan electricity consumers by category

Code	Type of customers	No. of customers	Percentage
10	Domestic and Commercial	291 724	98.61
20	Medium industrial	836	0.28
30	Large industrial	130	0.04
40	Extra large industrial	---	0
50	Street lights	3140	1.06
	Total	**295 830**	**100**

Source: UEDCL Records June 2006

The large scale hydropower potential along the River Nile has been estimated at about 2 000 MW including six potential major hydropower sites at Bujagali 250 MW and Karuma 200 MW in the medium term and Kalagala 450 MW, Ayago North 300 MW, Ayago South 250 MW, Murchison Falls 600 MW, Uhuru in the long term (MEMD 2006b).

6.4.5 Alternative renewable and new energy sources

There are other considerable renewable energy resources that are largely unexploited due to perceived technical and financial risks (MEMD 2006a). These resources include geothermal, solar, wind, bio diesel and biogas. The estimated electrical power potential is as shown in the table below:

Table 6.11: Estimated power potential in Uganda

Energy source	Estimated electrical power potential (MW)
Solar	230
Geothermal	450
Peat	800
Wind	---
Total	1480

Source: MEMD (2004)

6.4.5.1 Solar energy

Uganda is endowed with plenty of sunshine giving an average solar radiation of about 4.5 kWh/m2/day. This level of insolation is quite favourable for all solar technology applications (MEMD 2002). Existing solar data clearly shows that the solar energy resource in Uganda is high throughout the year. This level of insolation is quite favourable for the application of a number of solar technologies which include

- Solar water heating
- Solar photovoltaic system for supply of basic electricity in rural institutions and household as well as areas that are not connected to the grid.

However, solar energy potential is not fully tapped and utilized, despite all taxes on solar systems (including VAT) having been removed.

6.4.5.2 Wind energy

Wind speed is moderate in most areas of Uganda. The average wind speed in low heights(less than 10m) generally ranges from 2m/sec to 4m/sec. In some areas with complex terrain, the wind may speed up due to slopes of hills, escarpments and tunnelling effect.

Based on wind data collected by the department of meteorology for a period of three years, it was concluded that the wind energy resource in Uganda is sufficient for small scale electricity generation (MEMD 2006a). Recent studies also confirm that electricity generation through wind is still feasible, especially for small industries or in rural areas where target for wind mill capacity ranges between 2.5 KV and 10 KV.

Despite these studies, wind energy in form of electric energy is not used in Uganda. Wind energy in Uganda can be used for special applications such as water pumping and grain milling and wind mills have been successfully used in Karamoja region. There are just a isolated cases of wind generators installed in the country. This is a clean energy source that owes its limitations to the prevailing wind region.

6.4.5.3 Biogas

This is a zero-waste technology and since 1980 when biogas energy technology was first introduced, there have been several initiatives involving private individuals, NGOs, Government and development partners. These initiatives include pilot demonstration and capacity building (MEMD 2006a). There is need to develop this resource further and many opportunities exist.

One of the recent initiatives involved support obtained from China to construct demonstration biogas digesters and to train some technicians. Biogas energy technology offers an opportunity to tackle the waste management problem in Uganda. Municipal waste in Uganda is generally composed of wet nitrogen and such materials that include organic waste from households, a few industrial wastes (slaughter houses, food industries), agro waste manure and straw. It is estimated that Kampala city generates 1 000 tonnes of waste per day. Other municipalities and towns also generate considerable amount of waste but do not have proper waste management plans.

These materials can be converted into biogas for cooking and lighting at a domestic level. At the industrial level these wastes can be used for the purpose of providing feed stock into digesters to generate biogas, which is treated in a purification unit and used in gas turbine to generate electricity (MEMD 2006a). Biogas technology has not gained wide use in Uganda. It is also important to note that biogas provides a cheap and clean source of energy for cooking and lighting.

The products of biogas plant like digested slurry can be utilised economically as manure for agriculture and horticulture. The slurry is rich in nitrogen, phosphorus and humus material and thus acts as an organic fertilizer.

6.4.5.4 Geothermal energy

Geothermal energy is one of the possible alternative energy sources in Uganda to supplement other sources of energy. Its major advantage is that it is environmentally friendly and multi disciplinary in use such that it can support various development activities ranging from production to processing. Uganda is endowed with rich geothermal potential mainly located in the rift valley parts of the country. The national geothermal potential is over 450 MW. The three potential areas are Katwe-Kikorongo, Buranga and Kibiro. These are all situated in western Uganda in the western branch of the East African Rift Valley (MEND 2006b). Of the three areas, the Katwe resource shows the greatest potential due to powerful heat source characterized by volcanic and tectonic features.

Further studies have revealed that these areas have the capacity to provide energy for local area consumption and the potential for feeding into the national grid (NAPE 2005).

Detailed geothermal utilization studies done during the geothermal exploration 1(GEEP) to make the first valuation of the potential of geothermal energy in Uganda arrived at the conclusion that the three areas could be suitable for both electric power production and direct use of the geothermal heat (NAPE 2005)

Table 6.12: Temperature ranges of potential geothermal energy producing areas in Uganda

Site	Surface Temp ^{0}C	Reservoir Temp ^{0}C	Possible Plant sizes MWe
Katwe-Kikorongo	11.0	160-230	5-10
Buranga	98.2	120-150	
Kibiro	86.5	>200	

Source: MEMD 2004a

Current efforts by government are focused on developing the above three targets to a pre-feasibility stage, which would pave way for availing required data for feasibility. The Icelandic International Development Agency (ICEIDA) is carrying out field surface geophysical and geological investigation on Kibiro geothermal prospect and has also extended technical assistance toward this cause (MEMD 2004a).

The World Bank is supporting MEMD to carry out further surface exploitation for geothermal prospects as well as reconnaissance survey for other geothermal areas in Uganda. The International Atomic Energy Agency (IAEA) is supporting isotope and geothermal investigation of Katwe, Buranga and Kibiro prospects with the aim of delineating the recharge areas and locating the geothermal reservoir.

6.4.5.5 Peat

It is estimated that the total area of peat land in Uganda is about 4,000 km^2 while the average thickness of peat deposits is about 1.5 metres. The total peat volume is estimated to be 6 000 million m^3. The estimated theoretical peat volume represents about 250 million oil equivalent tonnes. Taking into consideration the varying quality of peat and wetland policy in Uganda, as well as the possibility of using conventional peat production methods, some 10 per cent could probably be used for power production.

The available stock of peat resources would therefore be adequate for the generation capacity of about 600 MW for the next 50 years (MEMD 2006a). However peat is not used to generate power currently and there has been no effort to use peat for power generation.

6.4.6 Bio fuels

Bio fuels such as ethanol and bio diesel are derived from biological ingredients. Methanol is from condensing smoke during wood distillation process. Ethanol and bio diesel can be blended with or directly substituted for gasoline and diesel respectively.

In Uganda, ethanol is being produced at a small scale by sugar manufactures as a by-product from the molasses and several small cottage industries from cereals and fruits.

It is estimated that in the year 2010, Uganda will import and consume 360 000 000 litres of diesel and 385 000 000 litres of gasoline. If this fuel could be blended with environmentally friendly locally produced bio fuel such as Methyl Alcohol, (25 per cent for gasoline and 60 per cent for diesel), it would require a total of 312 000 000 litres of Methyl Alcohol, a product, produced locally from wood grown by rural populations. In terms of impact on the environment, if a total of 312 000 000 litres of petroleum products is replaced by Methyl Alcohol, this will replace nearly one million tones of carbon dioxide emission in the country (MEMDO 2006a). Since bio diesel is essentially from plants and animals, the sources can be replenished through farming and recycling. It is environmentally friendly because it has fewer emissions than standard diesel. It is also biodegradable and renewable. It contributes to the lubrication of an engine, it acts as a solvent, is non toxic and has a higher flash point (meaning, it cannot accidentally combust, making movement and storage easier). Its disadvantage lies in production of nitrogen oxides as emissions and its behaviour as a solvent.

6.4.7 Energy for rural transformation programme (ERT)

ERT is one attempt to develop solar energy resources for consumption and rural development. The ERT programme comprises of a 10 year plan developed by the GOU together with the African Rural and Renewable Energy Initiative (AFRREI) of the World Bank aimed at raising Uganda’s rural electrification level to at least 10 per cent by 2012. It is a multi-sectoral programme addressing main grid related power distribution and generation, independent grid systems, Information and Communication Technology (ICT), solar PV systems and cross sectoral linkages with health, agriculture, water and education.

6.4.8 Uganda photovoltaic pilot project for rural electrification (UPPRE)

UPPRE is an experimental project for rural electrification in Uganda. The project targeted individual communities and government services that had the ability and willingness to pay the real market cost of PV-base services. The project was to establish the foundation for sustainable use of photovoltaic (PV) technology for rural electrification in areas considered not accessible to the national grid in the foreseeable future and it is aimed at overcoming the existing financial, social and institutional barriers to the widespread dissemination of technology within Uganda (Opio 2003).

UNDP/ Global Environmental Facility (GEF) funded the pilot project at US$ 2 956 000 of which US$ 200 000 was contributed by the government of Uganda.

6.4.9 Ongoing and future investments in the energy sector

It is worth noting that there are investments going on in the energy sector that will ease the energy scarcity in the country. There are plans to procure additional thermal generation capacity (100 MW in total) to address the current electricity supply deficit.

West Nile Rural Electrification Company Limited (WENRECO) has invested in a temporary 1.5 MW HFO-fired thermal generator which has been in operation since May 2005, located in Arua, while developing the 3.5 MW hydropower plant at Nyagak where construction has already started and will operate in 2007, as well as 1.5 MW at Olewa in Arua.

Kakira Sugar Works (1985) Limited is investing in a baggage co-generation expansion to generate about 12 MW in 2007. Kisiizi Hospital is also investing into expanding its existing production from 60 KW to 250 KW so as to set up a distribution network in the nearby shopping centre.

Other generation/ thermal projects in the pipeline to mitigate the load shedding problem include Bujagali hydropower plant which is expected to add 250 MW of generation capacity and construction is expected to commence at the beginning of 2007. Karuma hydropower project is expected to add 200 MW of generation capacity and construction is expected to start in September 2007. A 50 MW, HFO thermal plant at Mutundwe Kampala as well as a 100 MW HFO thermal at Lugogo/ Namanve are also expected to come up soon. The Norwegian Power Group (SN Power Invest AS, Alston and Norplan) has finalized feasibility studies for mini hydro projects at Waki (5 MW) and Bugoye (11 MW) for which construction work is expected to begin in December 2006. Shan Chuan Jiulong Ltd of China has also finalized feasibility studies for generation of 6 MW at Kikagati and construction is expected to begin in late 2006. Eco power of Sri Lanka is finalizing studies on Ishasha (5 MW) and Kakaka (8 MW) and plans to begin construction by early 2007. Hydromax has carried out feasibility studies on River Wambabya, Buseruka (10 MW) and is putting together financing for the project.

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6.5 Cultural heritage

6.5.1 Overview

Cultural heritage resources are symbols of spiritual, aesthetic, social, economic and environmental traces of humanity. At the UNESCO conference of 1972, cultural heritage was described as monuments, groups of buildings and sites with historical, aesthetic, archaeological, scientific and ethnological or anthropological value. Palaeontology and archaeological sites can inform us about the history of humankind's impact on the environment, use of resources, creativity, genuineness and evolution (Taboroff 1992). Uganda is endowed with a rich cultural heritage, which consists of palaeontological, archaeological, historical and traditional sites and monuments. The country is also rich in other intangible heritage of ethnographic nature, some of which have been collected since 1900.

Intangible heritage is defined as the practices, representations, expressions, knowledge, skills as well as the artefacts and cultural spaces associated therewith (UNESCO 2003). It forms part of the universal heritage of humanity that brings together different peoples and social groups asserting their cultural identity and also defining the roots of people in contemporary culture (Seitel 2001). Intangible cultural heritage follows the realms of oral traditions and expressions built on language as the major vehicle. It also includes performing arts, social practices, rituals and festive events, knowledge and practices concerning nature, the universe and traditional craftsmanship (ACCU 2004). One spectacular example of traditional craftsmanship in Uganda is the bark-cloth making of the Bantu peoples of Uganda (*Box 6.1*).

Box 6.1: Bark-cloth making among the Bantu of Uganda

Bark-cloth making skills of the Bantu peoples of Uganda are a rich and ancient craftwork. The Ngonge clan craftsmen of Nsangwa are the re-known royal bark cloth makers for the kings, princes and princesses of Buganda Kingdom. According to the legends, the skill of making the cloth is dated 600 years old, which is passed on from generation to generation as hereditary occupation. Bark cloth has links to the legends associated with the origins of the Baganda people and as a result they take high esteem in the cloth as the emblem of the Ganda culture. Its history is rooted in folklore, religious and cultural traditions, rituals, healing ceremonies and the cloth is also used in coronation ceremonies, political and cultural gatherings involving the royalty as well as in sacred places, burial storage, decorations, and souvenirs.

Source: Seitel (2001)

6.5.2 Institutional capacity of cultural heritage in Uganda

Uganda's' cultural property are protected under the *Historical Monument Act No. 22 of 1967* and the *Amendment Decree of 1977*. The main of objective of the *Act* was to provide for the preservation and protection of historical monuments and objects of archaeological, palaeontological, ethnographical and traditional interest and for other matters connected there with. The *National Environment Act Cap 153* also provides for the protection of the country's cultural heritage. According to the Ministry of Tourism, Trade and Industry (MTTI) 2006, there are so far about 357 sites and monuments that have been identified and documented. The ones included in the World Heritage list are the Kasubi Tombs, Bwindi Impenetrable and the Rwenzori Mountain national parks (UNESCO 2004). Besides the ones on the World Heritage list, Uganda has more cultural heritage sites found almost in all the regions of the country. Regional examples of these sites are given below.

6.5.3 Regional Endowments

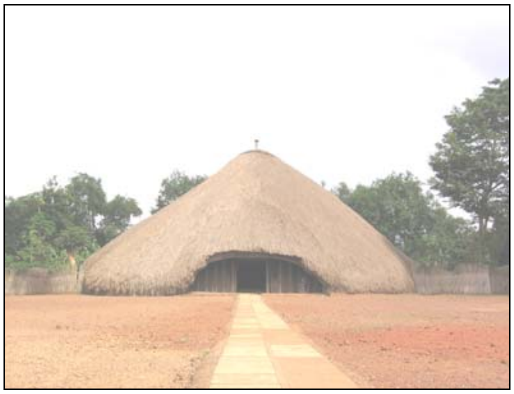
6.5.3.1 Central Region

i) Kampala District

- **Kasubi tombs**

Kasubi tombs also known as the Ssekabaka's tombs, located on Kasubi hills in Kampala, are active religious place in the Buganda Kingdom. It was built in 1881 by King Sunna II, and later rebuilt by King Mutesa I in 1882. The Kasubi tombs owe its cultural significance as the burial ground for the previous four kings (Kabakas) of Buganda. Consequently, it is a very important religious centre for the royal family and a place where the Kabaka and his representatives frequently carry out important rituals related to the Ganda culture. The tombs are also an outstanding example of traditional Ganda architecture and an exceptional testimony of the living Ganda traditions.

Plate 2: Exterior (Kasubi tombs) **Interior (Kasubi tombs).**



ii) Mukono District

- **Ssezibwa Falls**

The sacred Black River Falls is located 3 km off the Mukono – Jinja Highway in Ssezibwa, Mukono District. Ssezibwa Falls is recognized by its dynamic mixed heritage property, which has both natural and cultural landscape interpretations. The Black Falls provide beautiful scenery, with caves and a forest reserve that has more than 100 species of birds and a variety of plant species including the *Ficus natalensis* from which bark cloth is made. The cultural landscape comprises of caves of which one is used as a shrine where a traditional healer performs rituals and cultural ceremonies ─ an example of a living cultural heritage. In 1889, Kabaka Mwanga II planted the bark cloth tree to show his love for the site and subsequently, in 1954 Mutesa II planted more trees to enhance the site for leisure and recreation.

Plate 3: Ssezibwa Falls

6.5.3.2 Eastern Region

i) Jinja District

- **The source of River Nile Monument**

The monumental pillar erected at the steep western bank of the River Nile symbolises the point where John Hannington Speke stood on the spot and saw the source of River Nile on the 28th July 1862. The local community named the river as Omuga wa kiyira.

6.5.3.3 Northern Region

ii) Moroto District

- **Napak**

It's a "Miocene" fossilliferous site where deposits of fossil materials over a period of about 20 million years ago are collected. The discoveries of the palaeontological collections give evidence of the origin and evolution of animal species, vegetation pattern, landscape features, and the humankind imprint on the landscape (Bishop and Clark 1967).

Plate 4: Napak Rocks

ii) Apac District

- **Olum Footprints**

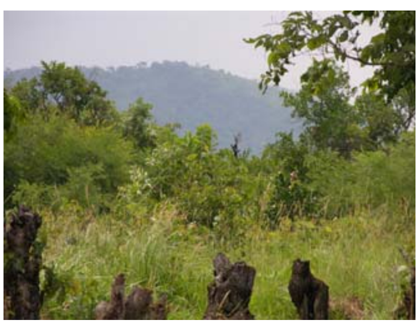
These are ancient footmarks of adult humans on a lateritic rock enshrined in Acandano Village, Ibuje sub-County, Apac District. The footmarks are surrounded with "cups" and "oval" shaped engraved depressions symbolizing children games. The footprints are landmarks where the Langi trace their ancestral roots and spiriturial beliefs.

ii) Yumbe District

- **Ambala Cultural Village**

The Ambala tribe is found extreme north of Yumbe District. Unlike other tribes of West Nile, the Ambala people inherited their culture from the ancestral site in Kei. The Ambala tribe connect their beliefs and traditions with the remains of the cultural objects found in Kei Wildlife Reserve. On February 7th of every year, the clan members from the Sudan, DR Congo and Uganda converge for annual spiritual ceremonies at the Cultural Village. They perform ritual feasting, trial on the footmarks of their ancestor *Okuna* and view his burial site and grave including other stone tools.

Plate 5: Ambala Burial Site



6.5.3.4 Western Region

i) Kasese District

- **Lake Katwe salt work**

Lake Katwe, a crater lake within the Albertine rift, is known for local salt production, which is a symbol of living traditional industry being practiced since the pre-colonial times. The local salt mining is a testimony of African technological development interacting with the natural environment without endangering the ecosystem. The indigenous salt production involves extracting large slabs of salt that are floated on rafts and heaped ashore for direct sale or sun dried into high quality salt granules in mud pans constructed along the bank of the Lake.

Plate 6: Katwe Salt Lakes

ii) Hoima District

- **Katasiha Fort**

Captain Thrustan built the fort in February 1894 after colonel Colville's expedition against the *Omukama* (King) Kabalega of Bunyoro (MCCD 1969). There were a series of forts built such as Kibiro on Lake Albert, Katasiha and Baranwa on the Kafu River to suppress Kabalega's resistance. However, in October 1898 when the British forces moved towards Murchison Falls, Kabalega's people had resorted to guerrilla warfare and destroyed the Katasiha Fort.

- **Mparo tombs**

The Kabalega's tombs, Mparo is the burial grave for Kabalega who was the *Omukama* of Bunyoro from 1869 until he was forcefully deposed by the British in 1898 and exiled in the Seychelles Islands. He was later allowed to return in 1923 but died on way at Mpumudde in Jinja and his body was buried at Mparo. The tombs are enclosed in a grass-thatched hut with mud walls surrounded with reed fence. In the yard, Sir Tito Owinyi, a successor to Kabalega and his mother were buried.

Plate 7: Mparo Tombs

6.5.4 Sustainable development of cultural heritage

Spaling *etal.* (1996) and Jukka (2001) define cultural sustainable development as *"the development that is shaped by and takes into account its impacts on the shared ideas, beliefs and values as well as the intellectual, moral and aesthetic standards of a community. It is guided by the principles of cultural diversity, cultural change, cultural holism, cultural sovereignty and cultural relativism"*. Thus, sustainable development of cultural resources envisions foreseen consequences of its diverse activities ensuring continuity of process. The aim is to build humanity on a desirable social justice that fulfils the people's cultural material and spiritual needs in equitable ways.

Uganda became a state party to the World Heritage Convention in 1994 and by signing the convention; it pledged to conserve its cultural heritage for prosperity and future generations and recognised universal values of monuments and sites within its borders. However, in recent years the pledge has become somewhat harder to perfectly achieve due to a number of pressures and threats to these sites and monuments. Pressures and threats include, among others, inadequate financial resources for the conservation of some of these sites and monuments, vandalism, population growth, loss of cultural legacy due to HIV/AIDS and attitude change among the youth.

6.5.5 Threats and challenges to cultural heritage

Cultural heritage resources in Uganda are threatened by destruction and deterioration. The destruction of cultural heritage is irreversible and its reconstruction is not always authentic, hence losing its spiritual meaning or historical significance (SIDA 2004). The effectiveness of cultural heritage protection in Uganda is limited with the major challenge being inadequate financial resources to recruit enough personnel to enforce the legislation regarding gazetted sites.

From 1994 till now, Uganda's population has nearly doubled. Taking into account that most Ugandans live off the land and other ENRs goods and services, cultural sites and monuments that stand in the way of agricultural expansion and settlement are regarded as obstacles to livelihood and survival. The need for more farmland and/or land for settlement have increasingly become critical as the population continues to grow. Consequently, cultural heritage sites are becoming targets for cultivation and settlement (Taboroff 1992). For instance, Fort Lugard, one of the historical sites in Kampala, is being demolished and altered in spite of its historical significance (MTTI 2006). Besides their being converted into farmlands or settlements, the sites have often suffered other hazards associated with human habitation. Indiscriminate dumping of garbage, noise, dust, vibrations and other human activities such as vandalism has become common. In some cases, vandalism has taken the form of graffiti and other inscriptions on ancient rock paintings, historical art, interpretations, traditions and religious symbols ending up defacing them.

Other threats to cultural heritage in Uganda, particularly the intangible heritage are the loss of cultural legacy and changing values and attitudes among the youth. Although Uganda has won several praises in its fight against HIV/AIDS, the war is still far from over and the disease still has some serious implications for Uganda's future society. With more and more young people getting affected with the disease, there is fear of discontinuity in passing over oral histories or traditions from the elderly into the future (Khanakwa 2002). Thus, there are worries that a "generational vacuum" could easily occur between the present generation and the next resulting in the loss of cultural legacy as the HIV/AIDS scourge rages on. This, ultimately, could lead to the loss of oral histories, extinction of minority languages and the breakdown of traditional healers, artists, craftsmen, folk tellers and custodians of cultural or historical sites. Many youths, by exposure to "western" lifestyles mainly through films, TVs, magazines, etc. are currently dissociating themselves from the indigenous knowledge, skills and cultural practices of craft making and traditions leaving them to the elderly who are dying away. This could lead to the extinction of indigenous knowledge and other cultural practices in the future.

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7.0 LINKAGES

7.1 Macroeconomic development and environment linkages

7.1.1 Economic performance

The Ugandan economy experienced a strong growth in 2005 of 5.8 per cent, only marginally lower than 5.9 per cent recorded in 2004 (AfDB/OECD, 2006) but much higher than the 4.8 per cent projected in the national budget statement of 2005/06 (MFPED, 2006). According to the National Statistical Abstract (UBOS, 2005) cash crop and livestock production have grown at a much faster rate than food crops (*Table 7.1*). Agriculture was adversely affected by a serious drought, however, and grew by a mere 2.1 per cent in 2005. Long-standing problems of poor soil conditions, pests and crop diseases also continued to hold back agriculture. Food crop production expanded at only 1.7 per cent in both of the last two years, well below the 2001 peak of 8.2 per cent growth (AfDB/OECD, 2006).

Table 7.1 Agricultural sub-sector's GDP growth rate, 2003/04 – 2004/05 (% in real terms)

Types of crops	2003/04	2004/05
Cash crops	0.3	4.8
Food crops	1.5	0.7
Livestock	1.1	5.3
Total	0.8	1.5

Source: MFPED (2006)

Uganda's poverty eradication action plan (PEAP) recognises five pillars, which underpin efforts to eradicate poverty. These are economic management, enhancing production, competitiveness and incomes, security, conflict resolution and disaster preparedness, good governance, and human development (*Table 7.2*). The Uganda government's economic management plan consisted of a long-term 7 per cent annual gross domestic product (GDP) growth.

Table 7.2: PEAP indicators for economic development and performance between 2002-2005

Performance indicator	PEAP Targets	Actual Achievements by financial year			
	2013/14	2002/03	2003/04	2004/05	2005/06
GDP growth per annum %	7.0	4.7	5.5	6.2	5.8
Fiscal deficit	6.5	10.4	10.6	8.8	
Fiscal deficit (% of GDP)	15.8	12.2	12.7	12.8	
Enhanced revenues (% of GDP)	22.5	22.6	23.2	22.7	
Reduced expenditure (% of GDP)	<5.0	2.4	5.0	4.7	

Source: MFPED (2006)

The average GDP growth rate achieved of 5.5 per cent per annum was below the set target. This was attributed to the declining trends in agricultural output. This has also been aggravated by the volatility of the headline inflation. The slow-down in agriculture output has been associated with the reliance on rain-fed agriculture. In addition, the rate of growth of Uganda's population is putting more pressure on land; through land fragmentation and on the forest reserves that are encroached for settlement and agriculture and swamps that are reclaimed for agriculture. To enhance production, competitiveness and incomes can be achieved through intensifying agricultural production and productivity, as a means of increasing the incomes of the poor and increasing non-farm employment.

Table 7.3: Performance indicators on natural resource management in Uganda

Performance indicator	Baseline (2002/03)	Target (2007/08)	Actual achievements (2004/05)
Growth of agriculture	3.8%		1.8%
Percentage of titled land	12%	17%	
Percentage of land under forest cover	24%	27%	
Distance travelled by villagers to firewood sources	0.73	0.5	
Roads in good condition	75%	100%	80% national; 60% district 20% urban roads; 10% community roads
Percentage of rural households accessing electricity	3%	9%	4%
Cumulative storage capacity of water for production	13.1Mm^3	15.0Mm^3	13.7Mm^3
Increase in irrigation areas	7,600 ha	8,500 ha	
Percentage wetlands with sustainable management plan	7.5%	20%	

Source: (MFPED, 2006)

7.1.2 Performance of trade in environmental and natural resources

Nearly all Uganda's agricultural production is carried out by smallholder farmers. External production is only found in sugarcane and tea estates and the flower sub-sector. In 2005 exports grew at a rate of 10 per cent to US$ 812.86 millions (UBOS, 2006). Coffee was again the major export and it grew at 7 per cent in dollar terms. Coffee has maintained the lead as the main foreign exchange earner, although its share to total export earnings declined from 20.7 per cent in 2002 to 18.7 per cent in 2004 then increased to 21.3 per cent in 2005 (UBOS, 2006).

Table 7.4: Uganda's exports by value ('000 US $), 2001 - 2005

Commodity	2001	2002	2003	2004	2005
Traditional export crops					
Coffee	97,652	96,626	100,233	124,237	172,942
Cotton	13,434	9,519	17,755	42,758	28,821
Tea	30,031	31,293	38,314	37,258	34,274
Tobacco	32,006	45,262	43,042	40,702	31,488
subtotal	173,213	182,700	199,344	244,955	267,522
Non traditional Exports					
Fish and Fish products	78,150	87,945	88,113	103,309	142,691
Others	200,402	196,960	246,649	316,825	402,644
subtotal	278,552	284,905	334,762	420,134	545,335
Total Exports	451,765	467,605	534,106	665,090	812,857

Source: UBOS (2006)

The contribution of traditional exports (coffee, tea, cotton and tobacco) to the overall exports value has further declined from 39.1 per cent in 2002 to about 33 per cent in the year 2005. The non-coffee commodity exports grew at an even faster rate of 11.1 per cent contributing US$ 563 from the private sector. The non-traditional exports (NTEs) have maintained their contribution to total export earnings of over 60 per cent. There has been a general increase in the export share from 60.9 per cent to 67.0 per cent in 2002 and 2005 respectively (UBOS, 2006). Fish exports increased from US$ 103.3 millions to US$ 142.69 millions. The other items in the NTEs category that attracted considerable earnings are maize and cut flowers and roses. However, the contribution of cut flowers and roses to total exports reduced from 4.1 to 3.0 per cent in 2003 and 2005 respectively. On the other hand, electricity had its contribution to total export falling from 2.6 per cent to 0.6 percent in 2003 and 2005 respectively (UBOS, 2006).

7.1.3 Uganda's performance towards achieving the MDG and PEAP targets

Uganda's performance towards achieving the millennium development goals (MDGs) shows that progress is on course for reducing extreme poverty and hunger, achieving universal primary education and access to safe water. However, with regard to health the reduction of child mortality, improvement of maternal health may not be achieved if the current trend of developments in the sector is to be followed. Indeed, there is uncertainty whether reduction in child mortality and maternal health care in Uganda will be determined because the status of health care is determined by other factors such as the internally displaced communities in northern Uganda. Outside of health care and with better policies, institutions, and additional funding, extreme poverty and hunger can be eradicated; universal primary education has already been achieved; gender equality is on course; the prevalence of HIV/AIDS has been reduced to less than half from the 1990 levels, malaria and other diseases can be reduced; and environmental sustainability is on course.

Table 7.5: Uganda's performance on MDG and PEAP targets

	1990 (or closest available)	2005 (or latest available)	2007/ 2008 PEAP target	2013/ 2014 PEAP target	2015 MDG Target	Target possible at current rate?	Target possible with better policies, institutions. additional funding
1. Eradicate extreme poverty and hunger	**2015 target = halve 1990 $1 a day poverty and malnutrition**						
Poverty headcount ratio (%)	56	38		28**	28	yes	yes
Prevalence of child malnutrition (% of children under 5)	23	23			12	no	yes
2. Achieve universal primary education	**2015 target = net enrolment etc, to 100**						
Net primary enrolment ratio (% of relevant age group)	58 boys	87 boys	90 boys	100*	100	yes	yes
	48 girls	86girls	89 girls				
Primary completion rate (% boys and girls		56	69		100	met	yes
3. Promote gender equality							
Ratio of girls to boys in primary education (%)	83	99	100*	100*	100	met	yes
4. Reduce child mortality	**2015 target = reduce 1990 under 5 mortality by two=-thirds**						
Under 5 mortality rate (per 1000)	177	152			53	no	uncertain
Infant mortality rate (per 1000 live births)	98	88		68	32	no	uncertain
Immunisation DPT3 (% of children)	45	83		90		n/a	
5. Improve maternal health	**2015 target = reduce 1990 maternal mortality by three-fourths**						
Maternal mortality ratio (modelled estimate, per 100,000 live births)		505	354		126	no	uncertain
Deliveries in health centres (% of total)		24		50		n/a met	yes
6. Combat HIV/AIDS, malaria and other diseases	**2015 target = halt and begin to reverse AIDS etc,**						
Prevalence of HIV total (% of adult population)	20	6.2	5*		<20	met	yes

Table 7.5: Uganda’s performance on MDG and PEAP targets

	1990 (or closest available)	2005 (or latest available)	2007/ 2008 PEAP target	2013/ 2014 PEAP target	2015 MDG Target	Target possible at current rate?	Target possible with better policies, institutions. additional funding
7. Ensure environmental sustainability	**2015 target =integrate into government policies reverse loss of environmental resources, halve proportion of people without access to safe water and sanitation**						
Forest area (% of total area)		24	27*	30*	>24		
	45	65 urban	100* urban		90	yes	yes
Access to safe water (% population)	55 rural	90* rural					
		65 urban	100* urban				
Access to improved salinisation (% of population)		56 rural	80* rural				
Titled land		13	17				
8. Develop a Global Partnership for Development	**2015 targets = sustainable debt, make available benefits of new technology**						
Debt service ratio		305	238	187		yes	yes

* PEAP targets more ambitious than MDGs
Source: World Bank (2005)

7.2 Poverty and environment linkages:

7.2.1 Causes of poverty in Uganda

Two of the greatest global challenges are elimination of poverty and the reversal of environmental degradation (DFID, 2002). The priorities of many poor people demonstrate a direct and indirect link between the environment and poverty. The poor are concerned about livelihood opportunities such as jobs, livelihood security; food security; education; access to basic services such as energy, water and sanitation; health; and a decent place to live. The link between environment and poverty is strong. In fact, since the Rio Earth Summit in 1992, the importance of sound environment management to sustainable livelihoods has been widely acknowledged. Income derived from the environment is a major constituent of the livelihoods of the rural poor, and this direct dependence on nature does not appear to be decreasing (UNDP, 2005). Since the launch of the Uganda Poverty Participatory Assessment Process (UPPAP), the communication of the causes of poverty has emerged from the communities themselves, with 12 districts[5] representing the country in the second participatory poverty assessment (PPA2), an

[5] From the central region: Mubende, Wakiso and Rakai; Eastern: Bugiri, Jinja, and Soroti, Western: Masindi, Ntungamo and Bundibugyo; and Northern: Moroto, Arua and Kitgum.

increase from the nine districts used for the first participatory poverty assessment (PPA1). In separate assessments used for the poverty status report 2005 (MFPED, 2006) six districts were used for the welfare assessment.

Table 7.6: Districts considered in the poverty (PPA1 and PPA2) and welfare assessments

	PPA1	PPA2	MFPED (2006)[6]
Districts considered	Kalangala; Kisoro; Kabarole; Kumi; Kapchorwa; Kotido; Moyo; Kampala; Bushenyi	Mubende; Wakiso; Rakai; Jinja; Bugiri; Soroti; Moroto; Kitgum; Arua; Bundibugyo; Ntungamo; Masindi	Masaka; Lira; Kamuli; Pallisa; Tororo; Bundibugyo

Source: Adapted from PPA1, PPA2 and MFPED (2006)

The most frequently mentioned causes of poverty in Uganda also show a close linkage with environmental concerns. The poverty causing concerns, in order of importance, are poor health (50 per cent); limited access or shortage of land (47 per cent); lack of markets or market access (40 per cent); unemployment (38 per cent); high taxes (35 per cent); low commodity prices, lack of education, limited capital large family size with dependants and excessive alcohol consumption (33 per cent); death of a family member, HIV/AIDS, pests and diseases, ignorance and lack of information (27 per cent); low productivity (25 per cent); and lack of credit facilities (23 per cent) (MFPED 2002).

The environment is also a source of vulnerability. Environmental factors contribute substantially to the burden of ill-health that the poor suffer. In addition, low-income families are especially vulnerable to natural disasters and environment-related risks such as the growing impacts of global climate change. Environmental risks such as unclean water, exposure to indoor air pollution, insect-borne diseases and pesticides account for almost a quarter of the global burden of disease and even greater proportion of the health burden of the poor (WRI, 2005). The poor are far more likely to be exposed to environmental health risks than the rich by virtue of where they live. The poor also have much less access to good health care, making their exposure more damaging. In turn, poor health is an important obstacle to greater income and a contributor to diminished well-being in every dimension of life.

At the end of 2006, income poverty still stood at 38 per cent, as was the case in 2003, with 42 per cent of the poor being rural dwellers and 12 per cent urban residents (MFPED, 2006a). With the exception of northern Uganda, 52 per cent[7] of households reported an improvement in welfare associated with accumulation of assets particularly

[6] Out of poverty report (MFPED, 2005) and the Ladder II study (2005)
[7] Based on the moving out of poverty study conducted by MFPED (2006)

land and livestock. 40 per cent of households reported a worsening welfare particularly in the districts of Masaka, Lira and Kamuli (MFPED, 2006b). The decline in welfare was associated with a scarcity of land available for production. As populations increase in some areas the working age population is increasingly becoming landless as the land has been severely fragmented and some other renewable natural resources have also declined.

Table 7.7: Reasons for decreases in self ranking welfare

Reasons for welfare Ladder change/ stagnation	PPA1 Reporting community (%)	PPA2 Reporting community (%)	% of households ranking reasons that made them worse (MFPED, 2006)*
Problems with children/dependants	42	33	16.3
Job/ loss of employment	---	38	16.0
Death of family members	---	27	9.5
Ageing	---	---	8.8
Health problems	67	50	8.5
Natural disasters	---	---	5.4
Insurgency	40	---	---
Lack of market access	44	40	---
Lack of education	50	33	---
Economy got worse	---	---	3.7
Lack of financial facilities	50	23	---
Loss of business	---	33	3.7
Low agriculture yield	---	25	3.1
Divorce or separation	---	---	2.7
Pests and diseases	---	27	---
Death of animals	---	---	2.4
Vulnerable market prices	---	---	2.4
Others	---	---	14.0

Source: MFPED (2006); MFPED (2002): * cumulative percentage used for MFPED (2006); in PPA1 and PPA2 multiple-responses were allowed for each respondent

According to the Moving out of poverty report (MFPED, 2005) and the Ladder II study (2005), low agriculture yield was identified by households as the second most important factor explaining the decline in human welfare, behind health concerns (*Table 7.7*). Low agricultural productivity and health problems are directly derived from fears about the declining environmental resource. The other major causes of welfare decline are also clearly linked to the environment and they include: death of animals due to diseases such as foot and mouth disease, death of family members who contribute income to the household, which has in many cases been blamed on HIV/AIDS, ageing and natural disasters. In the later years problems have been defined largely as social, for example, a large family causes worries about how to take care of the children both in terms of feeding and educating them. Even from PPA2 unemployment was emerging as a major concern and one-sixth of a representative sample of Ugandans in 2005 attributed the low welfare status to unemployment. Yet according to the African economic outlook Uganda’s unemployment was low compared to the rest of the continent at 7 per cent. The Southern African region to which Uganda was classified has an average unemployment rate of 31.6 per cent (Economic Commission for Africa, 2006). Health problems continue to be an important cause of poverty in Uganda. Other concerns that have stayed high as causes of low welfare status are natural disaster, such as heavy rains that cause land slides (UN-Water, 2006), worries about the state of the economy and business and low agricultural productivity.

Other hidden causes of poverty, which impact on the environment are: poor infrastructure: a survey of 243 firms found that firms often have to purchase their own generators because of unreliable energy supply. This cost represents 25 per cent of the firm's total investment in equipment and machinery. And many small firms cannot afford a generator. Given the constraint of public resources, infrastructure is a promising field for public-private partnerships (Economic Commission for Africa, 2006).

7.2.3 Agricultural production land, poverty and environment linkages

Crops are the dominant (70 per cent) source of rural household incomes followed by non-farm activities (25 per cent) and livestock (5 per cent) (IFPRI, 2003). Nationally, beans are the most extensively grown crop (17 per cent), followed by cassava (17 per cent), maize (14 per cent), sweet potatoes (12 per cent) and bananas (11 per cent) (UBOS, 2004). Coffee is grown on only 3 per cent of crop plots (UBOS, 2004). The principal food crops that contribute to the national diet are root crops, which contribute 32 per cent of the calories that is cassava (22 per cent) and sweet potatoes (10 per cent); bananas 30 per cent, cereals 19 per cent, pulses 8 per cent, oil crops 4 per cent, and milk and meat 4 per cent (MAAIF *et al.,* 1999). Nearly, all agricultural output comes from smallholder farmers with the exception of tea and sugarcane, the bulk of which is grown on commercial estates.

Livestock contributed 13 per cent of the total agricultural GDP between 2001/02 - 2004/05 (UBOS 2005b). Although several studies suggest that livestock was increasingly becoming a major asset and source of income for rural households, especially in the central and south western parts of the country (Sserunkuuma, 2001), civil disturbances combined with cattle rustling and disease led to dramatic decrease of livestock in Northern Uganda, since the mid-1980s. For instance, 45 per cent of total livestock in northern Uganda was lost. In Gulu and Lira districts, 95 per cent and 68 per cent respectively of the cattle were lost (Action against Hunger, 2005).

7.2.4 Fisheries, poverty and the environment

Spanning artisanal fish production and industrial export trade Uganda's lake fisheries are worth over US$ 200 millions a year (*Table 7.8*). Fisheries in Uganda employ over 135 000 fishers and 700 000 small-scale operators in processing, trade and associated industries (World Fish Centre, 2005). The fish sector is one of the most important economic sectors in the country. Current projections indicate that fisheries will have become the major agricultural export of the country in 2006, surpassing coffee exports. Fisheries have created livelihoods for over 1.5 million people in Uganda and are said to employ over 350 000 people (MAAIF, 2004). Small-scale fishers carry out most of the capture fish harvests. Total volumes captured are expected to increase by 71 per cent from 416 000 tonnes in 2005 to 712 000 tonnes in 2006. Domestic consumption is dominant largely because fish is a major source of protein for low income people (Keizire, 2004). Exports, both to the regional and international market, were expected to be only 10 per cent of the volume of fish catches. There has been an increasing concern that most of the Nile Perch captured is exported and domestic consumers largely consume the left over skeleton (UNDP, 2005). Indeed, there are ongoing research efforts to increase the volume of Nile Perch through breeding and commercial fish farming to fill the gap of growing trade and domestic demands (Nyeko, 2005).

Table 7.8: Trends in fish trade in Uganda between 2002 and 2006

Indicators	**Actual**				**Projected**
	2002	**2003**	**2004**	**2005**	**2006**
Volume of catch ('000 tonnes)	222	242	249	416	712
Domestic consumption	190	209	210	366	649
Regional exports	6.88	7.77	8.79	10.98	15.92
International exports	25.2	25.1	29.8	38.9	56.0
Export volumes					
Regional exports	6.88	7.77	8.79	10.98	15.92
International exports	25.2	25.1	29.8	38.9	56.0
Processing ratio	2.5:1	2.5:0	2.5:1	2.5:1	2.5:1
Export price (fob U$/kg)					
Regional exports (fob U$/kg)	1.34	1.53	1.63	1.71	1.80
International exports (fob U$/kg)	3.48	3.0	3.416	3.685	3.931
Export earnings (US$ million)					
Regional exports	9.2	11.9	14.3	18.8	28.6
Regional exports share of international exports (%)	11	14	14	13	13
International exports (%)	87.6	86.4	101.8	143.2	221.6

Source: UBOS (2006)

The second participatory poverty assessment process (PPA2) indicated that in most fishing communities, boat owners constitute the wealthiest group and these groups are largely (96 per cent) men. In terms of income distribution by gender, it is apparent that the wealthier group within the poor categories of those depending on the fisheries sector is men. However, there are indicators of positive changes in poverty levels amongst fishing communities. PPA2 indicates that in most major landing sites (especially on Lakes Victoria and Kyoga), fishermen and boat owners, who sell mainly Nile Perch, have invested in shops, video halls, restaurants, and lodges at landing sites and as a result, they have become local leaders and/or opinion leaders (Bahiigwa and Keizire, 2003). In PPA2 it was discovered that in most fishing communities, few women own boats and almost none go fishing as fishermen (persons) neither are they fishmongers. A high number of women are involved in fish processing and marketing and as such a substantial value of money was added to the fish production chain by these fishmongers (UNEP/NEMA, 2006).

7.2.5 Land use and poverty

Participatory poverty assessment II (PPA2) highlighted the problems of limited access to land and land shortage as one of the most important causes of poverty in Uganda, both in rural and urban areas. Recent evidence suggests that the trend of land ownership has worsened with poorer households having much smaller land sizes and increasingly becoming landless. The rural livelihoods study conducted in Mbale, Kamuli and Mubende shows that land access in rural Uganda is shrinking, especially in densely settled farming areas. The typical farm size in 2005 ranged between 0.5 and 1.0 hectares compared to an average of 0.75-1.5 hectares in 2001 and 1.5-2.0 hectares ten years ago (*Table 7.9)*. Indeed, close to 40 per cent of the sampled households owned less than 0.5 hectares. The decline in farm size has been experienced by households with smaller land sizes suggesting increasing inequality in access to land especially by poorer households.

Table 7.9: Land ownership in three sample districts and the national average 2001 - 2005

Area owned	Mbale		Kamuli		Mubende		All districts	
	2001	2005	2001	2005	2001	2005	2001	2005
Less than 0.5ha	32.3	38.5	64.6	57.0	18.7	22.0	37.2	38.4
0.5-1.0ha	27.1	22.9	11.4	16.5	13.2	22.0	17.7	20.7
1-2ha	16.7	18.8	12.7	13.9	28.6	17.6	19.6	16.9
2-3ha	7.3	7.3	3.8	6.3	14.3	16.5	8.7	10.2
3-4ha	5.2	4.2	1.3	1.3	11.0	12.1	6.0	6.0
>4ha	11.5	8.3	6.3	5.1	14.3	9.9	10.9	7.9
No. of households	96	96	79	79	91	01	266	266

Source: Frank Ellis (2006) in MFPED (2006)

The reasons for the landlessness included lack of proper land regulations and effective land management structures; sometimes land is managed and allocated in corrupt ways with poor planning, and lank of capacity to settle land conflicts (MWLE, 2005). In Kibaale district, due to the large number of absentee landlords and the continuous exodus and resettlement of people from other parts of the country, landlessness and conflict over land have become acute. Internal displacement and the refugee factor have caused landlessness in Gulu and Kyenjojo districts, while Nakasongola also suffers the problem of absentee landlords. However, in Nakasongola there is also the problem of migrants from the neighbouring districts of Apac and Lira who came as a result of the civil strife in their area, and have since settled to form new communities. This is compounded by the fact that most of the new settlers have chosen to stay in the community forest reserve areas, which are already depleted by excessive harvesting for charcoal production, use by cattle keepers in the dry season as the last resort source of feed for their animals. This situation has put enormous pressure on the Nakasongola forest reserves. Additionally, some of the descendants of Nakasongola, who had left the area in the 1960s in search of better agricultural grounds, were forced to return by their hosts (Nakasongola DSOER, 2004; NEMA/UNEP, in Press).

Nationally, arable land per capita was expected to decline from 1.1 hectares in 1991 to 0.6 hectares in 2015 (NEMA 2001). However, the population has risen so much faster that with a population of 27.4 million towards the end of 2006 (UBOS, 2006) and total arable land at 16.7 million hectares (MAAIF, 2000), the arable land per capita is 0.61 hectares.

The widespread lack of access to land has had a negative impact on the production potential and social welfare of a significant number of households in Uganda. Lack of legal ownership of land has left much of the land unutilized or underutilised with the majority of households engaging in short-term investments with low returns.
Land fund: the land fund was established in 1998 to resettle landless people, enable government purchase or acquire registered land and assist poor people to acquire title deeds; however, it is still facing many challenges. Recent evidence from Kyenjojo, Nakasongola, Kibale and Gulu (MWLE, 2005) indicate the following:

- The fee of 35 000 – 40 000 paid per acre as compensation is so small in relation to the size and value of land. This has hampered the government process to acquire land and also deterred the absentee landlords from selling their mailo land rights to government.
- The process of the Land Fund and that of compensation is so slow and cumbersome that the impact is not felt on the ground.
- Funding is limited and this has hampered management and outreach of the Fund
- Lack of transparency and information in the management of the fund
- Limited outreach to the intended beneficiaries such as internally displaced persons.

7.2.6 Water

Water supply and sanitation are among the key issues emphasized under the national poverty eradication action plan (PEAP), which is the key government framework for ensuring poverty eradication through creation of an enabling environment for rapid economic development and social transformation (UN-Water, 2005). Water is the “lifeblood” of agricultural practice worldwide. However, water scarcity is a major constraint on rain-fed agriculture. As well as being a consequence of low or erratic rainfall, the perceived water scarcity may be caused by choices made by the farmer, e.g. of a crop or variety sensitive to water stress, or by inadequate management of available water from rainfall. Inappropriate practices in a particular context can have a dramatic effect on water resources management and soil moisture availability. In order to minimize the impact of drought, soil needs to capture the rainwater that falls on it, store as much of that water as possible for future plant use, and allow plant roots to penetrate and proliferate. Any problems with one or several of these conditions cause soil moisture to be a major limiting factor for crop growth. Where natural rainfall patterns or quantities do not allow reasonably secure satisfaction of crop water requirements, the conventional answer to water deficit has often been to increase water availability through irrigation systems (FAO, 2004).

The percentage of rural inhabitants with access to improved sanitation increased from 68 per cent in 1991 to 85 per cent in 2002. However, access to clean and safe water is still far from universal (*Tables 7.10 and 7.11*). In 2003, only 59 per cent of rural inhabitants had such access. Frequently, people have to collect water from distant locations. This burden falls mainly on women and children, who are the most vulnerable members of society. The long distances they travel significantly reduce their productive time and subsequent contribution to the economic development of the country.

Table 7.10: Rural water supply by source

Source	2001	2002	2003	2004	2005
	Number of units available				
Spring	19,029	20,224	21,477	22,869	23,696
Borehole*	17,915	17,846	18,873	19,001	19,717
Shallow well	4,734	5,998	7,432	8,721	9,872
Gravitation Flow System	134	138	183	238	257
Taps*	4,058	4,233	4,803	5,768	6,182
Rural Population% coverage	50.2	51.2	53.5	56.9	60.8

Source: UBOS (2006)

Table 7.11: Rural water supply by source

Region of the country	Service			
	Number of people served		Percentage	
	2004	2005	2004	2005
Central	2,630,680	3,059,550	50.3	57.0
Eastern	3,016,410	3,437,300	48.3	52.8
Northern	2,789,005	3,001,800	52.7	54.0
Western	4,384,070	5,044,550	69.5	77.6
Grand total	12,820,165	14,543,200	55.6	60.8

Source: UBOS (2005) and UBOS (2006)

Water is a key strategic resource, vital for sustaining life, promoting development and maintaining the environment. Access to clean and safe water and improved sanitation facilities and practices are pre-requisites to a healthy population and therefore have a direct impact on the quality of life and productivity of the population. Besides domestic water supply, water is also vital for: livestock, industrial use, hydropower generation, agriculture, marine transport, fisheries, waste discharge, tourism, and environmental conservation. Water, therefore, significantly contributes to the national socio-economic development and thus poverty eradication.

Despite Uganda being well endowed with significant freshwater resources, the challenges of rapid population growth, increased urbanization and industrialization, uncontrolled environmental degradation and pollution are leading to accelerated depletion and degradation of the available water resources. Uganda is also faced with the challenge of low safe water coverage (59 per cent rural and 65 per cent urban, as of December 2003).

Water for food security will remain the dominant use of water around the world. However, there needs to be a shift in emphasis from traditional irrigation for national food self-sufficiency to a stronger focus on the specific needs of the poor (the ‘food insecure’). Policies that develop sustainable irrigation and also harness the wider potentials of rain-fed farming, on-farm water management, home gardens and foods from common property resources are needed (UN, 2001).

Low access to clean water has had many health implications in Uganda. According to a study carried out in 2002, diarrhoea alone accounted for approximately 19 per cent of infant mortalities in the country. Furthermore, statistics from the Ministry of Health indicate that malaria is the leading cause of child morbidity. Approximately 70 000 to 100 000 children in Uganda die each year from malaria. This represents 30 per cent of the country's child mortality rates (between the ages of 2 and 4 years), and accounts for 23 per cent of total disability-adjusted life years (DALYs) lost and 25 per cent of all instances of illness in Uganda. Estimates from the Ministry of Health indicate that the average expenditure on malaria related treatments are as high as US $300 millions annually. AIDS is the leading cause of death for people between the ages of 15 and 49 and is responsible for 12 per cent of all annual deaths.

The total potential irrigable area in Uganda is approximately 202 000 hectares (FAO, 1995). However, about 14 000 hectares of the potential irrigable area is under official irrigation and 6 000 hectares under unofficial irrigation, particularly for rice production. The total amount of water used for irrigation is 12 km3 per year, whereas the annual total renewable water resources are 66 km3. These figures reveal the high potential for irrigated agriculture in Uganda. Currently, most of Uganda's agriculture is rain-fed and thus more vulnerable during climatic variations.

Livestock production is concentrated along 'the cattle corridor' which runs from southwest to northeast across Uganda, encompassing twenty-nine districts. Animal husbandry is a considerable source of income. It represents 7.5 per cent of the GDP and 17 per cent of the agricultural GDP. However, water scarcity in the cattle corridor reduces productivity and triggers conflict among herders.

7.3 Health and the environment

Health is a state of complex physical, mental and social wellbeing and not merely the absence of disease or infirmity (WHO/UNEP, 2004). There are three major categories of ill health and they are communicable diseases such as HIV/AIDS; maternal, perinatal conditions and nutritional deficiencies; and non-communicable diseases e.g. cardio-vascular diseases. Poor health was one of the leading causes of poverty in Uganda according to the second Uganda poverty participatory assessment project (PPAP II) (MFPED, 2002), and this was re-affirmed in 2005 (MFPED, 2006). Environmental hazards and ecosystem degradation are a root cause of a significant number of health burdens. One-quarter of the global disease burden, 35 per cent of the disease burden of poor regions such as sub-Saharan Africa and in Uganda 80 per cent of the disease burden comes from environmental health problems (MOH, 2005). The commonest links to environment-related disease burden come from unsafe water, which causes diarrhoeal diseases, indoor smoke from solid fuels, and malaria, which kills over 1.2 million people in the world annually. Other links from environmental hazards include: air pollution, poisoning including agro-chemicals, which kill 224 000 people annually in developing countries, and climate change effects, which kill over 150 000 people annually including deaths from extreme weather and natural disasters (WHO/UNEP, 2004). The Tsunami that hit south-eastern Asia at the end of 2005 killed over 200 000 from a single disaster.

7.3.1 Environmental health problems in Uganda

According to the UBOS (2006) statistical abstract, malaria was the most prevalent illness at 51 per cent among the outpatient cases during the period 2002-2005. Of all the adults aged 15-59, 6.3 per cent are infected with HIV and 0.7 per cent of the children below 5 years are infected with HIV. The other two common cases of illness are acute respiratory infection (ARI - not pneumonia) and intestinal worms accounting for close to about 20 per cent and 10 per cent of illness cases respectively (UBOS, 2006).

Table 7.12: Out-patient proportional morbidity of the most common diseases, 2001-2005

Diseases	2002	2003	2004	2005
Malaria	47.9	48.1	47.6	51.2
ARI-not Pneumonia	18.5	19.4	19.8	19.8
Intestinal worms	10.9	10.7	10.0	9.7
ARI-Pneumonia	6.5	5.9	5.2	5.3
Diarrhoea diseases	5.5	5.8	5.7	5.8
anaemia	2.3	1.9	1.6	1.6
Other OPD diagnoses	8.4	8.2	10.2	6.7

Source: UBOS (2006)

Poor sanitation and hygiene continue to be a most predisposing factor to Uganda's disease burden. It is estimated that 80 per cent of the disease burden in the country is associated with poor sanitation. Currently, national latrine coverage is estimated at 57 per cent (MOH, 2004). Poor sanitation and unsafe water are associated with ill health, low productivity and poverty hence undermining government's efforts to alleviate poverty in communities.

7.3.2 Malaria

Malaria transmission is high in 90 per cent of Uganda, with 5 per cent of the country mainly in the highland areas. Therefore, 93 per cent of the total population is at risk of catching malaria (CDC, 2004). Although all four species of malaria parasites exist in Uganda, *Plasmodium falciparum* is responsible for over 95 per cent of cases. Major vectors are *Anopheles gambiae s.l.* (and within the complex mainly *A. gambiae s.s.*) and *Anopheles funestus*. Malaria contributes the major share of the disease burden in the country, with 39 per cent of outpatient visits and 35 per cent of inpatient admissions being due to malaria.

Clinically diagnosed malaria in the health management information system (HMIS) for governmental and nongovernmental organizations [NGO] increased from 5 million cases in 1997 to 16.5 million cases in 2003. This translates into a 2003 incidence rate of 0.98 malaria episodes/child/year in children under 5 and 0.64 in older patients. The two major reasons for this increase are thought to be 1) the abolition of user fees in the public sector resulting in increased use; and 2) increasing treatment failures due to drug resistance. The estimated case fatality rate in 2001 was 4.1 per cent of cases. In 2004, estimated annual numbers of deaths from malaria rose from 70 000 to 100 000. Prevalence rates for malaria parasitemia (asymptomatic) range from 50 per cent to 80 per cent in young children, 20 per cent to 50 per cent in older children and generally below 30 per cent in adults.

The Uganda national malaria control policy (1998) and in keeping with the health strategic sector plan (HSSP) and, as part of that, the minimum health care package, the Ugandan malaria control strategic plan FY 2001/2-2004/5 stated four main elements of the strategy for malaria control: case management, vector control; intermittent preventive treatment in pregnancy; and epidemic preparedness and control.
The ongoing programmes towards malaria control include:

- *Roll back malaria (RBM) partnership:* Specific structures have been designed to assist in this process, namely the inter-agency coordination committee on malaria (ICCM) and four working groups: case management/drug policy; vector control/insecticide-treated nets (ITN); advocacy/information, education and communication (IEC); and research.
- *Drug policy*: From chloroquine/sulfadoxine-pyrimethamine (CQ/SP) to artemisinin-based combination therapy (ACT). Before the year 2000 resistance testing was limited to chloroquine (CQ) and sulphadoxine-pyrimethamine (SP) but with the change of drug policy to a CQ/SP combination therapy (designed as an interim solution and implemented in 2002) testing of single drugs was abandoned. To date results are available for the following combinations: CQ/SP, amodiaquine (AQ)/SP and artesunate (AS)/SP.
- *Home-based management of fever (HBMF):* These further interventions target the treatment-seeking behaviour at the household level and in the private sector since all evidence showed that 50-80 per cent of fever episodes were treated at home with drugs purchased mainly from the private sector (shops and drug shops).
- *Intermittent preventive treatment (IPT) during pregnancy*: In 2002 and 2003, major efforts were undertaken to train all health workers in government and NGO facilities in IPT and to ensure consistent supply of drug and information materials. IPT has been integrated into HMIS data collection. Based on these figures, the current coverage with at least 2 doses of SP is estimated at 30 per cent in 2003. It was believed that a coverage rate of 45-50 per cent could be achievable by the end of 2005.
- *Insecticide treated nets:* Use of insecticide-treated mosquito nets (ITNs) is relatively new in Ugandan communities. In 2004 a national ITN voucher scheme for targeted subsidies was introduced in the context of the Global Fund malaria project. This scheme was expected to cover those two thirds of the country with adequate commercial infrastructure and help distribute 1.8 million ITNs within 3

years. Economically disadvantaged districts in the North and Northeast were to be served by a subsidized social marketing programme by Population Services International (PSI) and - starting with Africa Malaria Day 2004 - a biannual national campaign for free net treatment will be launched.

7.3.3 Diarrhoeal diseases

While malaria is the leading cause of morbidity and mortality in Uganda, and it is partly due to poor sanitation as well, diarrhoeal diseases are also a major killer of young children, they alone are responsible for 19 per cent of all infant deaths in Uganda. Cholera has become an endemic disease in some districts in the country. However, the incidence of diarrhoeal diseases (cholera and dysentery) fell from 6.4 per 1 000 persons in 2000/01 to 3.0 per 1 000 persons in 2004/05. Cholera case fatality rate (CFR) fell from 6 per cent in 2000/01 to 2.5 per cent in 2004/05, although the WHO recommends that the CFR should be below 1 per cent. Outbreaks were propagated mainly due to poor environmental sanitation, low safe water coverage (less than 50 per cent in some parts) for domestic and personal hygiene practices and constant mass movement of populations, especially among refugees and IDPs (MOH, 2005).

Table 7.13: Trends in diarrhoeal disease indicators FY 2000/01 – 2004/05

Indicators	Baseline	Achieved	Achieved	Achieved	Achieved	Achieved
	1999/00	2000/01	2002/03	2003/04	2004/05	2005
Cholera CFR	N/A	6%	5%	2.5%	2.5%	2%
Incidence of diarrhoeal diseases of epidemic potential cases in 1000 people	N/A	6.4	--	3.2	3.0	2.5

Source: MOH (2005)

The constraints that continue to exist include: continued shortage of key drugs and supplies at the national medical stores. This has affected buffer stocks and frequently interfered with supply of drugs to districts and ultimately patient care. IDPs in northern Uganda, refugees and constant migrations maintain the risk of diarrhoeal disease outbreaks. A further cause is the excessive rains in densely populated urban areas with poor drainage systems. In December 2006, Mulago hospital reported a daily growth in the number of people affected by diarrhoea of 30 per cent and the number peaked at 600 (New Vision, 2006).

There have been several achievements such as an environmental health act and subsidiary legislation which have been submitted for cabinet approval (MOH, 2005). The proportion of districts conducting water quality surveillance has increased to a modest 20 per cent. However, there are several challenges. The geographical and technical constraints in terms of terrain and peculiarities arising from rocky grounds, sandy lose soils, high water tables, termite damage, and limited land for construction of toilets in high populated areas. No single technology option for sanitation and hygiene is affordable or pertinent.

Fishermen, cattle keepers or nomads and displaced persons or refugees pose special problems of sanitation and hygiene. The HSSP II document for instance highlights the dire demands of close to 1.5 million people living in the internally displaced people's camps in northern Uganda. Many socio-cultural factors like taboos, negative beliefs and myths have not been overcome over the years. As well as blocking effective use and maintenance of latrines and other hygiene facilities. Safe water chain studies have shown that over 90 per cent of households accessing safe water actually consume water of unacceptable quality because the water gets contaminated at the time of consumption.

Table 7.14: Trends in environmental health indicators FY 2000/01 – 2004/05

Indicators	Baseline	Achieved	Achieved	Achieved	Achieved	Achieved
	1999/00	**2000/01**	**2001/02**	**2002/03**	**2003/04**	**2004/05**
1. Safe water disposal (latrine coverage used as proxy)	47.2	49.2	51.3	55.6	55.9	57
2. Proportion of districts conducting quality surveillance activities	2	10	15	18	18	20
3. Increased access to safe water (rural)	47	48	51	54	54	61.3

Source: MOH (2005)

Box 7.1: The quality of water from protected springs in Katwe and Kisenyi parishes, Kampala city, Uganda

In the sub-urban areas of Kampala city, springs are a major source of water for domestic use. Though spring water is considered to be aesthetically acceptable for domestic use, presence of poorly designed pit latrines, poor solid waste management as well as poor and inadequate spring protection, may lead to contamination of spring water with pathogenic bacteria.

A study was carried out by Department of Civil Engineering, Faculty of Technology, and the Department of Veterinary Public Health and Preventive Medicine, Faculty of Veterinary Medicine, Makerere University. The objectives of the study were to examine the bacteriological quality of water from ten springs in Katwe and Kisenyi parishes of Kampala, and to identify and quantify risks for spring water contamination with faecal bacteria. This was achieved by employing methods such as a cross-sectional sanitary risk assessment using a standardised format was carried out in ten randomly selected springs in the parishes of Katwe and Kisenyi parishes in Kampala. A total of 80 samples of water from these springs were collected from December 2001 to March 2002. The samples were analysed for indicators of faecal contamination: total coliforms, faecal coliforms and faecal streptococci. Physico-chemical parameters were measured.

The results of the study indicate that aggregate qualitative sanitary risk scores ranged from medium to high. The total coliform counts in 90% of the samples exceeded the WHO guideline for drinking water. All the samples had faecal coliform counts above the WHO guideline. A strong correlation (r2= 887) was observed between the median faecal coliform counts and the sanitary risk score. Sixty percent of the samples had nitrate levels above the WHO recommended limit. There was no correlation between the levels of chlorides and nitrates and levels of indicators of faecal bacterial contamination. The sanitary risk assessment score is a reliable tool for predicting the likely levels of bacterial contamination of spring water. Water from the ten protected springs studied is unsuitable for drinking without treatment.

Source: Rukia *et al.*, (2005)

The specific targets for HSSP II, which runs after HSSP I include:

- Improvement in safe waste disposal using latrine coverage as proxy from 57 per cent to 70 per cent in 2010; and
- To increase the proportion of the districts implementing water quality surveillance and promotion of safe water consumption.

7.3.4 HIV prevalence in Uganda

The national adult HIV prevalence was 6.7 per cent (5.7–7.6 per cent) in 2005 but it was significantly higher among women (nearly 8 per cent) than among men (5 per cent) (UNAIDS, 2006; MoH and ORC Macro, 2006). Approximately one million [850 000 – 1.2 million] people were living with HIV in Uganda in 2005 (UNAIDS, 2006). Regionally, prevalence was lowest in the West Nile region and highest in the Kampala, Central and North-Central regions (over 8 per cent) (UNAIDS/WHO, 2006).

HIV prevalence fell sharply among pregnant women in Kampala and other cities from the early 1990s to the early 2000s, in the context of significant behaviour change (including sexual abstinence and condom use during casual sex) and increased AIDS mortality (Kirungi et al., 2006). However, in some rural areas there is now evidence of an increase in HIV infection. Prevalence rose from a low of 5.6 per cent in men and 6.9 per cent in women in 2000, to 6.5 per cent in men and 8.8 per cent in women in 2004, according to data gathered in a study done in 25 villages. A similar trend, dating to 2002, was found among pregnant women at about half the antenatal surveillance sites included in this study. The large-scale roll-out of antiretroviral drugs (and prolonged lifespan of people on treatment) cannot account for the fact that there were more people living with HIV. The treatment roll-out only began in 2004, whereas the increase in the percentage of people living with HIV started several years earlier, around 2000. The rural study found that HIV incidence in older men and women (40–49 years) increased since 2000; among men, which peaked at levels higher than those observed in 1990–1994. The finding was echoed in the 2004–2005 national HIV household survey, which noted high infection levels among middle-aged Ugandans (UNAIDS/WHO, 2006). Behavioural changes could be at work. The rural study, for example, found that the percentage of men aged 40 years and above who said they had at least two casual partners in the previous month had increased between 2000 and 2004 (UNAIDS/WHO, 2006).

Further research is needed to validate these apparent trends, but the current findings do hint at the possible erosion of the gains Uganda made against AIDS in the 1990s. Such an interpretation finds support in national behavioural data which shows erratic condom use (about half the men and women aged 15–49 years reported using a condom the last time they had sex with a casual partner) and rising numbers of men who had sex with more than one sexual partner in the previous year, according to the 2004–2005 national HIV household survey (Ministry of Health Uganda and ORC Macro, 2006). More encouraging, meanwhile, are recent study findings (from rural Tororo) that persons receiving antiretroviral therapy had significantly less risk of transmitting HIV after two years on treatment, partly due to a strong reduction in viral load and less frequent unprotected sex (Bunnell et al., 2006).

7.3.5 Conflict and HIV risk

New research findings from Uganda cast doubt on the widely held assumption that internally displaced persons and refugees are more likely to be HIV-infected than people in ostensibly more stable settings. Acholiland, in northern Uganda, is home to an estimated two million internally displaced persons. At just over 8 per cent, HIV prevalence in the region is high (Ministry of Health Uganda and ORC Macro, 2006). However, a study among pregnant women in the Gulu, Kitgum and Pader districts has revealed that women living outside protected camps had a higher risk of being HIV-infected than their displaced counterparts living in protected camps. This might be due to the reduced mobility and increased access to health and prevention services of women in some of the camps (Fabiani et al., 2006). A recent review of HIV literature on displaced persons in eight countries (including Uganda) also failed to find evidence that conflict increases HIV transmission (Spiegel and Harroff-Tavel, 2006).

7.3.6 Very high malaria rates found in HIV-infected persons

Unexpectedly high levels of HIV infection are being found in adults seeking treatment for malaria in Uganda. More than 30 per cent of adults presenting at district health centres with uncomplicated falciparum malaria were co-infected with HIV. Clinical treatment for malaria was three times more likely in adults with HIV. The findings are in line with a growing body of evidence from elsewhere in sub-Saharan Africa that malaria tends to occur with increased frequency and severity in HIV-infected adults. This underlines the need for new strategies of HIV testing and counselling for adults with uncomplicated falciparum malaria (Kamya et al., 2006).

7.3.7 Continuing health concerns in northern Uganda

While health indicators in Uganda are steadily improving – the country is ranked 144 out of 177 on the UNDP Human Development Index scale – the humanitarian situation remains dire in the northern conflict-affected Acholi sub region. After two decades of war, social structures, community resilience and coping mechanisms have broken down. The situation is characterized by armed violence, large-scale displacement and limited assistance: difficult food relief, little health care, and no water or sanitation. The result is extreme food insecurity and spiralling mortality in camps hosting internally displaced persons. By mid 2005, there were an estimated 1.8 million IDPs and 220 000 refugees, 187 000 of them from Sudan. UNICEF estimates that 80 per cent of the IDPs are women and children. UNICEF (2006) reported that 935 000 vulnerable children are living in 200 IDP camps. Up to 58 per cent of health facilities are non-functional, drought further limits already poor access to water, and average primary school completion rate of 1.3 per cent, compared to 22 per cent national average. The districts that were included are Gulu, Pader, Kitgum, Apac and Lira.

Box *7.2: Health Status in the internall*y displaced camps of northern Uganda

A 2005 health and mortality survey conducted in Gulu, Kitgum and Pader districts revealed crude and under-five mortality rates well above emergency thresholds (1 and 2/10,000/day) at 1.54 and 3.18/10,000/day respectively due to primarily to malaria, fever, HIV and violence. Another survey carried out in Karamoja sub-region revealed a crude mortality rate of 3.9/10,000/day. In the conflict-affected districts, all these threats are magnified in relation to national averages:

a) Immunization rates for vaccine preventable diseases, especially measles, are very low;
b) The leading cause of morbidity in both the displace and local populations is malaria;
c) Maternal mortality is estimated at 600 to 700/100,000 live births per year and is associated with low ante-natal care attendance, low institutional delivery rate and poor emergency obstetric referral;
d) In Kitgum, Global Acute Malnutrition (GAM) rates for children under five range between 7 and 18%; 69% of under-fives in Pader and 46% in Kitgum have malaria, 59% in Pader and 31% in Kitgum suffered from diarrhoea and 58% in Pader and 40% in Kitgum from pneumonia;
e) Lack of potable water carries increased risk for diarrhoea, dysentery, cholera hepatitis and typhoid;
f) HIV sentinel surveillance site in Gulu indicate up to 11.3% prevalence rate among pregnant women;
g) Most diseases are preventable through well-proven life saving interventions targeting children under-five and women of childbearing age that can be delivered by health units and within communities.

Source: (UNICEF, 2006)

7.3.8 Food security and nutrition

While the Ugandan population is generally food secure, there continues to be problems of malnutrition and pockets of famine and hunger in the country (MFPED, 2006). Children afflicted by under-and mal-nutrition account for 40 per cent of all children who die before the age of five years. Over 38 per cent of children under the age of five years are stunted, especially in rural areas. Four per cent of children nationally show signs of wasting, and 22.5 per cent are underweight. In addition, 10.5 per cent of women are undernourished, while micro-nutrient deficiencies, particularly vitamin A, are common. Some of the causes of these problems include: inadequate food intake, ignorance, poverty, taboos and prevalence of HIV/AIDS. Food insecurity is a major feature among the populations in the areas affected by civil conflict, in particular those living in Gulu, Kitgum, Pader and Lira districts and the Karamoja region. The number of nutritionally vulnerable people amounts to 2 million, of whom 1.4 million are internally displaced persons living in northern Uganda (MFPED, 2006).

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7.4 Ecosystems services and value

7.4.1 Introduction

Ecosystems provide human beings with different types of services, a good number of which multifunctional. Forests, for instance, exhibit a high degree of biodiversity, provide timber resources as well as non-timber benefits which include; regulation of water flow, acting as a reservoir of fertile soils and a barrier to soil erosion, purifying air, influencing climate, offering recreational functions as natural landscapes, and cultural significance (UNEP/NEMA, 2007 in print). For a long time, these services have been largely free of charge. There are mainly four categories of services that people derive from ecosystems. They include provisioning, regulatory, cultural and supporting services.

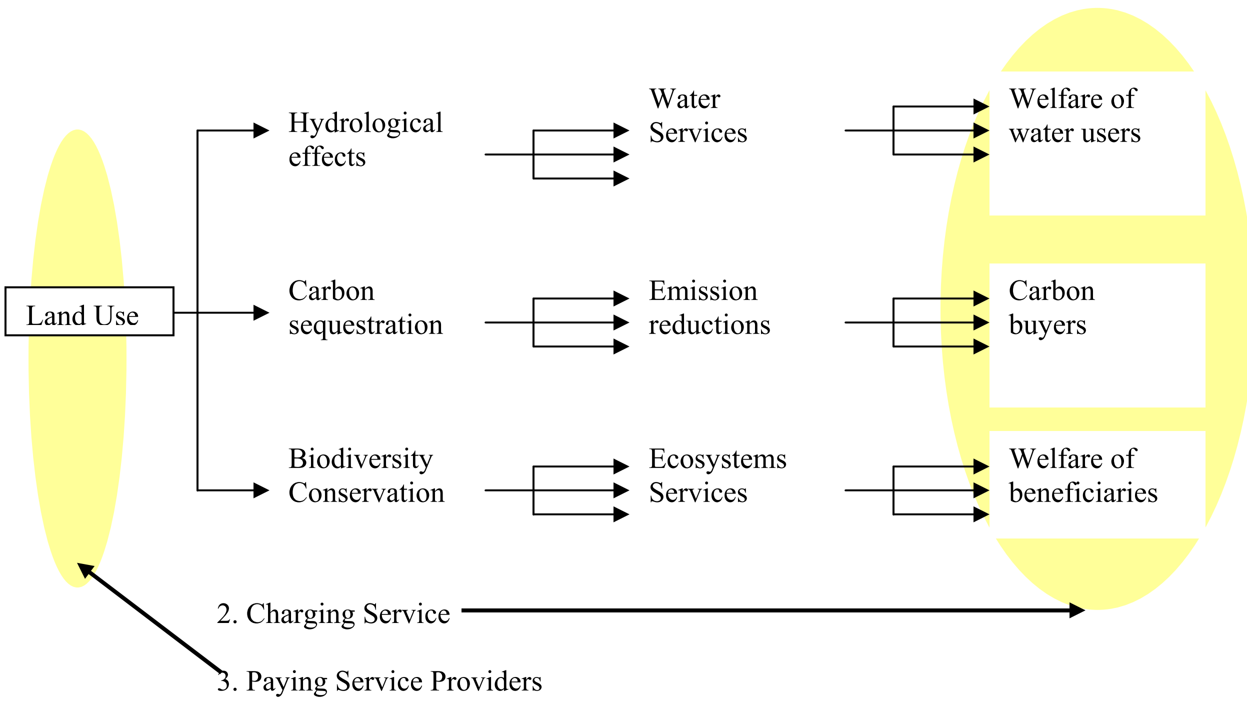
Provisioning services are the products provided by ecosystems. They include food, water, and timber among others (UNEP, 2006a). The demand for such products has been increasing in the country as the population grows. This leaves the capacity of ecosystems to provide the same amount of products to the future generation questionable as services are used more quickly than they can be renewed. For example, the current rates of fish demand from capture fisheries if not substituted by aquaculture are not sustainable in that, the LRSY would be exceeded by 2011.

Regulatory services result from the functioning of ecosystem processes. They include, for example, climate regulation, disease control and waste processing. Human activities have substantially modified regulatory services by modifying the ecosystem that provides the service resulting into poor performance (UNEP, 2006a). For example, deforestation reduces the level of carbon sequestration leading to global warming. Also, high levels of waste generation limit the capacity of ecosystems to eliminate toxins and excess nutrients. Cultural services are the non-material benefits obtained from ecosystems such as spiritual enrichment, recreation and aesthetic experiences (UNEP, 2006a). The use of these services has continued to grow in relation to peoples' lifestyles. However, the capacity of the ecosystem to provide these services diminishes with increases in population. Supporting services are not directly used by humans though they are of significant importance in the maintenance of other ecosystem services (UNEP, 2006a). They include soil formation, pollination and nutrient recycling which supports provisioning services of food production.

7.4.2 Payment for ecosystem services

Payment for ecosystem services (PES) schemes are a set of new mechanisms for financing activities that lead to conservation at the same time providing a service (or product). It involves recognising and compensating work done by people who manage the resources in ways that contribute to the long-term security of ecosystem functions through sustainable forms of resource use. Buyers and sellers come together in order to reach agreement on the provision and use of the ecological services (Pagiola, 2003). In this case, those who manage the land are the sellers, ecosystem services are the goods, and the beneficiaries are the buyers. Various ecosystem services do exist in Uganda, but there are very few cases where direct payments for them occur (Ruhweza and Masiga 2005). Most ecosystem providers are not aware that the services they provide have a monetary value, and the beneficiaries are not aware of the need to compensate the providers.

Figure 7.1: Payments for ecosystem services from theory to practice



Source: Pagiola and Platais (2005)

Payment for ecosystem services involves an additional cost e.g. taxes or introduction of payment of a fee e.g. user fees for goods that were previously free of charge (Pagiola, 2003). Thus the process requires calculations of; the costs of social and economic damage; damage prevention and restoration as well as determination of willingness to pay and willingness to accept. PES is characterised by buyers and sellers coming together on a voluntary basis, and prices being set through the interaction of supply and demand.

The basis for payment for environmental services is that those who provide environmental services are compensated for the cost of doing so (Pagiola, 2003). This involves undertaking new resource management practices like afforestation, organic agriculture, and resource conservation through best use approaches or refraining from certain activities like pesticide use, discharge of wastes, and resource exploitation among others. Though PES is relatively a new arrangement in environment management, there are mainly three compensating mechanisms existing in the country. They include (Ruhweza and Masiga, 2005): direct monetary payments which involve direct payments by ecosystem service users to ecosystem service sellers. Like in the case of carbon trading where tree farmers are paid by carbon emitters; payment in kind in form of infrastructure development, access to training etc. This has involved funding school construction, road upgrading among others especially in biodiversity conservation areas; and access to resources or markets like access to new markets through certification like in the case of selling organically produced commodities at higher prices compared to conventionally produced commodities.

7.4.3 Types of payments for environmental services schemes in Uganda

In addition to payments for ecosystem services schemes discussed in the state of the environment report (2004/05) (NEMA, 2006), additional payments schemes were found for: watershed services, scenic beauty, biodiversity services, carbon sequestration, and potential in payments for re-use, or recycled waste (Ruhweza and Masiga, 2007).

7.4.3.1 Payments for watershed services

a) Opportunities for payments for watershed services

Economic incentives used to ensure the delivery of watershed services essentially consist of: payments to landowners to alter land management practices in the expectation of downstream benefits. The types of arrangement vary depending on the characteristics of the service, the scale of relevant ecosystem processes, and the socioeconomic and institutional context. These range from informal community based initiatives to more formal contracts between individual parties facilitated by intermediary organizations (Pagiola and Platais, 2005). Water has traditionally been considered as a public and social good, which is available in unlimited quantities and therefore should be available to everyone free of charge. The Government prepared a national water action plan (WAP) which embraced most of the Rio (UNCED, 1992) principles, the most important one of which being the recognition of water as an economic good with an economic value and that should be taken into account while allocating it among competing uses (MWLE, 1999). The WAP principles were later embedded in the water statute, 1995, and the national water policy, 1999 (MWLE, 1999). Watershed values usually cover the following:

i Economic value of water

The national water policy 1999 (MWLE, 1999) provides that water is a socio-economic good and its allocation should be based on the social and economic values. Recognition of the different values of water helps in conserving the water resource; reducing wastage and loss; shifting consumption to high value uses and balancing scarce water resources with increasing demands (MWLE, 1999). The national water policy noted that in Uganda, water is provided to users at a price lower than the marginal or even average supply cost, and hence there is no incentive for conservation and waste reduction. This leads to a paradoxical situation where the water resource is already under stress and yet the subsidy encourages users to waste it (MWLE, 1999).

ii Cultural value of water

There are many cultural norms associated with different water bodies in Uganda. In many communities waterfalls, hot springs and rapids are associated with traditional cultural heritages (MWLE, 1999). An example is Bujagali falls which is considered to be an ancestral divine place for the Basoga. The site is believed to be home to what believers claim to be special healing powers for several common diseases. Hot springs located in the mountainous areas of western and eastern Uganda are also considered to be special divine sites by the local communities who visit the sites regularly for supernatural cleansing, healing, and blessings from the ancestral spirits (MWLE, 1999).

iii Water for agriculture and food security

Water is a key factor in the production of adequate food for Uganda. Water resources are a prime factor in irrigation, livestock watering, aquaculture, fisheries, food processing and other agro-industry activities, as well as fishing industries, which provides opportunities for employment to a large proportion of both rural and urban populations (UN-water, 2006).

iv Water for hydropower production

Hydropower is the major source of electrical power in Uganda. With a total estimated potential of 2 000 megawatts (MW), it is the most abundant and cheapest electrical power source in the country (MWLE, 1999). Uganda has a comparative advantage in hydropower resources in the region. Most of Uganda's hydropower potential is concentrated along the White Nile (MWLE, 1999). In addition, there are several small rivers in different parts of the country, with a potential for mini and micro hydropower development.

v Water for domestic consumption

Access to clean and safe water and improved sanitation facilities and practices leads to improved health and is an essential investment in human capital and therefore has a direct and immediate impact on the quality of life, thus contributing to long-term socio-economic development of the country and eventual elimination of poverty (UN-water, 2006). The current safe water supply coverage of 58 per cent in rural areas and 60 per cent in urban areas is still low and there is a need for a concerted effort to invest the necessary resources to ensure that all Ugandans have access to safe water supply (UBOS, 2006).

vi Water for industrial production

Water plays a very crucial role in the mining and manufacturing sectors. The sectors are among the major consumers of bulk water, which is used as an intermediate input in their production processes. The major industries include: breweries, soft drinks, soap, textile, steel rolling, dairy processing, fish processing, sugar, tea, tobacco, paper, cooking oil.

vii Recreation and tourism

Tourism is an important sector in Uganda because it provides jobs and foreign exchange earnings to the country. There are a number of water related tourist attractions e.g. white water rafting along the Nile in Jinja, sport fishing on the major lakes, and boat riding, swimming and beach volleyball along Lake Victoria. In addition, wildlife in game parks and reserves thrive on the fresh water resources in these areas.

b) Actual PES schemes for watershed services

i Payment for watershed in Mukono

The major aim of Mukono water system is to ensure that people have access to clean and safe water at the least cost possible. The project is basically not commercial. In attaining this, Mukono water system helps communities to improve on the quality of water sources in the area. This is done through building wells/springs and drilling boreholes.

After the improvement/construction of the water sources, communities are advised to form water user committees to which the water source is hande. The water user committee is advised to plant grass and dig terraces in gardens near the water source and not to dig pit latrines near water sources as a means of managing the watershed. The water user committees have control and make decisions over the water source; for example, they set bye-laws concerning proper use of water and agree on how much to pay to access water.

The amount paid ranges from Ushs 300 to 2 000 per month in relation to the use and location of the water source. Money collected by the user committees is used to repair boreholes in case of breakdown and ensure general cleanliness of the water source. This helps to ensure sustainability of the water sources, say, in case of a breakdown.

ii Payment for watershed services by Uganda beverage companies

Uganda Breweries Limited uses a total of 800 000 cubic metres (m^3) of water per year. The company draws water directly from Lake Victoria. Although there is no direct supplier of water to the company, and therefore no direct seller, the company pays abstraction fees to the directorate of water development which totals to Ushs 1 000 000 per year.

In relation to the components of the waste discharged, the company pays Ushs 650 000 per year for a waste discharge permit. In addition, the company owns a waste treatment plant where the company's waste water is treated before being discharged into the lake. As a way of managing the watershed of the lake, Uganda Breweries Limited is engaged in tree planting in areas around Lake Victoria. This involves giving free seedlings and guidance to tree farmers.

Table 7.15: Payments for ecosystem services projects in Uganda, watershed projects

Project	Location	Beneficiaries
Katonga Wetland Conservation Project	Western Uganda in Kabarole district along River Katonga	Community ecotourism has been developed and revenue is ploughed back to development activities. The community members practice fish farming and other activities like making of handcrafts and these are sold to tourists.
"Household Rainwater Harvesting" project/UBL Water of Life Project	Western Uganda in Kabale District	UBL provides water tanks to households built by women of local community to harvest rainwater from roofs.
Kitanga Wetland Conservation Project	South Western Uganda in Kabale district in Rukiga County	The local community earns income through the sale of fish and honey.

Source: Ruhweza and Masiga (2005)

7.4.2.2 Payments for carbon sequestration services

The signing of the Kyoto protocol in 1997 as part of the United Nations convention on climate change set the stage for the emergence of a market for carbon sequestration services (Pagiola, 2003). One of these market based solutions is to plant trees. Forests sequestrate and store carbon thereby playing an important role in climate regulation. There are two main approaches to increasing the amount of carbon sequestered by forests – the planting of new trees (afforestation, reforestation and agroforestry), and the avoidance of emissions by retaining trees (through conservation and improved management practices that prevent or reduce deforestation and conversion of forests to other land uses).

ECOTRUST and FACE are some of the leading intermediaries in carbon trading in the country. In addition, government priority actions for PEAP include the establishment of a national tree fund to help communities access resources for tree planting and market for ecological services such as carbon trading in the global market place (Kazoora, *et al.,* 2006).

Table 7.16: Payments for ecosystem services projects in Uganda, carbon projects

Project	Location	Beneficiaries
Bufumira Islands Alternative Energy Demonstration Project	Bufumira Islands	The stations serve approximately 100 people who pay to have the batteries of their solar panels recharged there.
ECOTRUST – Trees for Global benefits program	Ruhinda and Bunyaruguru counties of Bushenyi District Western Uganda	The payments are channeled through a European based carbon broker Bioclimatic Research and development (BR&D) and a Ugandan national conservation trust fund (ECOTRUST) to individual farmers.
West Nile Power Project	The project is located in the West Nile region of Uganda, which is composed of 5 districts Adjumani, Arua, Moyo, Nebbi and Yumbe. The two hydropower dams are found along the river Nile at Nyagak in Nebbi and Olewa in Arua district.	The Project is part of the Uganda's Energy for Rural Transformation Project funded largely by the World Bank. The PCF is a private-public partnership operated by the World Bank. PCF buys the Carbon Emission Reductions that accrue from this project. Two streams of revenue are generated - sale of power to the communities in 5 districts of the West Nile region of Uganda and the ERCs
UWA/FACE Forest Certification Initiative	Kibale National (10,000 ha) and Mt. Elgon (25,000 ha) National parks	FACE Foundation signed an agreement with the Government of Uganda to replant the deforested areas of Mt. Elgon and Kibale National Parks in order to sequester carbon, manage water resources and recreate a habitat for diverse wildlife. In return GoU allows FACE to sell the carbon offsets generated. FACE works on behalf of the Dutch energy group. The deal falls under the CDM of the UNFCCC
Rwoho Forest Conservation Project	South Western Uganda, in Mbarara district	In exchange for sustainable use of forest resources, the people are supplied with seeds for agro forestry, modern bee hives and honey harvesting tools. The benefits from the forest are shared between the forest edge community and NFA.
Fuel Efficiency for West Bugwe Forest Conservation Project	Eastern Uganda in Busia district	The project provides timber and other wood products to the people around the forest reserve to substitute for products that would otherwise have come from the forest.
Community Forests Management Project	Budongo Forest in Masindi district	BUCODO pays the farmers for the plant materials supplied. Percentage of the profit is ploughed back to the project for maintenance and upgrading of the equipment and improvement of the facilities and the enterprises in general. The rest of the profit is used for sustaining conservation activities around Budongo forest.

Source: Ruhweza and Masiga (2005)

7.4.2.3 Payments for scenic beauty: Landscape beauty payments

The provision of landscape beauty represents a key attribute in the market for ecotourism. Landscape beauty has a market which is well recognised but is always considered as a free input by operators despite the payment of entrance fees in these areas. Though government authorities and the tourist industry promote the value of "charismatic" wildlife in marketing them as visitor attractions the mountain gorillas in Mgahinga and Bwindi Impenetrable national parks, and more recently, bird watching and sport fishing, a growing number of ecotourists prefer a more inclusive and interactive experience with both the natural and the cultural landscapes. For such visitors, it is not a brief view of "big game" they seek, but the viability of the entire ecosystem, including its human communities, that is cherished. Consequently, the challenge facing Ugandans is how to balance development with community and environmental conservation.

Through tourism, residents achieve self-sufficiency while visitors, managers, and developers are able to better appreciate the diverse natural and cultural environments on which all depend. By so doing, the symbiotic relationship between ecotourism, nature, and community development is made clear; a reminder that it is only through similar partnerships that Uganda can successfully sustain itself economically, socially, and environmentally over the long-term.

Table 7.17: Payments for ecosystem services projects in Uganda, landscape beauty

Budongo Forest Eco-tourism Development Project (BFEP)	Budongo forest	The community association has 28 people that operate the eco-tourism activities on behalf of the community. The people in the local communities are paid over the counter by tourists.
The Mabira Forest Reserve Eco-tourism Project	Mabira forest	The communities and NFA share the revenue generated from eco-tourism. Both the communities and the NFA carry out the activities of the eco-tourism.
'Kibale Association for Rural and Environmental Development (KAFRED)' Project	The project is located in Western Uganda in areas surrounding Kibale National Park.	Revenues from tourism are ploughed into community projects such as Education, Health and Sanitation

Source: Ruhweza and Masiga (2005)

7.4.2.4 Payments for biodiversity services

The services provided by biodiversity range from the maintenance of ecosystems functions to option and existence values. Biodiversity projects aim at broad conservation amongst communities surrounding the protected areas. This is mostly done through revenue sharing where the local communities earn a specified amount of money from the revenues generated. For example, under the Mgahinga and Bwindi Impenetrable Forest Conservation Trust (MBIFCT) the arrangement is that 60 per cent of the trust fund is given to the communities to implement their development and conservation programmes.

Revenue sharing in the area has encouraged local communities to conserve the natural resources because they earn money from such conservation.

Apart from biodiversity conservation, four main environmental benefits may also be associated with payments for biodiversity conservation; for example, water benefits through water quality maintenance and reduced chemical pollution; soil benefits through reduced soil erosion and maintenance of fertility, moisture and nutrients; air benefits through controlled air pollution and carbon sequestration; and landscape beauty.

Table 7.18: Payments for ecosystem services projects in Uganda, biodiversity projects

Biodiversity projects	Location	Beneficiaries
Mgahinga Bwindi Impenetrable Forest Conservation Trust (MBIFCT)	The project is located in south western Uganda. It includes Mgahinga and Bwindi National Park. In Kabale and Kisoro districts.	The communities living in and around Mgahinga National park and Bwindi National park and UWA authority
Kibale and Mt. Elgon National parks Co-management scheme	Kibaale and Mt Elgon National parks	UWA gives rights to access certain resources in the national park to Local communities living around the national parks
The 'Kibale Forest Wild Coffee' Project	The project is located in Western Uganda in Kibale National Park	The project provides incentive to small Arabica farmers. The small farmers are paid a premium to grow their coffee in small farmer agricultural systems that are certified as organic and 'shade' grown
Gumutindo Coffee Project	Eastern Uganda in Mbale district	The farmers are rewarded financially for their extra efforts. In return for producing high quality coffee farmers are paid a higher price, based on fair trade, and increasingly on the organic premium
West-Bugwe Forest Conservation Project	Eastern Uganda, Tororo district	The project has developed a campsite that has encouraged ecotourism and is used by the community for aesthetic purposes and income generation.
Echuya Forest Conservation Project- Nature Uganda	Echuya forest reserve in Kabale and Kisoro districts	Communities are granted access to the reserve on condition that they carrying out conservation. Activities include tree planting and forest conservation and protection.
Collaborative forestry management in Kibale and Mt Elgon National Parks	Kabirizi, Nyakarongo parishes in Kibale and Nyabweya parishes in Mt. Elgon	The communities have signed formal forest border agreements with UWA. UWA allows the communities to enter the forest and extract non timber forest products. The communities are allowed to plant 5 lines of eucalyptus on the boundary of the park. The communities guard the park border and

		only extract the agreed items from the forest

Source: Ruhweza and Masiga (2005)

Table 7.18: Payments for ecosystem services projects in Uganda, biodiversity projects (cont'd)

Biodiversity projects	Location	Beneficiaries
West-Bugwe Forest Conservation Project	Eastern Uganda, Tororo district	The project has developed a campsite that has encouraged ecotourism and is used by the community for aesthetic purposes and income generation.
International Gorilla Conservation Programme (IGCP) Water Gravity Scheme	Buhoma in Kabale district, and the communities surrounding Bwindi Impenetrable National Park (BINP)	IGCP & Buhoma community to jointly develop a water gravity scheme that will guarantee the availability of clean water. The development of enterprises, linked to tourism, is helping to bring in alternative revenue for the community, who are mainly subsistence farmers, and support forest conservation.
Market Access for Organic Products	The Export of Organic Products from Africa (EPOPA) ,local exporters and their contracted farmers' groups	The farmers receive a premium price, which is usually 25 % to 50% above the price of conventional produce, in return for using sustainable production practices. The practices ensure sustainable utilisation of the soils, water, and fishery resources. The exporters are enabled to access international markets where they have access and a premium price.
Promotion of Bamboo Sector-Prime/West Project	South-western Uganda in the districts of Kisoro, Kabale, Bushenyi and Kanungu	Tea factory managers and local people pay the Bamboo product makers directly.
International Gorilla Conservation Programme (IGCP) Water Gravity Scheme	Buhoma in Kabale district, and the communities surrounding Bwindi Impenetrable National Park (BINP)	IGCP & Buhoma community to jointly develop a water gravity scheme that will guarantee the availability of clean water. The development of enterprises, linked to tourism, is helping to bring in alternative revenue for the community, who are mainly subsistence farmers, and support forest conservation.
Lemon Grass Oil Project	South Western Uganda, Ntungamo District	The local people provide raw material (lemon grass) for the extraction of essential oil that fetches a premium in the international market for its uses in cosmetic and pharmaceutical industry.

Source: Ruhweza and Masiga (2005)

7.4.2.5 Potential payments from re-use of waste

Cane provides bagasse, which is the main fuel, used in sugar factories. The sugarcane plant happens to be the most efficient converter of solar energy into biomass, while absorbing carbon-dioxide from the atmosphere. The fibre fraction is the biggest constituent of bagasse. On combustion, bagasse generates carbon dioxide as well as thermal energy. Cogeneration projects could make use of bagasse by converting it into electricity.

Cogeneration projects have environmental benefits as they provide an economical way of disposing bagasse. Currently, the three sugar factories in Uganda (Kakira, Kinyara, and SCOUL) are faced with the problem of disposing of excess bagasse. The present practice is to transport bagasse to open fields where it is burned. This method of disposal has a transport cost associated with it and is a waste of an energy resource.

The three sugar factories are involved in cogeneration, which meets most of their electricity demand. Kakira sugar factory has an installed capacity of 4.5 MW electricity generation, while Kinyara Sugar Works has 1.7 MW and SCOUL has a capacity of 0.8 MW. These factories have not been involved in commercial cogeneration in the past because the old electricity act of 1964 gave the monopoly of generating and distributing electricity to the Uganda Electricity Board (UEB). The new electricity act of 1999 now in place, allows any developer to invest in the power sector. This therefore means that the sugar industry can take part in commercial cogeneration.

7.4.3 Barriers to implementing PEs in Uganda

7.4.3.1 Information barriers

Potential buyers of ecosystem services (consumers, businesses, utilities, government agencies at all levels, and even conservation NGOs) are often unaware of their dependence on ecosystem services. In addition, potential sellers are not aware of ecosystem service payments and markets and even when they are, they do not know how to find potential buyers. Further compounding the situation is the fact that few policymakers and regulators are knowledgeable about the policy requirements and implications of payments for ecosystem services. Finally, there is a shortage of service providers and project developers to assist with nascent PES deals.

In Uganda, for example, limited data on emissions is one of the biggest challenges associated with determination of emission reductions for CDM projects. There is lack of useful efficiency data for the required estimations, actual figures are not available for some sectors and the limited historical data poses an obstacle to calculating these GHG emissions. There have been attempts in the past to carry out natural resource accounting in the forestry and fisheries sub-sectors, however, these efforts were not comprehensive enough as they relied on secondary data and no new data was collected. Only a few case studies based on three to four target districts are used to make estimates about the national potential for CDM projects. Moreover, the findings of the PES inventory (Ruhweza and Masiga, 2005) suggest that there are a lot more projects and initiatives that are skipped.

Another key issue for buyers is the lack of clarity over what it is they are buying, as the linkages between specific management practices and ecosystem services outcomes are often unclear, particularly related to water and soil sequestration of carbon. Addressing these issues often requires specific technical skills to bring the right kind of information to the buyers – including information on the value of the ecosystem service and what benefits it will deliver. Ideally, a base of intermediaries would exist with the skills to assess linkages between management and ecosystem service outcomes, either in-country or at least in-region. However, this availability of technical assistance is more limited and tends to be costly.

Since without a buyer, no PES deal is possible, it is essential that buyers are clear about exactly what they could buy as well as what risks are associated with the deal. Therefore, having effective mechanisms to identify, develop the interest of, and allay the concerns of buyers is an important barrier that must be overcome in all settings.

7.4.3.2 Technical barriers

There is a general lack of individuals and organisations with the requisite knowledge to organize, design and implement payments for ecosystem services (PES) effectively. Even where sellers and buyers may be aware of the ecosystem services, the technical skills needed for PES are seldom readily available, such as experience with methods for calculating the financial value of these services and assessing the price that buyers should be willing to pay and sellers willing to receive. In addition, "best practices" have not yet been established through extensive on-the-ground experience and examples in the region. This gap increases the risks for buyers, both in terms of reputation and return on investment.

For prospective sellers, including land and resource owners as well as environmental stewards the technical barriers are significant. Few have access to the specialized skills needed to assess the market potential of their resources and the potential resource management options that would focus on restoring and maintaining ecosystem services. Also, PES models that clearly work for low income communities are few and often unproven. And if low income community members wish to go beyond carbon or water deals, particularly to consider multiple ecosystem services "bundled," they find that robust and proven models for biodiversity payments are especially weak.

Government, policymakers and regulators often have inadequate understanding of PES to determine where, when and what forms are appropriate, particularly in relation to national or sub-national strategic priorities for conservation and development. In addition, many prospective PES service providers and project developers lack the technical and business skills and knowledge specific to PES, including: market analysis, enterprise analysis, contract familiarity, project design, implementation and measurement, and monitoring.

Negotiating and structuring deals serves as another technical barrier as it requires knowledge of how specific natural resource management practices within particular ecological contexts would result in maintenance of the desired ecosystem services. Simply put, the question is whether particular practices will deliver real conservation benefits over time. One approach is by working with specialists and/or institutions that play the role of aggregators of ecosystem services and deals, and can assist with explaining how to "bundle" multiple ecosystem services for purchase by buyers. Such in-country specialists are few, and even if they are available, hiring them is very expensive and ends up increasing the transaction costs.

In addition, for communities, there may be barriers to the negotiation of deals related to tenure rights, literacy, and familiarity with entering into contracts. Communities can also encounter unfamiliar terrain in terms of the logistics related to receipt and expenditure of funds, particularly if the revenues will be paid to the community as a whole and not to individuals.

To address these barriers, there is need to strengthen capacity of buyers, seller service providers, and policy makers by developing the requisite skills and knowledge through training and other interventions.

7.4.3.3 Policy and regulatory barriers

In many cases, there is confusion about appropriate government roles in the development and operation of specific types of PES. In some cases, problems have arisen from an insistence by government officials that flows of funds should go through particular agencies. More fundamentally, there are conflicts between delivery of ecosystem services as "private goods" versus "public goods;" over existing rights to ecosystem services and the flow of benefits from their sale; and related to equity issues for low-income buyers or sellers of ecosystem services.

Nonetheless, the inventory in Uganda revealed that policies establishing rights to buy and sell ecosystem stewardship services have not been a prerequisite for pilot activity in PES. The lack of policy support is felt more at the expansion stage as well as, in some cases, reducing the prices buyers are willing to pay. This is because without policy and regulatory arrangements, potential PES buyers are not certain about the legal standing for purchases and the enforceability of contracts is unclear. In addition, both buyers and sellers may be uncertain about underlying tenure rights for land and resources, thereby increasing the risks of long-term ecosystem service agreements.

Addressing all of these policy and regulatory issues would require the establishment of "pro-poor" PES legislative and regulatory frameworks that take all the above issues in consideration including policies/regulations for the establishment, or certification of service providers for PES.

7.4.2.4 Institutional barriers

Uganda lacks necessary institutions across the value chain from sellers to buyers such as certification bodies, financial intermediaries, national registries for ecosystem services, and so on. To achieve ecosystem service benefits in most of the CDM projects, for example, requires effort over a larger area than a single company can afford to finance. PES-friendly institutional mechanisms are therefore essential to provide economies of scale and scope in finding and negotiating with buyers, bundling multiple ecosystem services for different markets, and achieving efficiencies in management, monitoring and certification.

Currently, most PES support is provided by international public sector or by conservation NGOs still in the early stages of the PES learning curve, rather than by business leaders or seasoned leaders in PES development. There is therefore a need to establish PES enterprise support centres for advisory and capacity-building services. There is also a need for community level institutions to engage and train prospective sellers, as well as financial institutions at the community level for efficient delivery of payments. Finally, public private partnerships are important to develop and encourage an enabling environment for PES deals. The essential element is to create a context in which the parties entering into deals feel confident that revenues flowing in from the PES scheme will be administered appropriately and will go to the intended uses as outlined in the agreement.

Although some local organizations/consultancy firms and NGOs that provide some of the above services are starting to emerge in Uganda, it would be cheaper if such activities were taken over by a fully facilitated government body which can offer them at a subsidised rate. Even if PES initiatives were to stay in the private sector domain there is a need for strong regulatory and enforcement mechanisms to ensure that all the revenue does not end up in private hands. One of the major driving forces for a government orientation is that the potential beneficiaries of PES schemes are poor people who may not be empowered enough to make claims for the environmental services they provide. Additionally, at the district level, environmental officers are not yet adequately skilled to run PES initiatives.

All in all it should be noted that PES schemes cannot function without having the necessary institutional capacity in place. This is important at the local and national levels. National governments have to play a pivotal role to create the necessary legal framework, while international institutions and NGOs may be needed for brokering, monitoring, and evaluating tasks. This would also include identifying the leading institutions relevant for PES design and implementation and distributing responsibilities among them according to capacity. Uganda, like many developing countries has an overarching goal of reducing poverty. Therefore, PES needs to be seen within the context of poverty eradication. It has been argued that by the very nature of the system, participation in PES schemes is purely voluntary, and therefore nobody should be worse off than they were without PES. Furthermore, payment platforms constitute a new source of income and increase welfare, particularly because PES schemes can help transfer money from urban to rural areas.

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Section 3: Emerging issues and outlook

8.0 Emerging issues

8.1 Energy scarcity: opportunities and risks from turning to bio fuels
8.2 Climate change
8.3 Genetically modified organisms
8.4 Invasive alien species
8.5 Chemicals
8.6 Solid waste management

9.0 Outlook

8.0 EMERGING CHALLENGES

8.1 Climate change

8.1.1 Causes and definitions of climate change

The average surface temperature of the earth has increased over the 20th century by about 0.6°C (Green Facts, 2006). This increase occurred mainly from 1910 to 1945 and 1976 to 2000. The increase is larger at night and over land area. Changes in climate are the result of internal variability within the climate systems and external factors (both natural and anthropogenic). Human emissions are significantly modifying the concentrations of some gases in the atmosphere. Some gases are expected to affect the climate by changing the earth's radiative balance, measured in terms of radiative forcing. The greenhouse gases, which have a global effect, tend to warm the earth's surface by absorbing some of the infrared radiation it emits.

The principal anthropogenic gas is carbon dioxide (CO_2) whose concentration has increased by 31 per cent since 1750 to a level, which is likely to have not been exceeded for 20 million years. This increase is predominantly due to fossil fuel burning, but also due to land-use change, especially deforestation. The other significant anthropogenic greenhouse gases are methane (CH4); 151 per cent increase since 1750, one-third of CO_2's radiative forcing; halocarbons such as Chloro Floro Carbons (CFCs) and their substitutes, 100 per cent anthropogenic, one-quarter of CO_2's radiative forcing; and nitrous oxide (N_2O), 17 per cent increase since 1750 one-tenth of CO_2's radiative forcing.

Anthropogenic climate change will persist for many centuries. Emissions of long-lived greenhouse gases (i.e., CO2, N2O, PFCs, and SF6) have a lasting effect on atmospheric composition and climate. Even after greenhouse gas concentrations have stabilized, global average surface temperatures would continue rising at a reduced rate. Global mean surface temperature increases and rising sea level from thermal expansion of the ocean are projected to continue for hundreds of years after stabilization of greenhouse gas concentrations (even at present levels). Ice sheets will continue to react to climate warming and contribute to sea level rise for thousands of years after the climate has stabilized. For instance, a Greenland warming of 5.5°C, if sustained for 1 000 years, would likely result in a sea level rise of about 3 meters.

Natural systems can be especially vulnerable to climate change because of limited adaptive capacity. While some species may benefit from climate change, existing risks of extinction could increase for some more vulnerable species. The risk of damage will increase with the magnitude and rate of climate change. Human systems that are sensitive to climate change include mainly water resources, agriculture (especially food security) and forestry, coastal zones and marine systems (fisheries), human settlements, energy and industry, insurance and other financial services, and human health. Vulnerability varies with geographical location, time, and social, economic, and environmental conditions. Some effects will be adverse but others will be beneficial. The populations of East Africa are particularly vulnerable to climate change and climate variability, including extreme climatic events such as drought and flooding, due, in part, to reliance upon hydroelectric power (HEP), localised (untreated) water supplies and rainfall-fed agriculture.

8.1.2 Climate change projections and drivers of ecosystem change

By virtue of Uganda's location along the equator, it experiences two rainy seasons annually, although the two rainy seasons merge into one rain season as one moves away from the equator. Mean annual rainfall ranges between 750mm and 2000mm (Orindi and Eriksen, 2005). However, Uganda's contribution to global warming is quite low in terms of emissions from the use of fossil fuels. Nearly 90 per cent of the national energy demand is derived from biomass. This excessive dependence on biomass has worsened land degradation and led to a decrease in forest and vegetation cover (Kayanja and Byarugaba, 2001).

The average global surface temperature is projected to increase by something between 1.4 and 5.8°C (2.5 to 10°F) over the period 1990 to 2100 (Green Facts, 2003). Vulnerability assessments carried out in Uganda identified precipitation as the most important climate change related impact. Climate change impacts are envisaged to exacerbate the constraints on livelihood activities leading to a decline in water rights, increased insecurity, rising unemployment and a spread of HIV/AIDS (Orindi and Eriksen, 2005).

The majority of farmers practice rain-fed agriculture, which is sensitive to fluctuations in weather conditions. Food security arising from occurrence of drought and floods may worsen with climate change. Declining and unreliable rainfall may lead to crop failure in some areas. Other areas experienced enhanced crop potential with increased rainfall, although any increase in rainfall intensity and flooding may destroy both crops and property. Increased temperature and reduced rainfall could lead to scarcity of water resources for human consumption and watering of livestock. This may result in increased conflicts among different groups over water particularly in drought prone areas. Fodder for livestock may also become scarce with drier conditions. Heavy rainfall expected in the medium and high altitude areas may accelerate soil erosion and land degradation and also cause damage to communication infrastructure.

Table 8.1: Water related diseases that are linked to climate change effects in Uganda

1961/1962	El Niño rains	▪ Extensive floods experienced in many parts of the country ▪ Destruction of roads, bridges, houses, crops, property ▪ Drastic rise in the water levels of Lake Victoria (2.5 M) submerging all major infrastructure along the lakeshore
1993/94	Drought and Famine	▪ Over 1.8 million people were affected due to lack of food, water and inadequate pasture for livestock
1997/98	El Niño Rains	▪ Landslides killed 53 people and over 2 000 people were displaced especially in the Mount Elgon region. ▪ Roads, bridges, houses, crops and property worth over US $ 20 million were destroyed
1999	Drought and Famine	▪ Over 3.5 million people in 28 districts were affected by lack of food and a large number of livestock suffered from inadequate pasture and water

Source: PEAP (2004).

8.1.3 Example of El Nino (1997) and its effects on Lake Kyoga

Precipitation and evaporation are almost in balance in a yearly scale in the Lake Kyoga region. Average yearly precipitation around the lake is 1 284 mm while average evaporation is 1 500 mm. From the total water coming to the lake, precipitation has a portion of 10 per cent while most of the water comes from Lake Victoria, worth another 10 per cent from smaller water systems to the east such as River Mpologoma and River Manafwa.

After abnormally heavy El Nino rains (1997/98) the level of Lake Kyoga rose and dislodged the papyrus bed, floating suds and water hyacinth mats. The weeds accumulated into the outlet of Lake Kyoga and fully blocked it. Within one year, the water level rose over two metres in the lake. This impacted negatively on the lake shore wetlands and the breeding grounds for fish shrunk. The flooded area altogether was some 580 km^2. The floods displaced populations, destroyed infrastructure, caused disease and some deaths, and paralysed the socio-economic activities of the region. Todate the outlet of Lake Kyoga is still partly blocked by the papyrus and hyacinth (ILM, 2004). In Nakasongola district, the El Nino has additional effects. For example, the people displaced by the floods lost about 13 per cent of their annual revenue (Nakasongola DSOER, 2004), three roads were destroyed, 1 390 houses were destroyed, 300 hectares of crops and 7 000 hectares of farmland were flooded and destroyed and 5 493 people were displaced.

8.1.4 Climate monitoring

The responsibility to monitor climate in Uganda lies with the department of meteorology in the Ministry of Water, Lands and Environment. The policy goal in the sector is "to maintain a well developed weather and climate monitoring system that provides necessary information and advisories to support sustainable social economic development". In light of the UNFCCC, there are proposals to put in place a national climate change secretariat. The major function of the secretariat is to coordinate and implement the UNFCCC as well as the Kyoto Protocol. Uganda operates a network of stations, which include synoptic stations, climatological stations, upper air stations and rainfall stations.

Table 8.2: Network of climate monitoring stations in Uganda

Station type	Operational stations (no)	Optimum stations (no)
Synoptic station	7	15
Hydrological stations	6	18
Agro-meteorological stations	5	14
Other climate stations	10	N/A
Rainfall stations	112	500
Upper air stations	1	2
Radar stations	1	2

Source: MWLE (2001)

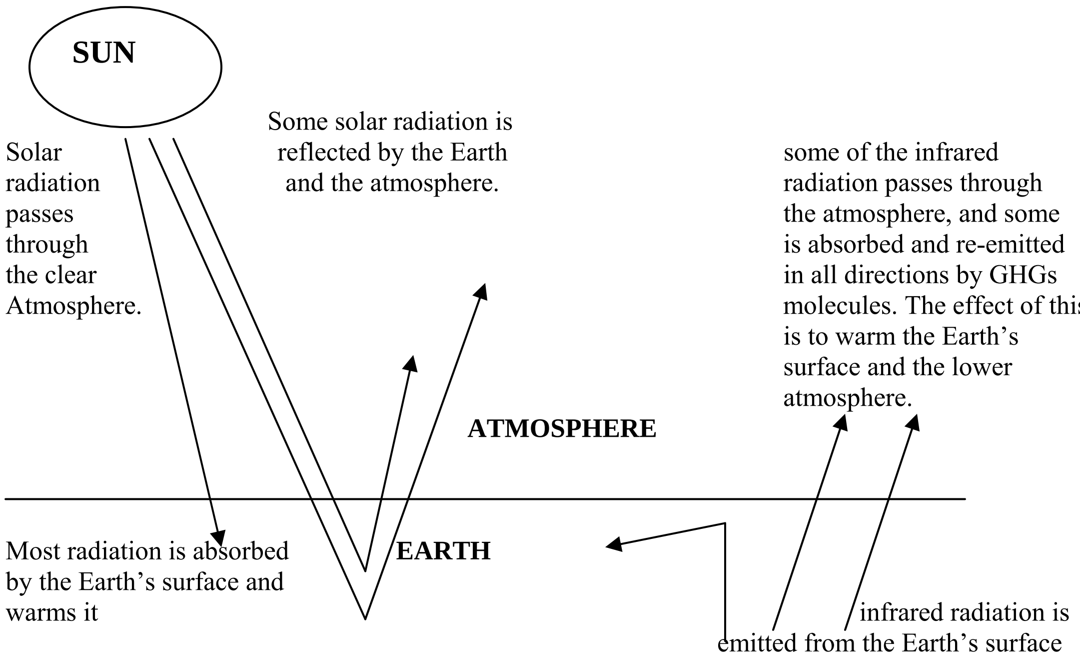
At synoptic stations, meteorological parameters are observed on an hourly basis and disseminated worldwide through global telecommunication systems (GTS) for use in weather and climate prediction. At climatological stations (agro-meteorological, hydro-meteorological and other climate stations) observations are made twice a day and returns are submitted to the department of meteorology headquarters in Kampala.

The existing network of climate monitoring stations in Uganda is far from adequate. The management of the climatological, hydrological and other databases relevant to climate change also needs strengthening.

8.1.5 Greenhouse gas emissions and associated impacts

It should be noted that climate change is mainly caused by human-made emissions of greenhouse gases which include carbon dioxide, methane, nitrous oxide and oxides of nitrogen. While the developed countries contribute to these emissions through industries, energy production by use of coal and petroleum, transportation through motor vehicles, rail, sea and air transportation, emissions from developing countries are largely survival emissions. Most of these emissions are attributed to the poverty circle and have mostly to do with adequate energy supply, hygienically portable water and comfortable shelter. The common practices indicate continued use of obsolete technologies, poor economic policies, lack of enforcement, and mismanagement of natural resources.

Figure 8.1: The greenhouse effect



Source: Michael et al, 2003

8.1.6 Possible major impacts of climate change

Some extreme events such as drought, floods, heat waves, avalanches, and windstorms are projected to increase in frequency and/or severity. Others, such as cold spells, are projected to decrease. The damage, hardship, and death caused are also expected to increase with global warming. The impacts are expected to fall disproportionately on the poorer regions.

8.1.6.1 Impact on and vulnerability of the human systems

i) Impact on human settlements, energy, and industry

Human settlements would be affected by climate change in three major ways: economic productivity, infrastructure and population health or migration. The most widespread direct risk is flooding and landslides. The number of people who would be flooded by coastal storm surges would increase several fold.

ii) Impact on insurance and other financial services

The costs of ordinary and extreme weather events have increased rapidly in recent decades. Part of this increase is linked to socioeconomic factors, such as population growth, increased wealth, and urbanization in vulnerable areas, and part is linked to climatic factors such as the observed changes in precipitation and flooding events. Climate change would place upward pressure on insurance premiums and/or lead to certain risks being reclassified as uninsurable.

iii) Climate change and health

There are a number of climate-sensitive diseases, the most prominent being malaria, meningitis and cholera. Some vector borne diseases, like malaria and dengue fever, show significant seasonal patterns whereby transmission is highest in the months of heavy rainfall and humidity. Epidemics of other infections, like meningococcal meningitis, tend to erupt during the hot and dry season and subside soon after the beginning of the rainy season. Therefore, seasonal fluctuations in infectious disease occurrence are associated with climate change.

Vectors, pathogens and hosts survive and reproduce within certain optimal climate conditions and changes in these conditions can modify greatly these properties of disease transmission. The most influential climatic factors for vector borne disease include temperature and precipitation.

Extreme temperatures are often lethal to the survival of disease-causing pathogens but incremental changes in temperature may exert varying effects. Where a vector lives in an environment where mean temperatures approach the limit of physiological tolerance for the pathogen, a small increase in temperature may be lethal to the pathogen. Alternatively, where a vector lives in an environment of low mean temperature, a small increase in temperature may result in increased development, incubation and replication of the pathogen.

Variability in precipitation may have direct consequences in infectious disease outbreaks. Increased precipitation may increase the presence of disease vectors by expanding the size of existent larval habitat and creating new breeding grounds. In addition, increased precipitation may support a growth in food supplies, which in turn support a greater population of vertebrate reservoirs. Unseasonable heavy rainfalls may cause flooding and decrease in vector populations by eliminating larval habitat and creating unsuitable environments for vertebrate reservoirs. Alternatively, flooding may force insect or rodent vectors to seek refuge in houses and increase the likelihood of vector – human contact.

Heavy rains can contaminate watersheds by transporting human and animal feacal products and other wastes in the ground water. On the other hand, water shortages have been associated with increases in diarrhoeal disease outbreaks that are attributed to improper hygiene.

8.1.6.2 Impact on and vulnerability of the natural systems

i) Impacts on hydrology and water resources

Most scenarios project increases in annual mean streamflow in high latitudes and Southeast Asia, and decreases in central Asia, the area around the Mediterranean, southern Africa, and Australia. The population living in water-stressed areas is projected to increase. Floods could increase in many regions. However, water management could be applied to adapt to the changes.

ii) Impacts on agriculture and food security

Crop yield responses to climate change vary widely, depending on many parameters. Increased CO2 concentration can stimulate crop growth and yield, yet that benefit may not always overcome the adverse effects of excessive heat and drought. Crop yields are projected to increase in mid-latitude regions for less than a few degrees, and to decrease in all other cases.

iii) Impacts on terrestrial and freshwater ecosystems

In certain ecosystems or biomes, species composition and dominance would change. Distributions, population sizes, population density, and behaviour of wildlife have been, and will continue to be, affected directly by changes in global or regional climate and indirectly through changes in vegetation. Fish distributions would move towards the poles, along with loss of habitat for cold-and-cool-water fish and gain in habitat for warm-water fish. Extinction risks should increase for endangered or vulnerable freshwater fish species. A small amount of climate change would increase global timber supply in developing countries.

8.1.7 Climate change and agriculture

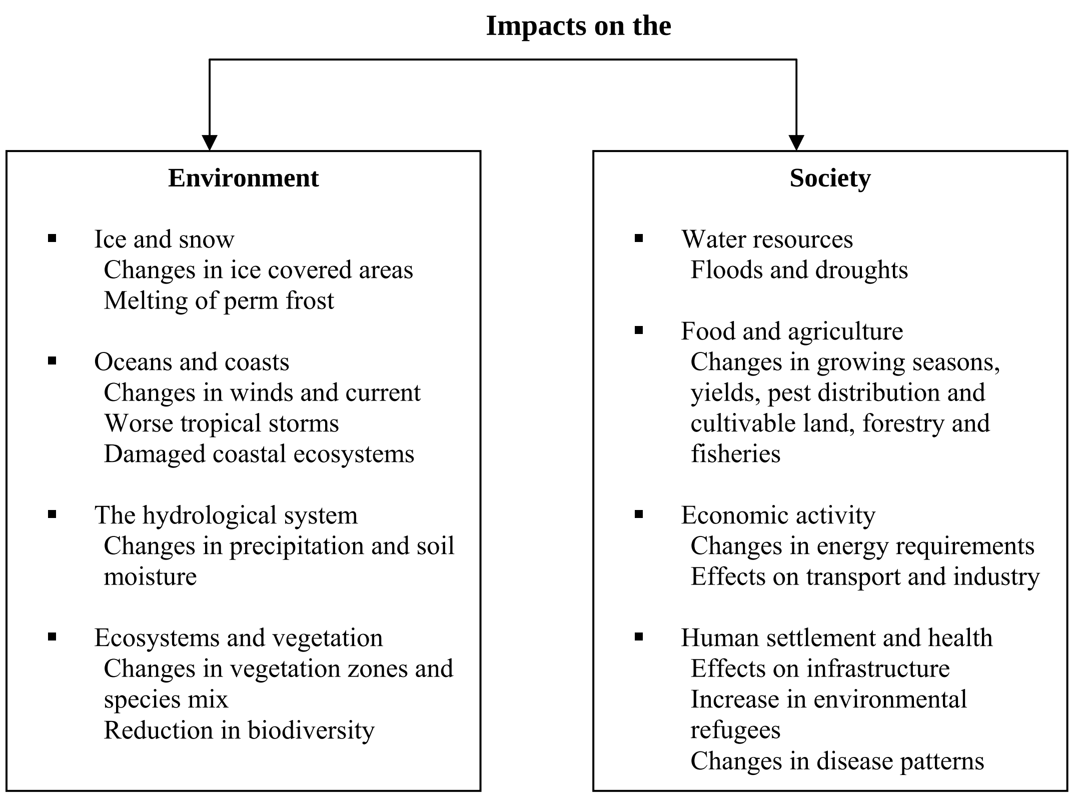
Poor climate conditions reduce Uganda's agricultural sector performance, which constitutes up to about 40 per cent of GDP. This results into higher food prices, low domestic revenues and widening of the current account deficit due to lower export earnings.

Productivity of Uganda's grasslands and livestock is dependent on climate and will therefore be affected by climate variability and climate change. The major grassland areas concentrate in the cattle corridor, with about 60 per cent of the cattle population in the country. The cattle corridor is an area of lower rainfall and has increasingly become prone to frequent droughts leading to depletion of both pasture and water resources.

Because we are concerned about what might be the local and regional effects of and responses to a global climate change, there is a need at the outset to identify how well societies have in the past dealt with local climate-related environmental changes regardless of cause. Such identification will provide researchers as well as policy makers with societal baseline data. To know how best to prepare for future changes, we must know how well we cope with presentday changes, identify societal strengths and weaknesses.

It is important to take societal impacts of global warming, and responses to those impacts. This underscores the need to educate relevant decision makers in those localities (and sectors) about the potential effect of climate change on their normal way of 'doing business'.

Figure 8.2: Overall effects of climate variation and change on the environment and human society.



Some atmospheric scientists have argued that the climate of the future will not be like the climate of the past. Therefore, they contend that, the past cannot be seriously as a useful guide to the future. However, societal responses to regional climate in the near future will most likely be similar to societal responses to the climate-related environmental changes of the recent past. Recent societal responses to variable climate conditions might provide useful insights into how best to cope with such condition at least in the near future. Forecasting society's ability to cope with the impacts of climate variations and changes can be through: Researchers identifying strengths and weaknesses, successes and failures in the way societies have responded to events that are most likely to recur in the future. Societies can then reduce the weaknesses while capitalising on the strengths to mitigate those impacts in the future. Climate plays an important role in human culture, how and where people live. Climate also plays an important role in human health and in the sustenance of plant and animal life. Over the last millennia, humenkind and ecosystems have adopted to particular climate conditions. However, current scientific knowledge points towards a discernable change in the global climate with associated regional impacts. Therefore, if climate changes, the life style and world ecosystems will live to change accordingly.

Mainstreaming adaptation to climate change is important to Uganda. The government of Uganda has therefore, ratified numerous international climate change commitments. Limited vulnerable assessments have been conducted in sectors such as agriculture, water resources and forestry. Some effort has also been made at policy level to communicate the urgent and immediate adaptation interventions needed to alleviate the adverse effects of climate change.

The issue of popular participation remains open to question. What is the extent to which information about adaptation, and about climate change adaptation programmes, legislative and policy developments should be communicated to all stakeholders? Consultations where all stakeholders, especially the vulnerable poor, are offered the opportunity to express their views and provide feedback on proposals is required.

There is an alarming gap between need and reality regarding providing vulnerable people with the power to choose between courses of action, and providing them with the assurance that decisions made regarding adaptation strategies will be implemented. The lack of meaningful community participation in decision making regarding appropriate adaptation has made it difficult to incorporate indigenous knowledge into conventional knowledge systems.

Local people have benefited little from adaptation efforts, most of which are based on top-down development models. Climate change adaptation in the context of government policies seems distant from local realities. The agriculture sector demonstrates this well, and provides useful analogy when looking at government policy regarding adaptation to climate change. Food security is of great concern to the people of Uganda, especially those in the north and east. Uganda's economy depends heavily on agriculture, and 90 per cent or more of farm produce is indigenous crops and animals. The plan for modernisation of agriculture (PMA) contains significant content on adaptation to climate change, including the development of drought-resistant cultivars, provision of water for production, agricultural information dissemination, among others.

Effective implementation of the convention depends on the level of awareness of the population at the various levels of society. Public awareness must therefore be an integral component of national programmes to address climate change and its adverse effects. Public awareness alone is not sufficient; education and training must also be carried out to complement public awareness. Incorporation of climate change issues into the education system will ensure that young generations are well informed about climate change and its adverse effects. Climate change is a crosscutting and a complex issue. There is acute shortage of expertise in this area. The lack of climate change expertise is compounded by the fact that it would need to be fused into many sectors if not all.

8.1.8 Response options for mitigating climate change

The successful implementation of greenhouse gas mitigation options needs to overcome many technical, economic, political, cultural, social, behavioral and/or institutional barriers which prevent the full exploitation of the technological, economic and social opportunities of these mitigation options.

The portfolio of government climate policy instruments may include: emissions/carbon/energy taxes, tradable or non-tradable permits, provision and/or removal of subsidies, deposit/refund systems, technology or performance standards, energy mix requirements, product bans, voluntary agreements, government spending and investment, and support for research and development.

The effectiveness of climate change mitigation could be enhanced when climate policies are integrated with the non-climate objectives of national and sectoral policy development, to achieve the long term changes required by both sustainable development and climate change mitigation.

Coordinated actions among countries and sectors may help to reduce mitigation costs, address competitiveness concerns, potential conflicts with international trade rules, and carbon leakage.

Climate change decision-making is essentially a sequential process under general uncertainty. The relevant question is not “what is the best course for the next 100 years”, but rather “what is the best course for the near term given the expected long term climate change and accompanying uncertainties”. More rapid near-term action would decrease environmental and human risks associated with rapid climate changes.

Any international regime could be designed in a way that enhances both its efficiency and its equity. The development of an effective regime on climate change must give attention to sustainable development and non-economic issues.

8.2 Energy scarcity: opportunities and risks from turning to biofuels

8.2.1 Introduction

Uganda has significant renewable energy options. Being mainly in the tropics, solar energy is quite pervasive. In addition, agricultural production can lead to large quantities of biomass but the most available resource is hydropower (Ogunlade, 2002). And yet, high fuel costs and energy scarcity, which combined have led to rationing and widespread blackouts, have kept economic growth below potential in a number of countries, most notably in East Africa. Power outages have become more frequent in recent years, as rapidly increasing demand is outpacing the increase in generating capacity, which has suffered from years of underinvestment and neglect, in part due to pricing policies that have forced electricity providers to produce at a loss (World Bank, 2007).

Energy security can be defined as consisting of two key dimensions that can be distinguished. Physical/quality dimension considers risks related to physical supply shortfalls occurring between production and consumption of energy due to infrastructural inadequacy/failure. The economic/price dimension consists of the risks of price distortions caused by high prices and fluctuations in the price of energy products and services (i.e. on the world/regional/national markets) (Leuenberger and Wohlgemuth, 2006).

The search for solutions to energy scarcity and energy insecurity in Africa and Uganda in particular has led to suggestions of a need for effective transfer of technologies. This will require partnerships among major stakeholders. African governments will have to formulate and implement measures that will improve the capacities of these countries to better receive technologies, while governments of technology suppliers will need to formulate policies that provide incentives for technology suppliers to find such transfers attractive. Energy technology "leapfrogging" can have a positive impact on African countries as they move towards a more sustainable development. Leapfrogging involves moving from one technology to another without going through the certain intermediate stages, such as moving from a traditional firewood stove to one using liquefied petroleum gas, while ignoring improved charcoal and kerosene stoves.

8.2.2 Biofuel options for energy generation in Africa

8.2.2.1 Power generation

The largest contribution by biofuels in the energy mix can be obtained through industrial heat and power generation.

Industrial power generation
Burning solid biomass releases a considerable amount of energy, which is used to fire a high pressure steam boiler, to produce electricity with a steam turbine. New high pressure technology is now available with higher efficiencies of electricity generated per unit of biomass, thus allowing excess electricity to be sold to the national grid. Sugar Corporation of Uganda Limited (SCOUL), Kakira Sugar Works (KSW) and Kinyara Sugar Works, in Uganda, currently generate about 7.0 MW of electricity used internally (Banaabe-Isingoma, 2004). In line with the country's electricity act (1999) the government has now put in place a strategy and plan to support rural electrification projects with a target of generating 70 MW from renewable energy sources. Reforms introduced in the power sector allow private developers to invest in the sector and the sugar industry can therefore invest in commercial cogeneration. The estimated potential based on the anticipated factory expansion of electricity generation and power surplus is 390 GWh if the best technology in Mauritius is applied and 650 GWh if the best technology globally is applied. The potential for power export to the grid is 286 GWh and 546 respectively.

Table 8.3: A comparison of cogeneration technology indices

	Current Status in Uganda	Best Available Technology Option from Mauritius	Estimated Cogeneration Potential for Uganda if the best Option Technology in Mauritius is Applied	Best Available Technology Options Globally	Estimated Cogeneration Potential for Uganda if best Available Technology Globally is Applied.
Bagasse Gasification	None	None	Not applicable	Not yet available. Potential is 500 kWh / Tonne of cane.	1300 GWh
Highest Boiler Specification.	30 tonne of steam per hour 25kg/cm^2, 350^{o}c	140 tonne steam per hour, 82 bar 525^{o}c	390 GWh	140 tonne of steam per hour 82 bar, 525^{o}c.	650 GWh
Power Output per Tonne of cane	50 kWh / tonne cane	150 KWh / tonne cane	390 GWh	250 KWh / tonne cane.	650 GWh
Power Export per Tonne Cane.	0	100 KWh tonne cane	286 GWh	210 KWh/tonne cane	546 GWh

Source Mbowa, (2001)

The main obstacles to commercial cogeneration in Uganda were cited to include: developers of cogeneration project demand a higher price per unit kWh of electricity compared to that from the big hydropower stations; there are few incentives for the sugar factories to promote cogeneration; sugar factories lack investment capital and policies in place are inadequate to attract private capital.

The sugar companies have to undertake major changes to increase power output from bagasse. Recommended changes to be introduced include: setting up bagasse power development projects, introducing measures to improve sugarcane yields, introducing efficient technologies such as high-pressure boilers to boost power output and developing human resource to match demands by cogeneration plants that use modern equipment.

8.2.2.2 Bioenergy for household and village applications

Apart from energy production on an industrial scale, biofuels also have a large role to play in improving quality of life and reducing fossil fuel demand at a household level in ACP countries (Cloin *et al.,* 2007). The vegetable origin fuel that replaces fossil gasoil is called "Biodiesel". It is manufactured from any number of plant oils (Jatropha, hemp, sunflower, soy bean, groundnuts, palm oil and algae to name but a few),' fish oils and animal fats, grease and tallow (MEMD, 2007).

Liquid biofuels
Remote areas in ACP countries can competitively use locally available raw material such as palm, Jatropha and coconut to produce liquid biofuels for village power generation (Cloin *et al.,* 2007). Generators that have been adapted for the purpose and agricultural conversion equipment such as mills and filters are needed to complement existing rural electrification programmes, which usually only feature diesel generators.

Biogas
Biogas can be produced from domestic and agricultural waste through anaerobic biogas digesters. The gas thus obtained can be used for cooking, heating both for households and light industrial applications and power generation (Cloin *et al.,* 2007). This requires cultural sensitivity analysis to ascertain its acceptability for use in the local context.

Biogas is a mixture of methane (CH4) and carbon dioxide (CO2) as the chief constituents. It also has traces of hydrogen sulphide (H2S), ammonia (NH3), oxygen, hydrogen, water vapour, etc., Biogas is combustible if methane content is more than 50 per cent. Typical methane composition in most biogas production units is 60 per cent (MEMD, 2007). Biogas is a zero-waste technology. Biogas is a non-poisonous and non-toxic gas which when mixed with air burns with blue flame, without soot or any offensive smell. The slurry is rich in nitrogen, phosphorus, and potassium as well as humus material. It has good applications in agriculture and horticulture. Methane burns very well. Biogas can therefore be used as a substitute of kerosene, charcoal and firewood. It is one of the renewable sources of energy, receiving popularity in rural areas, and will successfully meet the cooking and lighting energy needs of families, thus saving money, time and above all, help conserve nature since there will be less need to cut trees (MEMD, 2007).

In Uganda, biogas technology was introduced by the Church of Uganda in the early 1980s. In the early 1990's, the government of Uganda through the energy resources department, with assistance from IDA funds of the World Bank, started a national biogas pilot project that was not successful either. The project employed a World Bank hired technical advisor who was in charge of the project. Although biogas provides a cheap, clean energy source for cooking and lighting and also generates slurry that can be used as agricultural fertilizer, the technology has not yet gained widespread use in Uganda. Limited spread of this technology could be due to some social and economic issues.

8.2.2.3 Promotion policies

The use of biofuel can be made fiscally attractive based on the rationale of improving the balance of payments, decreasing dependence on fossil fuels and improving the local air quality by including these externalities into the price of fossil fuels through taxation.

8.2.2.4 Biofuels for transport

Blending ratios are determined by technical, economic and market considerations. For ethanol up to 10 per cent and for biodiesel up to 20 per cent blending is possible without engine modifications. However, the final blending ratios are influenced by the market for conventional fossil fuels and availability of feedstocks. To obtain optimal national blending ratios requires research in feedstock characteristics vis-à-vis environmental and socio-economic considerations. In order to support market development, national quality standards are imperative. Locally appropriate standards for a dedicated fleet with adapted engines operating on pure plant oils can also be considered.

8.2.3 Concerns over the development of biofuel technology

The increased international focus on expanding the production of biofuels has given countries the impetus to increase investments primarily to reduce dependence on imported fossil fuels and to mitigate climate change. The ACP countries have traditionally used biofuels but the efficiency and sustainability of their production systems are questionable. The decline in preferential markets for sugar and the need to diversify the industry to minimize the social displacement makes the production of sugar ethanol and other biofuels from a range of crops including cassava seem attractive. However, balancing food production, achieving food, nutrition and environmental sustainability, and producing biofuels at competitive prices for national and international markets will remain an elusive dream if the scientific and political community do not join forces in consultation with civil society.

8.2.3.1 Country case studies of Jatropha

In Uganda, Jatropha has existed as a fencing plant, as a wild growth in many fields and more recently in the vanilla growing areas as a support for the vanilla plant. Biodiesel can be made from Jatropha seeds. Although biodiesel may be new to Uganda, the plant Jatropha has been grown in the country for many years and is well known to the rural people. It grows very well on all kind of sites in the whole country. As stated earlier, it is neither eaten by humans nor browsed by animals. It is therefore an appropriate crop to be considered for biodiesel production in Uganda (MEMD, 2007). Jatropha curcas adapts well to semi-arid soil conditions, and can also be used to control soil erosion. In Uganda, the plant can be grown in drier areas such as Karamoja; drier hills in many parts of the country; along the railway line and the roadside; and planting it along the banks of the River Nile to check soil erosion.

Within the East African region, Tanzania has the most sophisticated level of development in the use of biofuels (Eijck and Romijn, 2006). Moreover, even in Tanzania the Jatropha activities in the different parts of the production chain still consist of a loose set of experiments. Cultivation of Jatropha has proceeded quite well in Tanzania, however, further down stream activities are small incomplete and the actors' network is not well coordinated. The experimentation, leaning and diverse expectations are not showing any sign of convergence, although much awareness and interest has been created in the plant (Eijck and Romijn, 2006).

Biofuels provide an opportunity for ACP countries, such as Uganda, to utilise their own natural resources and attract the necessary foreign and domestic investment to achieve sustainable development goals (Cloin *et al.,* 2007). Promoting widespread use of biofuels would provide greater energy security, improved quality of life for rural and urban populations, economic development, opportunities for job creation and poverty alleviation, especially in rural areas. The biofuel sector has strong links and synergies with other agricultural industries through provision of raw material base in the form of agricultural by-product streams from livestock and fisheries. At the same time, many biofuel by-products can provide feedstock for these same agricultural sectors.

8.2.4 Challenges of using biofuels

i) Economic challenges

Market prices of both agricultural feedstocks and fossil fuel prices are the main determinants of biofuel competitiveness. Given that both these commodities are highly volatile in nature, the very nature of biofuel competitiveness is a risky business and requires investors to look at the long term.

It is therefore important that knowledge and capacity are available to select the appropriate technology and feedstocks to produce biofuels, which are competitive with fossil fuel.

On the other hand, biofuels from woody biomass and bagasse are highly competitive with the current price of fossil fuels and are increasingly applied in cogeneration of steam and power.

ii) Industry-level challenges

a) Standards

In most ACP states, biofuels have not been standardised as a recognised fuel or fuel blend, neither have national standards been developed. This has its impact on the acceptability of biofuels by customers and car guarantees. On the other hand, most countries in the EU have established standards for the addition of both bio-ethanol and bio-diesel, which could easily be transferred or modified into ACP national standards, based on the EU experiences. Attempts to establish standards for the quality of pure plant oils in adapted engines can also build on the existing German standard for vegetable oils as a fuel in transport and power generation. Fuel standards for biofuels also exist in for example Brazil, Philippines, Malaysia, from which the ACP region can draw lessons.

b) Fuel blending

Biofuels can completely displace the fossil fuels in cars, trucks or generators, if they are adapted to accommodate the new fuel, for example in 100 per cent ethanol flex cars. To avoid the costs of switching or having to make engine adaptations, it is generally simpler to blend the proposed biofuel with the existing fossil fuel in proportions which will not require any modifications to the engine, such as E10, or B10 for diesel vehicles. Policies, for example based on the experiences in the EU as to the acceptable level of biofuel blending are thus a good start for market introduction of biofuels. To ensure that the correct infrastructure is in place to accommodate these blends, oil distribution companies need to invest, for which nationally appropriate incentives are required.

iii) Socio environmental issues

There is a potential conflict between using land and water for growing livestock feed, aquaculture ponds, food for human consumption and biofuels. In addition, largescale palm plantations in the tropical regions of the world result in loss of biodiversity (Cloin *et al.,* 2007).

The production of crops for biofuels requires improved efficiencies in land management practices. Likewise, the harvesting and management of available water is equally important for optimum production of the crops. Removal of crop residues, such as leaves and stalks, for use in co-generation, can negatively impact on soil structure and promote erosion, thus affecting the eco-system. Therefore strategies for managing crop residues must be developed for sustainability. Consideration can be given to using marginal lands e.g. to grow Jatropha. Stringent management must be carried out to achieve high productivity for maximum yield. Agronomic factors, e.g. the rapidly increasing price of fertilisers can negatively impact on the optimum application at small budget operations which will prevent the proper growth and development of the plant. Likewise, the harvesting and management of available water is equally important for optimum production of the crops. Removal of crop residues, such as leaves and stalks, for use in co-generation, can negatively impact on soil structure and promote erosion, thus affecting the eco-system. Therefore, strategies for managing crop residues must be developed for sustainability.

8.2.5 Policy responses suggested

i) Implement national biofuel strategies

Government in consultation with scientists, engineers and the general public should formulate strategies aimed at addressing critical issues such as promoting and sustaining local demand for biofuels. Targets should be set so that biofuels account for a share of the fossil fuel market. In addition, they should determine blending ratios; establish biofuel standards, recommend production modalities and consider environmental and social concerns and providing appropriate investment and consumption incentives.

ii) Institute a legal and regulatory framework

Government in consultation with scientists, engineers and the general public must set up a legal and regulatory framework aimed at guiding and regulating the biofuel industry and avoid negative environmental impact of the biofuel industry. There is a need to find a balance between biofuel commodity export and national consumption.

iii) Promote integrated agro-energy farming policies

Government in consultation with scientists, engineers and the general public should take into account the interconnectedness of the biofuel industries with livestock, farming, fisheries, and the conservation of forests and watershed areas to ensure maximizing national benefits and sustainable development. This integrated approach is also important for coherent and sustainable water and land management.

iv) Support ACP biofuel research

Government in consultation with scientists, engineers and the general public and international partners such as the EU should support local and regional research into evaluating and producing suitable feedstocks; process and logistics optimisation; economic analysis for cost effective solutions; adapting and transfer of technologies, such as ligno-cellulosic conversion; searching locally appropriate alternatives to existing biofuels; resource assessment, including the use of GIS and support laboratory capacity for the analysis of biofuel produced to ensure compliance with quality standards.

8.3 Genetically modified organisms

8.4.1 Introduction

Biotechnology creates opportunities for transformation of plants, animals or micro organisms or the same from completely different species thereby introducing desirable traits which would not have occurred through pollination or mating. This has therefore marred the debate on biotechnology particularly in respect of genetically modified organisms (GMOs) (Kisamba-Mugerwa, 2003). Uganda pursues a liberalized trade policy where traders are free to bring in merchandise as long as there is market for them and they conduct their business within the laws of the country. However, the laws regulating the importation of GM foods in the country are being developed. Even if this was so, the responsibility of regulating trade lies with the Ministry of Tourism, Trade and Industry (Nape, 2004). Under the leadership of the Uganda National Council for Science and Technology (UNCST) government has already produced a draft national policy on biotechnology and bio safety and this document is on its way for cabinet approval. The draft bio safety regulations and guidelines were developed through wide consultation across the relevant sectors and with a wide range of stakeholders. These documents are awaiting cabinet and parliamentary approval.

8.3.2 Genetically modified organisms

8.3.2.1 Understanding what GMOs are

Biotechnology refers to any technique that uses living organisms, or parts of these organisms. Such techniques are used to make or modify products for a practical purpose. Modern medicine, agriculture, and industry make use of biotechnology on a large scale. The genetic material is structured in a similar way in different species, which makes it easier to identify potentially useful genes. Certain species of crops, livestock, and disease-causing organisms have been studied as model species because they help us understand related organisms.

Certain fragments of DNA that can be easily identified are used to ‘flag’ the position of a particular gene. They can be used to locate and select individual plants or animals carrying beneficial genes and characteristics. Important traits such as fruit yield, wood quality, disease resistance, milk and meat production, or body fat can be traced this way.

For example a gene from a bacterium can be inserted into a plant cell to provide resistance to insects. Such a transfer produces organisms referred to as genetically modified (GM) or transgenic. Foodstuffs made of genetically modified crops that are currently available (mainly maize, soybean, and oilseed rape) have been judged safe to eat, and the methods used to test them have been deemed appropriate. These conclusions represent the consensus of the scientific evidence surveyed by the International Council for Science (ICSU) and are consistent with the views of the World Health Organization (WHO). However, the lack of evidence of negative effects does not mean that new genetically modified foods are without risk. The possibility of long-term effects from genetically modified plants cannot be excluded and must be examined on a case-by-case basis. New techniques are being developed to address concerns, such as the possibility of the unintended transfer of antibiotic resistant genes.

Genetic engineering of plants could also offer some direct and indirect health benefits to consumers, for instance by improving nutritional quality or reducing pesticide use.

Scientists recommend that food safety assessment should take place on a case-by-case basis before genetically modified food is brought to the market. In such assessments, foodstuffs derived from genetically modified plants are compared to their conventional counterparts, which are generally considered safe due to their long history of use. This comparison considers to what extent different foodstuffs can cause harmful effects or allergies and how much nutrients they contain.

Consumers may wish to select foods on the basis of how they are produced, because of religious, environmental, or health concerns. However, merely indicating whether a product is genetically modified or not, without providing any additional information, says nothing about its content or about possible risks or benefits.

8.3.2.2 Potential effects of genetically modified on the environment

Genetic engineering may accelerate the damaging effects of agriculture, have the same impact as conventional agriculture, or contribute to more sustainable practices. Growing genetically modified or conventional plants in the field has raised concern for the potential transfer of genes from cultivated species to their wild relatives. However, many food plants are not native to the areas in which they are grown. Locally, they may have no wild relatives to which genes could flow.

Moreover, if gene flow occurs, it is unlikely that the hybrid plants would thrive in the wild, because they would have characteristics that are advantageous in agricultural environments only. In the future, genetically modified plants may be equipped with mechanisms designed to prevent gene flow to other plants.

A controversy has arisen about whether certain genetically modified plants (which are insect resistant because they carry the Bt gene) could harm not only insect pests but also other species such as the monarch butterfly. In the field, no significant adverse effects on non-target species have so far been observed. Nonetheless, continued monitoring for such effects is needed.

Genetically modified crops may have indirect environmental effects as a result of changing agricultural or environmental practices. However, it remains controversial whether the net effect of these changes will be positive or negative for the environment. For example, the use of genetically modified insect-resistant Bt crops is reducing the volume and frequency of insecticide use on maize, cotton and soybean. Yet the extensive use of herbicide and insect resistant crops could result in the emergence of resistant weeds and insects.

The broad consensus is that the environmental effects of genetically modified plants should be evaluated using science-based assessment procedures, considering each crop individually in comparison to its conventional counterparts.

8.3.3 Uganda's position on GMO foods

Until the policy and regulatory frameworks are in place, Uganda's position on biotechnology, GMOs and GM foods is (Nape, 2004):

1. Until proven otherwise "GMO maize and other GM food products may be safe for human consumption and hence Uganda shall not refuse them. However, GMO products should be strictly for consumption and not for agricultural production purposes"
2. Since GM foods are products of biotechnology and GMOs, Uganda needs to develop its own capacity to understand, assess, evaluate and manage potential risks and benefits of biotechnology and GMOs. The country has already embarked on developing this capacity as outlined above, particularly in developing national policy and regulatory framework and in developing the required human resource and research capacity through the National Agricultural Biotechnology Center, the Universities and other institutions, to mention but a few.
3. The government appreciates the potential benefit and perceived risks associated with GMOs. Until policy and regulatory frameworks are in place, the National Bio safety Committee and any other relevant arms of government shall carefully and critically examine importation and work on GMOs on a case-by-case basis.

8.3.4 Perceptions on food safety, security and trade: Experience in Uganda

The need for food safety control systems to prevent and control the prevalence of food borne diseases is shared by various stakeholders. The difference arises out of the perceptions on food safety, and levels of mechanism to put it in place to meet international acceptable standards. The debate is worsened when issues relating to percentage composition of genetically modified organisms (GMOs) are brought into the picture (Kisamba-Mugerwa, 2003). The bone of contention in the World Trade

Organisation (WTO) stems from the interpretation of labelling requirements. There is no consensus and guidelines on what labelling must entail. One school of thought mainly dominated by Europe takes consideration of percentage GM component in a given food commodity. This would mean that biochemical and genetic analyses of component genes in a given food commodity are undertaken. This can be a serious constraint in a developing country. Another school of thought which serves developing country interests and capacity is to undertake labelling just for ethical considerations. In this respect labelling would be geared at indicating if a given food is modified or not, in other words taking into account that one takes a decision on an “informed consent”. There is also a perception that plant varieties developed through traditional processes, such as crossbreeding are considered more superior to those which are genetically modified and this is not true.

To guarantee food security in the Ugandan perspective can be perceived mainly through three ways. Either the household produces sufficient food to the extent of self-efficiency, or produces some and others for household incomes and other needs through the market. Failure of any of the two above would imply that household would access food through food aid just as a last resort. In all respects, to guarantee food security it is necessary to increase productivity and this warrants technology transfer research and development and also trade (Kisamba-Mugerwa, 2003). Technology transfer, research and development to increase agricultural productivity and trade in food are both limited due to economic and biotic factors. Biotechnology development would go a long way in enhancing productivity, reducing poverty, increasing food security and nutrition, promoting healthcare and sustainable use of natural resources.

8.3.5 Constraints and gaps for biotechnology and bio safety in Uganda

The fact that biotechnology is increasingly becoming useful cannot be over emphasized. Biotechnology however has some potential risks to public health, environment and social aspects of the countries involved. Biotechnology and bio safety require knowledge in science and technical issues which require specialized knowledge (NEMA, 2002). The management of biotechnology in Uganda is an issue of institutional development and governance requiring new institute values and standards, new capabilities at the policy making level and experimentation. Constraints being faced are given as follows:

- Lack of regulations to provide guidelines on the use of biotechnology.
- Limited institutional capacity for training in biotechnology
- Insufficient funding to develop biotechnology and bio safety in Uganda.
- Inadequate of awareness on the importance and potential use and applications of biotechnology and the related safety needs which leads to limited or lack of community involvement in biotechnology activities.
- Inadequate national systematic policy and structures (e.g. legal instruments) regulating biotechnology use in Uganda, coupled with the lack of a clear-cut policy on intellectual property rights.

- Inadequate institutional collaboration and consultation in biotechnology which results in minimal pooling of resources and sharing of experience/expertise.
- Poor utilisation of political infrastructure for effective management and sustainable use of biotechnology.
- Weak regional collaboration and coordination on matters related to biotechnology and bio safety.

8.3.6 Uganda's state of biotechnology and bio safety on GMOs

As Uganda moves towards embracing biotechnology, a number of constraints threaten advancements and as such, strategies have been put in place to overcome some of the obstacles and they include (NEMA 2002):

- putting in place policy and legal frameworks on biotechnology and biosafety;
- strengthening human, institutional and infrastructural capacity in all aspects of biotechnology;
- strengthening regional cooperation and collaboration in biotechnology and biosafety;
- identifying sustainable funding sources for biotechnology and biosafety activities;
- promoting research in medical, agricultural, environmental and other areas of biotechnology and biosafety;
- updating information on biotechnology and biosafety;
- establishing a strong and effective monitoring system for biotechnology use and applications;
- understanding EIA or risk assessments on biotechnology policies, programmes or projects that are likely to have significant negative impacts on human health and the environment including biodiversity;
- promoting trade in biotechnology products;
- developing mechanisms for sharing costs and benefits of biotechnology;
- promoting integration of biotechnology values into macro economic frameworks;
- undertaking awareness and publicity campaigns on the benefits and risks of biotechnology and biosafety; and
- developing and disseminating biotechnology awareness materials.

With funding from USAID, through APEP, Uganda is making trials on pest resistant cotton (Bt cotton). The trials will not be released commercially and all trial sites are guarded. USIAD is also doing trials on herbicide tolerance cotton, cotton that has been genetically modified so that if it is sprayed with round-up herbicide, the cotton is not affected but all weeds are killed. If proved effective, the technologies are expected to improve the competitiveness of Uganda's cotton sector and result in increased cotton output. The cotton output in the 2006/07 season was 135 000 bales down from 248,000 bales in the 2005/06 season. The output has generally increased from 103 000 bales in the 2004/05 season (Monitor, 2007).

8.3.7 Threats posed by GMOs

The biggest fear about genetically modified crops is that of new genes escaping into the environment. Although WTO rules require that standards set for products and processes that are internationally traded should be consistent and non-discriminatory, each WTO member state has considerable autonomy when deciding what to accept and what to reject. This applies, at least in principle, to developing countries just as much as it does to other countries. However, the range of choices open to developing countries is limited in part by their capacity to establish, finance and administer a risk assessment and regulatory system. As we have seen, different approaches to testing differ hugely in cost. The costs of conducting the tests typically fall on the companies requesting consent to market their products. But the administration that reviews and interprets the resulting data will also incur costs. The more complex, thorough and exacting the tests, and the more extensive the resulting data, the greater the cost of assembling the expertise required to analyse and interpret those data.

As a result, developing countries may need help with amassing enough trained personnel for this task. But there may also be considerable scope for collaboration with other countries in this position.

That, at least, would be the desirable scenario. In reality, the United States and the EU are economically and politically powerful bodies that exercise considerable influence over their smaller and weaker trading partners. Developing countries may find that they face strong pressure to design and introduce risk assessment regimes that conform to one or the other of those systems.

But they should remember that there is nothing in either the science, or the WTO's rules, that compels developing countries to adopt the standards or approaches to risk assessment and/or evaluation embraced by industrialised countries (Millstone & van Zwanenberg, 2003).

8.3.8 Possibility of Uganda being able to use GMOs in future

Building public support for genetically modified crops means developing a home grown solution to the region's own needs. At one level, the decision seems straightforward. Scientific achievements in GM plant breeding over the past two decades have produced a range of new crops that can increase farmers' productivity while reducing their production costs — for example, by substantially lessening the needs for fertilisers and insecticides. But at the same time, GM technology has not been around long enough for all its side effects to be understood (Kisamba-Mugerwa, 2003). For critics of the technology, the worrying possibilities of what might happen were the technology to get out of control, however remote, is sufficient reason to halt development until more is known.

Put in these terms, the political challenge is familiar. A new technology needs an effective regulatory regime that allows its potential to be harnessed safely. This is because scientific uncertainty remains over what the side effects are likely to be.

Governments must also ensure that their electorates are sufficiently informed about both the potential benefits and risks of GM technologies. Information campaigns — in which journalists have a role to play through sound reporting — will not necessarily endorse GM crops. They will, however, increase the chances that political decisions come out of scientifically-based arguments, rather than unfounded speculation (Dickson, 2007).

African countries — like others in the developing world — must develop the scientific and technological capacity to ensure that biotechnology meets their own needs, on their own terms. This will include acknowledging that biotechnology can become a home grown industry in Africa, with the willingness to commit the necessary resources.

The Cartagena Protocol on biosafety, which entered into force in 2003, sets out the first comprehensive regulatory system for ensuring the safe transfer, handling and use of LMOs. The focus is on regulating the movement of such organisms across national borders. It is concerned with both intentional environmental introductions and LMOs that are to be used as food or feed, and for processing. Such organisms are also alien species and currently the extent to which these will threaten biological diversity, ecosystem and habitats is poorly understood – much remains uncertain and there are fundamental areas of ignorance and gaps in knowledge. In addressing this, the Protocol: adopts a precautionary approach; and establishes an advanced informed agreement system.

8.4 Invasive alien species

8.4.1 Introduction

Invasive alien species (IAS) are also commonly referred to as invasives, aliens, exotics or non-indigenous species. They are species, native to one area or region, that have been introduced into an area outside their normal distribution, either by accident or on purpose, and which have colonized or invaded their new home, threatening biological diversity, ecosystems and habitats, and human well-being (UN 1992). The extent to which introduced species may proliferate and spread is affected by the state of the receiving ecosystem. An alien species may find a vacant niche and spread, or it may compete for one already occupied by a native species. Some IAS proliferate because they find no natural enemies in their new habitat. Although some species have invaded habitats on their own, human activity such as exploration, colonization, trade and tourism has dramatically increased the diversity and scale of invasions by alien species (UN, 1992; Shrine and others 2000; ESA 1998).

One of the major causes of the proliferation of alien invasive species is global trade. Global trade has enabled modern societies to benefit from unprecedented movement and establishment of species around the world. The various species movement could be for the purposes of forestry, agriculture, fisheries, pet trade and horticulture (Hobbs, 2000). A new challenge is to identify when these alien species or non indigenous species are bringing about changes that are harmful to ecosystems, biodiversity, health, economics or other aspects of human welfare.

The national environment act, section (1) provides that NEMA, in consultation with lead agencies, controls the introduction of alien species as a means of ensuring the conservation of biodiversity *in situ* (GoU, 1995).

8.4.2 Why are alien invasive species important?

According to the world conservation union (IUCN), invasive alien species are the second most significant threat to biodiversity after habitat loss. Invasive species can be predators, competitors, parasites, cause disease, or hybridize with domestic plants and animals. They often dominate the ecosystems they invade, causing losses to productivity and market access and increasing costs to producers (IUCN, 2005). Invasive alien species reproduce and spread in their new environments, dominating vegetation and water bodies and displacing native species.

However, not all alien species are invasive. Some of the alien species can even be beneficial; for example, most of our agricultural crops are alien species. Many alien species survive without ever becoming a problem. Although not all alien species will become invasive or threaten the environment, this is an area in which a clear policy approach is necessary because of its potentially wide-ranging impacts when they do become invasive, and because of the difficulties, including financial costs, in reversing its impacts. For example, while the introduction of *Lates niloticus* (Nile Perch) into Eastern Africa has had immense economic value in the countries where it has been introduced, it has also wreaked havoc in the ecosystems, resulting in the loss of endemic species and altering ecosystems with knock-on effects for livelihoods (UNEP, 2006).

The spread of invasive alien species is creating complex and far reaching challenges that threaten both the natural biological rich resources of the earth and the well being of its citizens. While the problem is global, the nature and severity of the impacts on society, economics, life, health and natural heritage are distributed unevenly across nations and regions. Thus, some aspects of the problem require solutions tailored to the specific values, needs and priorities of nations while others call for consolidated action by the larger world community. Preventing the international movement of invasive alien species and coordinating a timely and effective response to invasions will require cooperation and collaboration among governments, economic sectors, Non Governmental Organisations and international treaty organizations (Hobbs, 2000).

8.4.3 Fisheries and invasive alien species

8.4.3.1 Alien species in Uganda's fisheries and their impact

As noted in the national fisheries policy (2004), there is a need to regulate future introduction of fish and other aquatic species across water bodies (MAAIF, 2004). Indeed, before the 1950s, commercial fishery in Uganda depended on two native tilapia species. But by the early 1950s, they were over-fished and three species of non indigenous tilapia were introduced to refurbish the fishery (Hobbs, 2000). As a result the British colonial government decided in the 1950s, to stock some fisheries like Lake Victoria with the Nile Perch, *Lates niloticus*. The Nile Perch was chosen because it had a reach of two meters and 200 kg weight, and this was a means to convert the substantial biomass of smaller fish into large fish suitable for largescale, higher capital investment and exploitation for human consumption (Mooney and Hobb, eds). For the first few decades thereafter, Nile Perch remained rare. But in the 1980s, well after eutrophication was underway, Nile Perch quickly became abundant in Ugandan waters (43 per cent of the lake). For example, the total commercial catches of fish increased from 17 000 tons in 1981 to 132 400 tons in 1989, with Nile Perch and exotic tilapia constituting practically the entire catch. Nile perch catch constitutes over 80 per cent. Pre-existing eutrophication aided Nile Perch by increasing overall productivity and by concentrating remaining prey in areas with sufficient dissolved oxygen for survival (Hobbs, 2000). According to LVEMP (2004), the haplochromine population has dropped from about 80 per cent of fish biomass in the lake in the 1970s to less than 1 per cent in the 1980s.

Table 8.4: Estimated percentage share of the quantity and value of fish (alien and native) harvested in Uganda

Species	Percentage Shares	
	Quantity(Tons)	Value (Million Ushs)
Alien species		
- Nile perch	60,147.0	105,016.7
- Tilapia	28,948.0	27,616.6
Sub Total	89,095.0	132,633.3
Native species		
- *Hydrocynus* - *Alestes* - *Bogrus* - *Barbus* - *Clarias* - *Protopterus*	74,140.5 (For all)	17,862.2
Total	163,235.5	150.495.5

Source: NAFIRRI 2006

Introduced species differ in their reproduction, rates of spread and impacts. The introduction of Nile Perch into Ugandan water bodies (especially Lake Victoria) has increased profits from commercial fishing and contributed to foreign exchange gains (Table 8.3), at the expense of extinction of numerous endemic fish species.

At the turn of the 1990s, Lake Victoria suffered a further blow with population explosion of exotic water hyacinth, *Eichornia crassipes* a floating amazonian water plant considered to be one of the world's worst aquatic weeds. Water hyacinth, which was first reported in 1988, covered approximately 80 per cent of the Ugandan portion of the lake by 1995 (Kayanja, 2001). Stationary mats made up of 2 200 hectares while mobile mats covered 1 800 hectares in 1998. Water hyacinth infestation hot spots were Inner Murchison Bay, River Kagera, Victoria Nile, Nalubaale HEP Station Jinja, Thurston, Hannington and Waiya Bays. Systematic control efforts started in 1993 as the weed disrupted socio-economic activities (Kayanja, 2001). Infestation by water hyacinth was suppressed in 1996 through the use of biological control, ecological succession with native plants (hippo grass), manual removal at landing sites and mechanical harvesters at Wagon Ferry Terminal, Port Bell and Nalubaale HEP Station, Jinja (Kasoma, 2003). Two types of weevils (*Neochetina eichhorniae* and *Neochrtina bruchi*) used in biological control of water hyacinth are totally dependent on the weed for food and successful reproduction. Weevil effectiveness depends on the health of the weed, which in turn depends on the nutrient status of the water environment. However, strong resurgence of the weed was observed in November 2000 in Lake Victoria. Weed proliferation in Murchison and Wazimenya Bays consisted of fresh healthy infestations.

The water hyacinth has undesirable impacts on wetland and other aquatic ecosystem health. In Uganda, the hyacinth had suppressed the outer papyrus fringe fauna that was originally characterized by high abundance and diversity of macro-invertebrates. The type of macrophyte species or associations seems to influence the abundance and diversity of macro-invertebrates. Outer vegetation fringes indicated real water hyacinth impacts and the response of invertebrate faunal communities to the stressed habitats (Twongo *et al.,* 1996).

Water hyacinth was associated with habitats occupied by *Cyperus papyrus* and *Vossia cuspidata* on the landward side while the indigenous water plants such as *Nymphaea, Ceratophyllum and Pistia* were common at the interface with the dominant emergent macrophytes. In addition, a comparison between *C. papyrus* dominated shallow habitats with those occupied by water hyacinth, *Eichhornia crassipes*, found that water hyacinth-dominated habitats had significant effects on a range of water quality parameters particularly DO, pH, NO3-N but no significant effects on conductivity and Chloropyll-a (Balirwa, 1998).

8.4.3.2 Economic cost of controlling the water hyacinth

Government undertook efforts to control the water hyacinth at the Owen Falls dam between 1995 and 1997 (Kayanja, 2001). The effort to control the water hyancinth at the Owen Falls dam required three harvesters at a cost of US$ 2.5 million and variable costs of management at US$ 19 000 per month. In the case of chemical control using boats would have required US$ 246 per hectare for glyphosate and US$ 118 per hectare for 2, 4 D; Aircraft use US$ 187 per hectare for glyphosate and US$ 59 per hectare for 2, 4 D. On the other hand, biological control required US $ 95 000 annually for monitoring (Joffe and Cooke 1997).

Table 8.5: Economic costs and control expenditure (per annum) incurred to control the hyacinth

Country / Water body	Amount (Thousand of US $)
Nigeria	50,000
Lake Victoria	9,600
Uganda	4,560
Egypt	7,000
Malawi	133
Zimbabwe	43
Total	**71,396**

Source: Joffe and Cooke 1997

8.4.3.3 Other effects of the water hyacinth on Lakes Victoria and Kyoga

Water hyacinth makes it difficult to use the lake for transport, hydropower generation and fishing (and causes many fish to die), and puts more pressure on the land to produce food. The result is increased hunger, disease, social instability and environmental degradation. Left unchecked, the direct and indirect impacts of the water hyacinth are thus socially and economically devastating.

8.4.4 Forestry and invasive alien species

Alien trees have long been introduced for commercial forestry, agroforestry, and erosion control or landscaping. Overtime and with increasing dissemination, the invasive potential of woody species such as Leucina, *Leucaena leucocephala*, *Sena spectabilis, Sena siemea* and *Thevetia peruviana* are becoming apparent. A case in point is at Nyabeya Forestry College where *Sena spp* were planted as boundary markers but have since spread haphazardly causing unclear boundary lines (ICIPE, 1999).

Acacia species were introduced in south western Uganda in the 1950s–1960s. Though they have slow spreading rates, they displace native species that are more palatable to wildlife, change soil fauna e.g. earthworms and the thorns are dangerous to animals. *Leucaena leucocephala* invades agricultural range lands once introduced in an area. They outgrow native plants and as a result reduce the abundance of native fallow species and some other fodder plants. *Sena spectabilis* have invaded small rangelands in the country. Their main disadvantage is that they tend to exclude other plants and animals from the ecosystem. They do not however posses direct negative impacts on humans.

Forest plantations can be seriously affected by pests and disease. Commercial forestry has traditionally combated alien pest problems on alien tree species by simply felling trees and growing other unaffected tree species, but this is no longer economical viable in many circumstances and methods like eradication and biological control are increasingly employed. During the early 1990s, Cyprus aphids *Cinara cepressus* attacked cyprus plantations in Uganda and Tanzania. The aphids have a characteristic of spreading very rapidly hence destroying large tracks of plantations within a short time (ICIPE, 1999).

Time and again, alien eucalyptus trees from Australia have been blamed for draining too much water and of being harmful in environmental terms because their leaf litter contains chemical compounds that prevent other species from growing. Careful management can minimise the danger of alien trees escaping cultivation to become invasive in natural ecosystems. (Hobbs, 2000)

8.4.5 Agriculture and alien invasive species

The domestication of plants and animals that started 10 000 years ago has involved the intentional and beneficial movement of many species around the world. Most regions depend today on alien crops and livestock and indeed the greatest levels of agricultural production for any crop are usually outside its region of origin.

Introduction of plants for ornamental purposes is reinforced by consumer demands for novelty and complicated by low levels of understanding of the risks of biotic invasion. This is the case with *Lantana camara* which was originally introduced as an ornamental but have invaded extensive habitats. They have become common agricultural weeds and as a result have led to increase in agricultural production inputs.

Sadly, many nurseries have been equally problematic as sources of invasions — often to satisfy someone's desire to bring in some new, pretty plant with which to make more money. There may be a slightly more advanced level of understanding than in the pet trade, but the plant trade too suffers from negligible controls and virtually non-existent accountability.

8.4.6 Instruments/ responses pertaining to alien invasive species.

Legal frameworks are essential to support efforts to manage IAS, working at both national and international levels. GISP has produced a guide for designing legal and institutional frameworks on IAS (Shine, Williams, and Gundling, 2000), seeking to provide an essential tool in this regard. Any legal framework at the national level needs to include adequate provisions for mitigating the impacts of IAS, a challenge that faces numerous constraints e.g. lack of resources.

An effective policy and funding framework to control invasive species requires the integration of economic and legal concerns at local, national and international levels. This requires signatories to base all the Sanitary and phytosanitary (SPS) measures on scientific principles to publish their regulation to use principles of equivalence and to apply measures without arbitrary discrimination between members of General Agreement on Tariffs and Trade (GATT) now the World Trade Organisation (WTO).

The convention on biological diversity (CBD) was one of the key agreements adopted at the 1992 Earth Summit in Rio de Janeiro. Today some 188 countries are parties to the convention, committing to: take appropriate measures to conserve biological diversity; ensure the sustainable use of biological resources, and promote the fair and equitable sharing of benefits arising from the utilisation of genetic resources.

Article 8(h) of the Convention calls on parties to "prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats, or species". Considered a cross-cutting issue within the Convention, invasive alien species are addressed in various thematic areas.

8.4.6.1 Legal principles, approaches, and tools dealing with IAS

- *Precaution:* lack of scientific certainty shall not be used as a reason to postpone measures to avoid or minimise a threat of significant reduction or loss of biodiversity

- *Prevention:* protection of the environment is best achieved by preventing environmental harm rather than by attempting to remedy or compensate for such harm

- *Permit system:* permit (or licensing) systems provide a framework within which applications to introduce an alien species can be assessed or screened and an informed decision made before authorising an intentional import or release
- *Polluter pays principle (Cost recovery)***:** the natural or legal person who is responsible for causing the introduction of the alien invasive species should bear the cost of prevention and control measure

- *Public participation and access to information:* planning and decision-making procedures on alien species issues are complex and requires the involvement of all stakeholders, all sectors and at all levels
- *Risk analysis process:* should identify the relevant risks associated with a proposed introduction or management measures
- *Environmental impact assessment:* like risk analysis, should be conducted before making a decision on whether or not to authorise a proposed introduction of an alien species

There is an urgent need to strengthen institutional arrangements for hyacinth control and regional cooperation, revitalization of the weed control process, more research into water hyacinth dynamics and impacts as well as more effective information dissemination Kayanja (2001).

8.5 Chemicals

8.5.1 Introduction

Chemical substances, and their derivatives, are widely used in many development and economic fields, including industry, agriculture, mining, water purification, public health particularly disease eradication, and infrastructure development. However, production, storage, transportation, and removal of these substances can pose risks to people and the environment (UNEP, 2006).

Chemical industry predictions are that future global growth will be led by pharmaceuticals, followed by speciality chemicals, agricultural chemicals, textile fibres and industrial chemicals. The production of agricultural chemicals is a key focus of the chemical industry in Africa. Africa contributed approximately 4 per cent to total world pesticides (insecticides, fungicides, disinfectants) production in 1998, and approximately 5 per cent in 2002 (UNEP, 2004). Mining chemicals produced in Uganda include explosives and accessories such as fuses and detonators, mineral processing chemicals such as leaching agents, floatation agents, smelting and refining chemicals.

8.5.2 Chemical production and use in Uganda

The production of chemicals in Uganda is still minimal. Chemical production in Uganda constitutes less than 2 per cent of the total demand of chemicals. Most of the chemicals obtained in Uganda are through imports (Nampinga, 2005). Thousands of tons of chemicals are unloaded into the country every year for use in agriculture, forestry, veterinary, health and industry.Most chemicals used in Uganda are obtained through imports. The customs department of the Uganda Revenue Authority (URA) handles all issues related to imports and exports of goods. However, for certain categories of chemicals, specialised bodies/authorities have to approve their imports. Agrochemicals such as fertilisers, herbicides and others have to be approved by the agricultural chemicals board, while the importation of human and veterinary drugs has to be approved by the National Drug Authority (NEMA, 2002).

Table 8.6: Chemical production and trade

Chemical type	*Chemical manufacturing tons/ year*	*Imports tons/year*	*Imports value Ushs*	*Formulation packaging*	*Exports tons/year*
Pesticides (agricultural, public health and consumer use)	-	4,298	-	Powder and liquid	-
Fertilizers	-	15,500	-	Powder	-
Petroleum	-	450,000	-	Liquid and solid	-

Source: Nampinga 2005

A number of other chemicals are used in the industrial sector mainly in the manufacturing of goods using raw materials from agriculture, livestock and forestry. Chemicals are used in the primary processing (pre-cleaning, grading and packaging) of agricultural outputs for export such as coffee, cotton, tea, beans etc.

Table 8.7: Chemical use by category in Uganda

Type of chemicals	Number of tons used per year in Uganda
Pesticides	4,298
Fertilisers	15,500
Petroleum products	480,000

Source: Nampinga 2005

Apart from chemicals, the country also generates chemical waste. However, Uganda does not import or export chemical waste for processing or disposal purposes (NEMA, 2002). Some chemical wastes generated e.g. used oils are utilised by some industries (tea and sugar) as furnace fuels. Some used oils are also put to use as wood preservatives however this is not being encouraged. However, there are substantial amounts of expired chemicals especially in institutions (laboratories) as well as some pesticides and obsolete chemicals such as PCBs in old transformers that need to be disposed of. At the moment there are no guidelines on chemical waste management.

Pesticides are used in a variety of ways in Uganda. Different chemicals and often different formulations of the same chemical are used for the same purpose. Pesticides are one of these classes of chemicals that form a very important component of Uganda's national economy because of their extensive use in agriculture and their potential impact on public health. A wide variety of pesticides are used to improve the quality and quantity of crops and livestock. Most of these uses are being carried out by ill-equipped small scale farmers (CDI, 2006). In Uganda, pesticide chemicals are generally used for crop protection, livestock protection, vector control, locust/army worm control, weed control, seed dressing, forestry, and pesticide misuse e.g. fish poisoning and suicide.

Table 8.8: Commonly used pesticides in Uganda

Group	Named example
ORGANOPHOSPHATES	Malathion, DDVP, Diaznon, Methyl parathion, Dursban, Phosdrin, Fenitrothion, Dimethoate (Rogor), Bromosphos, Dichlorvos, chlorpyrifos
ORGANOCHLORINES	Dieldrin, Lindane, Thiodan, Toxaphene, Endosulfan
CARBAMATES	Dithane M45, Dithane M44, Dithane M22, Furadan
PYRETHRINS/PYRETHROIDS	Ambush, Ripcord (cypermethrin)
BIPYDRIDYLS	Grammoxone (Paraquat), weedol, Disquat
PHENOXY ACETIC ACID	2,4-D, 2,4,5-T, MCPA
INORGANIC METAL	Shell Copper (copper oxide), Lead Arsenate, phenylmecuric Acetate, Arsenic trioxide.

Source: (Wasswa and Kiremire, 2004)

8.5.2 A summary of chemical problems in Uganda

The problems and challenges of managing chemicals in Uganda are (Mulindwa, 2005): Limited capacities and resources of a large number of countries especially in low income developing countries; absence of facilities for environmental and human health monitoring and analytical capacity; lack of targeted research; inadequate information on chemical related issues especially in low developing countries; lack of national inventories on potential sources of generation and releases of persistent organic pollutants (POPs); the information available is in scientific language, which makes it difficult for local people to interpret the information especially the precautions on the labels; illegal trade in chemicals; poor enforcement of existing laws and policies; and corruption

Yet there are some efforts by several stakeholders to implement parts of the chemical management conventions to which Uganda is a signatory. In 2002 NEMA developed a chemicals profile for Uganda. And, alongside parallel activities undertaken by International POPs Elimination Project (IPEP), NEMA is also developing national implenetation plans (NIPs) for the Stockholm Convention on peristent organic pollutants. Within the POPs management plan NEMA will come up with a position on the management of what are commonly refered to a the dirty dozen, 12 chemicals Polychlorinated biphenyls, Unintentional Peristsnt organic Pollutants, of dioxins and furans, pesticides such as Dieldrin, Aldrin, Hexachlorobenzene, Heptachlor, chlordane, endrin, mirex and toxaphene, and DDT.

Table 8.9: A summary of chemical problems in Uganda

Nature of problem	*City/ Region*	*Brief description of problem*	*Pollutants*
Air pollution	National	Through generation of fumes Through burning of pesticides packaging Through spraying Through dusting Through use of aerosols Through fumigation	Fertilisers Insecticides Fungicides Wood preservatives Anti-pest products
Pollution of inland waterways	National	Use of pesticides near water ways Washing containers in water ways Direct discharge of agrochemicals into water bodies	Fertilisers Insecticides Fungicides Wood preservatives Anti-pest products
Marine pollution	Regional	Most waterways link up into lakes Most flower growers are found on lake shores	Fertilisers Insecticides Fungicides Wood preservatives Anti-pest products
Ground water	National	Through infiltration of contaminated water	Fertilisers Insecticides Fungicides Wood preservatives Anti-pest products

Source: NEMA (2002)

Table 8.9: A summary of chemical problems in Uganda (cont'd)

Nature of problem	*City/ Region*	*Brief description of problem*	*Pollutants*
Soil contamination	National	Through spraying Through dusting During transportation Disposal of obsolete chemicals Pesticide residues Through disposal of packaging materials	Fertilisers Insecticides Fungicides Wood preservatives Anti-pest products
Drinking water contamination	National	No water treatment in villages Inadequate treatment in towns Most water ways/bodies are source of drinking water Using chemical containers for drinking water	Fertilisers Insecticides Fungicides Wood preservatives Anti-pest products
Occupational Health agriculture	Country-wide	Lack of awareness of dangers associated with pesticides Most rural uers lack safety gear Safety gear expensive or uncomfortable hence reluctance	Fertilisers Insecticides Fungicides Wood preservatives Anti-pest products
Pesticide residues in food	National	Improper post harvest handling Extent of food contamination not known Excessive and frequent use of pesticides Pesticides discharge into water bodies accumulate in fish	Fertilisers Insecticides Fungicides Wood preservatives Anti-pest products
Hazardous waste treatment/disposal	National	Lack of awareness Lack of treatment technologies Lack of disposal facilities	Fertilisers Insecticides Fungicides Wood preservatives Anti-pest products
Storage/Disposal of obsolete pesticides	National	Lack of adequate storage facilities Lack of adequate logistics in distribution of pesticides Importation of excess than needed Lack of adequate facilities.	Fertilisers Insecticides Fungicides Wood preservatives Anti-pest products
Unknown pesticide importation	National	Varieties are too many to monitor Due to locally re-packed pesticides Lack of quality control guidelines on packaging	As above

Source: NEMA (2002)

Table 8.9: A summary of chemical problems in Uganda (cont'd)

Nature of problem	*City/ Region*	*Brief description of problem*	*Pollutants*
Pesticide poisoning	National	Safety and protective gears are expensive and un comfortable Use of pesticide containers for food and drinks Misuse of pesticides Lack of awareness	Fertilisers Insecticides Fungicides Wood preservatives Anti-pest products
Public health	National	Through ground water pollution Through food contamination Through air pollution Through occupation Through drinking contaminated water	As above
Use of persistent organic pollutants	National	Inadequate control of restricted pesticides	As above
Pesticide accidents transport	National	Due to spills on board Careless driving/riding Transport with other products	As above
Nature of problem	City/region	Brief Description of problems	Chemicals/pollutants
Air pollution	Kampala and other urban centers	Emissions from fuel boilers Through venting Through melting Generating of power Through heating Exhaust from production process Through chemical reactions Spill sites Through cleaning and drying of equipments Evaporation from storage tanks	Petroleum products Cox,Nox,SOx Palm steroids Chloroform Thinners Sprays Hydrocarbons Detergents Steam Chlorine gas Ammonia Methylated spirit
Soil contamination	Regional	During disposal During transportation During formulation During leakages During distribution During use	As above
Marine pollution	Regional	Run off from water-ways/bodies link up into lakes	As above
Drinking water contamination		Most water ways and bodies in which effluents are discharged are a source of drinking water	
Ground water pollution		Due to infiltration of contaminated water	

Source: NEMA (2002)

Table 8.9: A summary of chemical problems in Uganda (cont'd)

Nature of problem	*City/ Region*	*Brief description of problem*	*Pollutants*
Pollution of inland water ways		Oil spills into streams Sludge from storage tanks Effluents from servicing oils Through container disposal Discharge of semi-treated effluents	Dyes/colours Food colours Oils Acidic substances Plastic polymers Pharmaceuticals Solvents Filters Food additives Packaging materials Petroleum products Metallic inorganic salts and solutions
Occupational health industrial		Inadequate safety gears Reluctance to put on safety gears Burns due to Caustic	As above
Chemical residues in food		Contaminated water flows into agricultural fields and water bodies containing fish	As above
Hazardous waste treatment/disposal		Lack of disposal facilities Lack of treatment technologies Lack of awareness on the dangers Lack of adequate policy guidelines Lack of seriousness	As above
Chemical poisoning		Reluctancy to putting on safety gear Taking over-doses Misuse of drugs for different illnesses Taking expired drugs	Same as above and tablets, creams, syrups, capsules, oral rehydration salts, Penicillin
Chemical accidents transport		Seals not properly tightened Careless driving	As above

Source: NEMA (2002)

Table 8.9: A summary of chemical problems in Uganda (cont'd)

Nature of problem	*City/ Region*	*Brief description of problem*	*Pollutants*
Public health		Through food contamination Through air pollution Soil contamination Through drinking contaminated water Through ground water contaminatio	Same as above and tablets, creams, syrups, capsules, oral rehydration salts, Penicillin
Storage/Disposal of obsolete chemicals		Importation of low quality chemicals Delays in transportation of raw materials leading to expiry Discharge old transformers from use	As above and PCBs
Unknown chemical imports		The extent is not known	As above
Persistent Organic Pollutants		Discharge old transformers from use	As above

Source: NEMA (2002)

8.5.2 Agro-chemicals (crops and livestock)

Uganda has virtually the lowest level of utilization of agricultural chemicals and fertilizers per unit land area on the African continent (Mulindwa, 2005). Indeed, it is believed that one of the major reasons for declining soil fertility is the low use of fertilizers and other off-farm inputs. It is estimated that smallholder farmers use less than 1 kg/ha of inorganic fertilizers while only 10 per cent apply pesticides (Nkonya and Kato, 2001). Farmers have very little knowledge of the potential advantages and safety use of agro-chemicals. The Agro-Chemicals Board (ACB) requires retailers of agro-chemicals to have completed certification training and to be licensed to sell and apply agro-chemicals to their farms. However, out of the 1 675 input dealers selling chemicals, only 142 (about 8.5 per cent) have been trained to handle and sell agro-chemicals (Mulindwa, 2005). There is no known manufacture of agro-chemicals in the country. Most pesticides are imported ready for formulation, distribution, and application. At most, repackaging of bulk imports is carried out at industrial level (Nampinga, 2005).

The use of agro-chemicals for agriculture in Uganda has largely been under the charge of the Ministry of Agriculture, Animal Industry and Fisheries. This ministry has a countrywide distribution network down to the sub-county level manned by Assistant Agricultural Officers (AAO) and agricultural extension workers. The top of this network at district level is the District Agricultural Officer (DAO). A survey carried out (East African Pesticide Research Network, 1994) indicates that on the whole these officers know the correct method of application of pesticides and give advice to farmers (Senyonjo *et al.*, 2006).

A parallel distribution system is through the co-operatives movement, which also has a countrywide network down to the primary societies manned by co-operative assistants. These societies also have agriculturalists that are knowledgeable in the use of pesticides. They run the farm supply shops, which stock pesticides. Both systems (agriculture, cooperatives) have become unable to supervise farmer's activities owing to financial constraints that have befallen the responsible institutions for a long time. A significant population of farmers is therefore largely on its own.

A recent development in the distribution of pesticides is through the micro-finance schemes such as the Rural Farmer's Scheme. Those farmers who acquire loans from these schemes are given pesticides from the branch in the district in lieu of the loan. These schemes are however least equipped to distribute pesticides. They have neither skilled manpower nor correct storage facilities at their rural branches. They can not therefore give farmers advice on correct use of pesticides (Senyonjo *et al*, 2006).

The agriculture chemicals are managed under the agriculture chemicals (Regulations and Controls) 1993. Under the act, the Board is required to control agriculture chemicals, fumigators, commercial applications, and register of premises. This applies to both imported and manufactured. This requires the institution to collect all data on agriculture chemicals from literature and research regarding their potency, use, distribution and safety. For medical drugs and pharmaceuticals, the control and regulation is done under the national drug policy and authority regulations, 1995. The NDA licenses and controls both imported and manufactured drugs, their use and distribution (Mulindwa, 2005).

Uganda does not export pesticides owing to the fact that it does not manufacture them and only imports what it needs. However Uganda is a transit country for goods to the Sudan, Congo, and Rwanda. Large quantities of goods on long distance lorries are seen passing through the country. Transportation of hazardous chemicals, is therefore of major concern. Owing to meager resources, the administrative and technical measures necessary for chemical safety are scanty, poorly manned and poorly equipped. Vital data on the presence, trade and use of chemicals including exposure incidences is lacking. Current chemical regulation is thin and fragmented within departments with the effect that many dangerous chemicals continue to find their way into the country. The population remains largely unaware of the dangers of chemicals they handle (Nampinga, 2005).

Information on chemicals is still fragmented and scattered in various sectors and therefore there is an urgent need for a multi-stakeholder management approach, involving representatives from government as well as concerned parties outside of government, industry, research institutions, the private sector, labour as well as other public interest groups. As far as agricultural and industrial chemicals are concerned there is insufficient information that addresses concerns related to chemical production, import, export and use due to the following reasons, among others:

- There is no statistical data in place to address the above-mentioned concerns;
- There is no adequate information on solutions to the nature of problems encountered.

8.5.3 Health care chemicals

i) The Role of the National Drug Authority

The National Drugs Authority (NDA) regulates the safety, quality, efficacy, handling and use of drugs or drug related products in research. Part IV, section 40 of the National drug policy and authority act (Chapter 206) states that, with respect to clinical trials:

a) The authority (NDA) may issue a certificate to any person for the purpose of carrying out clinical trials in respect of a drug that may be specified in the certificate.
b) No person may carry out any clinical trial in respect of any drug unless he or she is in possession of a certificate issued under subsection (1). It is the responsibility of each trial sponsor and/or investigator to obtain such authorization certificate for all experimental drugs/devices, irrespective of whether the drug/device has previously been licensed for use in humans or not. Investigators must file a copy of the NDA certificate authorizing the importation and/or use of the trial drug/device in Uganda with the UNCST. The NDA shall also verify the continued use and eventual disposal of unused trial drug/device.

Applicant shall, *inter-alia*, provide the following information about the drug/device to the NDA (UNCST, 2007):

i) Investigator's brochure
ii) A description of the drug/device (physical characteristics);
iii) Dosage form of the drug/device;
iv) Composition (complete formula);
v) Active ingredients;
vi) Other ingredients (adjuncts, exipients, preservatives, colour, flavour etc);
vii) Pack size (weight or volume);
viii) Quality control processes done;
ix) Certificate of analysis;
x) Batch release certificate;
xi) Stability studies done on the drug/device;
xii) Good Manufacturing Practice certificate of plant from which drug/device was manufactured;
xiii) Containers in which products is packaged;
xiv) Labelling;
xv) Relevant published literature on the drug/device;

Table 8.10: List of key drugs administered in Uganda

Key drugs
1. 1. amoxicillin capsules 250 mg
2. Acetylsalicytic acid (aspirin) tablets 300mg
3. Chloroquine tablets 150 mg base
4. Cotrimoxazale tablets 480 mg
5. Ferrous sulphate + folic acid tablets 200mg +400mcg*
6. Mebendazole tablets 100 mg
7. Metronidazale tablets 100mg
8. Metronidazale tablets 200mg
9. Retinol (Vitamin A) capsule (drops) 100 000 IU**
10. Sulphadoxine/pyrimethamine tablets 500/25mg
11. Benzylpenicillin injection 1 mg (1MU)
12. Methylergometrine injection 200 mcg/mL
13. Gentamicin injection 40 mg/mL
14. Hydralazine injection 20 mg/mL
15. Magnesium sulphate injection 50%
16. Measleas vaccine
17. Medroxyprogesterone injection 150 mg/mL (*Depo-provera*)
18. Benzonic acid + salicylic acid ointment 6%+3%
19. Paracetamol syrup 120 mg/5 mL
20. Oral Rehydration Salts (ORS)
21. Tetracycline eye ointment 1%

Notes * Ferrous sulphate tablets 200 mg is an allowed alternative, ** 50,000 and 200,000 IU strengths are allowed alternatives
Source NDA (2002)

8.5.4 Case studies

8.5.4.1 Pesticide levels in the environment

In a 1996 study, Ejobi *et al.* (1996) focused on areas where organic pesticides had been sprayed for the tsetse fly control programmes, to determine the level of residues organocholrines in the food chain in cows that produce milk and in humans. The next competent effort (Ejobi *et al.,* 1996) focussed on organochlorines in cow milk in areas (Iganga) that were intensively sprayed with the pesticides for the control of tsetse fly. The following levels were found, expressed in mg/kg milk fat:

Table 8.11: Pesticide residue levels expressed in mg/kg milk fat

Compound	**Kampala City (samples = 60)**	**Iganga District (samples = 83)**	**Overall (samples = 143)**
α- HCH			
Mean ± SEM	0.46	0.01± 0.001	0.10± 0.005
median	0.46	0.01	0.01
Range	-	0.006-0.012	0.006-0.46
β-HCH			
Mean ± SEM	0.06 ± 0.017	0.07± 0.036	0.07± 0.004
median	0.04	0.04	0.04
Range	0.005 – 0.13	0.008 - 0.25	0.005 – 0.025
Lindane			
Mean ± SEM	0.87	0.01	0.44
Range	-	-	0.01 – 0.87
Dieldrin			
Mean ± SEM	0.06 ± 0.006	0.07 ± 0.0009	0.07 ± 0.008
median	0.04	0.05	0.04
Range	0.01 – 0.19	0.007 – 0.37	0.007 – 0.37
p,p'DDE			
Mean ± SEM	2.84 ± 0.255	2.00 ± 0.211	2.35 ± 0.201
Median	2.55	1.44	1.86
Range	0.63 – 13.58	0.20 – 13.93	0.20 – 13.93
p,p'DDD			
Mean ± SEM	0.04	0.09 ± 0.027	0.08 ± 0.038
Median	0.04	0.08	0.05
Range	-	0.04 – 0.15	0.01 – 0.15
o,p'DDT			
Mean ± SEM	0.07 ± 0.006	0.06 - ± 0.011	0.06 ± 0.022
Median	0.06	0.03	0.05
Range	0.01 – 0.22	0.01 – 0.49	0.01 – 0.49
p,p'DDT			
Mean ± SEM	0.76 ± 0.079	0.44 ± 0.051	0.57 ± 0.024
Median	0.60	0.26	0.37
Range	0.07 – 3.23	0.03 – 2.77	0.03 – 3.23
sum DDT			
Mean ± SEM	3.97 ± 0.353	2.71 – 0.284	3.24 – 0.64
Median	3.59	1.87	2.55
Range	0.88 – 18.52	0.26 – 18.72	0.26 – 18.72
p,p'DDT/p,p'DDE			
Mean ± SEM	0.27 ± 0.017	0.24 ± 0.015	0.25 ± 0.012
Median	0.23	0.21	0.22
Range	0.09 – 0.86	0.04 – 0.82	0.04 - .86

Notes: SEM = Standard Error of the Mean

Source: Ejobi *et al.* (1996)

8.5.5 Regulation of chemicals in Uganda

Chemicals management is being handled through a multiplicity of legal provisions and regulatory systems. These provisions include:

- The control of agriculture chemicals statute No. 8 of 1989
- The National Drugs Authority Act of 1994
- The National Environment Management Action Plan Act
- The Labour Laws on Occupational Health
- At the moment, the appointment of DNAs and their designation is still adhoc because of the multi-publicity of the legal framework
- The policy for management of PICs and POPs exists under NEMA but not well
- embracing
- The National Bureau of Standards Act

8.6 Solid waste management

8.6.1 Introduction

The term solid waste (SW) may be used to refer to municipal waste and can be categorized in seven groups. They are residential (or household or domestic waste), commercial, institutional, street sweepings, construction and demolition debris, sanitation and industrial wastes. Solid waste refers to organic and inorganic waste materials produced by households, commercial, institutional and industrial activities that have lost value in the sight of the initial user. It can be classified basing on its source for example hospital, commercial places, industrial settings, domestic areas and agricultural fields. It may also be classified according to whether it is hazardous in nature or non-hazardous (Walyawula 2004).

In Uganda, the responsibility for solid waste management (SWM) lies with local governments as specified in the Public Health Act 1964 and the Local Government Act 1997 (KCC 2000). The solid wastes generated in the urban areas of Uganda, typically consist of 73 per cent organic matter, 5.4 per cent paper, 1.7 per cent sawdust, 1.6 per cent plastics, 3.1 per cent metals, 0.9 per cent glass, 8.0 per cent tree cuttings and 5.5 per cent street debris and others constitute 0.8 per cent. Unfortunately, there is no data on the composition of solid waste generated by households in rural areas. However, it probably consists of more organic matter than that of urban areas (Walyawula 2004).

The composition of this waste is a function of income levels, education and other activities. It is estimated that vegetable matter will reduce from 73.0 per cent down to 30 per cent over the next twenty years while the amount of paper, as a percentage of the total is expected to increase from 5.4 per cent in 2000 to 30.9 per cent in the year 2020. Substantial increases are also projected for metals, plastics and glass.

Table 8.12: The composition of solid waste generated in urban areas by percentage, including the projected percentages to 2020

Material	Year 2000	Year 2010	Year 2020
Vegetables/Organic matter	73	50	30
Paper	5.4	21.1	30.9
Saw dust	1.7	1	1
Plastics	1.6	6.3	8.8
Metals	3.1	12.1	17.9
Glass	0.9	3.5	5.7
Tree cuttings	8.0	4.0	4.0
Street debris	5.5	2.0	2.0
Others	0.8	-	-

Source: MDR (2000)

8.6.2 Case studies

8.6.2.1 Waste management in Kampala city and Mpigi town council

Communal storage is the most common method used in Uganda's urban areas. It is however different from the rural areas where mostly wastes are dumped in open places, gardens and open pits. In Kampala, about 10 private waste collection agencies provide services to their clients mostly in affluent residential areas at a fee. Such agencies include BIN IT, Dott Services, Nabugabo-Owino Joint Venture, Kampala City Council, among others.

Solid waste generation rates vary from one area to another due to factors such as economic status of the population, population, geographical location, industrial growth, social habits, education levels, season of the year as well as the extent of salvage and recycling operations. In Kampala for instance, the average solid waste generated is estimated to be about 0.6 kg per capita per day averaging about 900 tons of waste per day (Walyawula 2004). The volume of solid waste generated in urban centers in Uganda has increasing, mainly as a result of growing urban population, concentration of industries, consumption of residents, and inadequate finance and facilities to manage waste collection and disposal. An increasing amount of plastic materials is threatening the environment country wide. The accumulation of plastic material has led to blockage of drainage systems, hindering water infiltration into the soil and killing a good number of animals (KCC 2002).

The annual rate of urban solid waste generation has been estimated at 0.2 metric tons per person. Based on the increasing population in urban areas, the waste generated is also increasing and is estimated at 780 000 metric tons (UHDR, 2005). Consequently, about 10 per cent of the solid waste generated enters and accumulates in the environment annually. Proper solid waste management is a very essential component of environmental sanitation, which is very important as regards the improvement of health in any situation.

Policy failures and the overall lack of awareness and limited community participation in the management of solid waste have contributed to poor waste collection and management. There are also inadequate measures for recycling such as paper, aluminium and glass as well as re-use measures (Walyawula 2004).

Table 8.13: Solid waste that can be used and user category

Type of waste	Usage	User category
Whole bottle or broken bottle	Recycle as burglar protection on perimeter wall	Pharmaceutical companies, households e.t.c.
Food peelings	Animal feeds	Farmers and households
Saw dust	Bio gas for cooking, litter for poultry	Farmers and households
Bones	Animal feeds	Farmers and households
Horns	Crafts and toys	Artisans
Metallic cans	Local candles, toys and crafts	Artisans and black smith
Plastics	Recycle	Industries and manufacturers
Kitchen refuse and other vegetable refuse	Compost manure	Farmers, schools e.t.c.
Cow dung	Bio gas, manure	Schools and households, farmers, e.t.c.
Coffee husks	Litter for poultry, production of brikettle, firing bricks	Industries/artisans, brick makers, farmers, households, industries, artisans e.t.c.
Metals	Recycle	Manufacturers

Source: Mpigi District Strategic Plan (2000)

Table 8.14: Prices of recyclable materials from selected dealers: A case for Kampala and Mpigi

Scrap item	Price of scrap	Recycled item	Price of recycled item
Old car tyres	500-5,000 shs a piece	- Slippers - Rat traps - Rubber fastener	100-3,000 shs 500 shs 200 shs
Used boxes of different sizes	300-100 shs	- Storage facility - Carriers for hawkers	500-3,500 shs
Scrap metal; lorry full of scrap metal	50-4,000 shs 500,000 shs	- Local stoves - Tin candles - Source pans - Steel bars	2,000-5,000 shs each 100-200 shs 1,000-10,000 e shs 8,000 shs per steel bar
Left over food	1,000 jerry can full	- Dog food	
Banana peels	2,000 shs a sack	- Domestic animal food	
Coffee husks	800 shs a sack	- Mulching materials - Component of animal feeds	2,000 shs sack
Wood shavings	500 shs per kg	- Material for making furniture	1,000 shs
One old news paper	100 shs an issue	- Packaging materials	150 shs
Plastic/polythene bags	1,000-5,000 per kg	- Melted to make new plastics - New polythene bags	50-200 shs

Source: Mpigi District Strategic Plan (2000)

Since 1969, there has been a great increase in the volume of municipal solid waste generated due to the increase in population as shown in the table below,

Table 8.15: Estimated daily solid waste generation rate for Kampala City 1969-2004

Year	Generation in metric tons/day
1969	198
1980	275
1991	360
2000	900
2004	12,000

Source: K.C.C. (2000).

Despite this drastic increase in solid waste generation, there has not been a proportional improvement in solid waste management and therefore leaving a lot of refuse indiscriminately disposed. Solid waste as a result has become one of the most pressing and challenging environmental problem in the country.

Though it is the responsibility of the various local authorities in their various areas of jurisdiction to manage all generated waste within their areas (Public Health Act 1964), there has been a shift in the recent years towards the involvement of private sector in waste management at all levels in order to increase both the efficiency and effective delivery of waste management services.

In the year 2000, Ngategize estimated that Kampala City Council spent US $ 1.53m per month and yet removed only 30 per cent of the total waste generated, showing that the solid waste management system has inadequately provided services which are sufficient and effective in collecting, transporting and disposing off all the waste generated.

Currently, Kampala City Council collects 750 tons of garbage every day and the average cost of collecting one ton of garbage is 12 000 Ushs. Kampala City Council also spends 7, 000 Ushs to land fill one ton of garbage collected (Kampala District Environment Officer *per com*). All stakeholders in solid waste management namely the communities, the public and private sector are faced with problems such as limited resources, low technologies and poor co-ordination and collaboration among the three stakeholders.

There have been efforts in Uganda to improve on solid waste management. One example is the 'First Urban Project' sponsored by the International Bank for Reconstruction and Development' under World Bank. The project's original objectives were to (i) improve living conditions and alleviate poverty in Kampala; (ii) improve urban financial management; and (iii) strengthen institutional capacity. As part of the mid-term restructuring, minor modifications were made to these objectives: (i) strengthen the Kampala City Council's (KCC) ability to better deliver, finance and maintain basic urban services for all Kampala residents, particularly the poor; (ii) assist KCC in getting demonstrable physical improvements on the ground aimed at gaining credibility with the people it serves; and (iii) strengthen the institutional capacity of sector institutions (Mohan 2002)

Under the above project, The Kampala city council increased its waste disposal operation by 100 per cent. Solid waste management in the city improved significantly, resulting in a wider coverage area and bringing the city into compliance with environmental regulations. Prior to project closing, some thirteen private firms were collecting refuse for a fee paid directly by the beneficiaries. Landfill management has been contracted out; and private refuse collection service has been piloted with encouraging results (Mohan 2002).

The waste disposal system and infrastructure in the country is inadequate. It is inadequate in urban centers and it is virtually non-existent in rural areas. Consequently, polyethylene is slowly but surely contributing to environmental degradation in Uganda.

The extensive use and indiscriminate disposal of polyethylene carrier bags and plastic materials in the country pose major threats to health and environment. Plastic bags do not readily breakdown in the environment, therefore the number of plastic bags is in effect cumulative, with the nation adding approximately a million of bags to the environment each year. In Kampala alone, plastics constitute 1.6 per cent of the total solid wastes generated. With the estimated population of 1.5 million, the per capita domestic waste generation in Kampala ranges between 0.9 kg – 1.1 kg per day, amounting to 900 000 kg/day (900 tones) of which 14 400 kg/day is plastic waste (Ssembajjwe 2004).

In the last 5-10 years, the use of plastics in Uganda has increased tremendously with local production growing, but still only caters for approximately 10-20% of the domestic consumption and almost 80-90 per cent of the plastics used in the country are imported.

In the Budget Speech 2007/2008, the Minister of Finance announced a ban on importation and use of ‘high density polyethylene’ (HDPE). The need for a sufficient and sustainable solid waste management system to meet the SWM challenge has led to increased involvement of the private sector. With the current privatization process of solid waste management, 17 companies dealing with garbage collection within Kampala had been brought on board as of June 2005.

8.6.2.2 Solid waste management in Jinja

Waste is collected from households and commercial places by means of skips. The skips are placed in vantage positions and when filled they are regularly taken and emptied into a landfill at Masese. This is mainly in the central business district and markets. Some refuse collection points are constructed concrete bunkers, but others are on bear ground. Industries are supposed to carry their waste to the landfill or find alternative means. Many households practice backyard dumping/composting (ILO, 2006)

There are 4 trucks engaged in refuse collection. An average of around 600 truckloads is collected every month i.e. about 25 truckloads per day. The average weight per skip is estimated at 2.512 tons. Around 70-90 tons are transported to the landfill every day. Research shows that about 149 tons of garbage is generated each day.

Table 8.16: Jinja waste generation profile

Source	Average weight, kg/day	Percentage
Households	77,650	52
Markets	6,689.53	4
Hotels	1,942	1
Restraunts	700	0
Shops	19,800	13
Service stations	211	0
Clinics /hospitals/ health centres	887.75	1
Fish factories	1,604	1
Leather tanning industry	588	0
Nile ply	3,301	2
Workshops	445	0
Grain milling	4,125	3
Other industries	5,900	4
Institutions	24,800	17
Garages	445	0
Total	**149,087**	**100**

Source: ILO (2006)

The waste composition profile shows that about 70 per cent is vegetable matter, 15 per cent is glass, 1 per cent is metal, and 4 per cent is paper while the rest is mixed matter. Much of the glass represented here is mainly broken bottles from giant bottlers of beverages. The waste collection records indicate that 40-60 per cent of the waste generated is collected (i.e. 70 – 90 tonnes) ant taken to the landfill. The variation is due tom deficiencies in availability of fuel and the mechanical status of the waste transport vehicles. The vehicles are old and rate of breakdown is high leading to reduced efficiency in waste collection (ILO, 2006).

The Jinja Volunteer Association has been contracted to sweep the street in down town. The Kika Multipurpose contractors collect garbage from Walukuba Masese Division. They use their own vehicles and collect garbage from refuse bunkers and skips and deposit it at the designated landfill. The contract was awarded in January 2005 but 3 months of work has shown greater efficiency that had hitherto not existed. The group has now found it cumbersome to collect waste using skips. They have convinced the division council to remove skips and are devising a better system of waste storage, either by roadside method or door-to-door collection method. The respective division councils pay these contractors. Private companies or groups are contacted to collect waste from industries, but have to pay a disposal fee at the landfill (ILO, 2006).

The contracting process goes through a pre-selection by the ward or village committees before final evaluation by the technical team and consequent awarding of the contract by the municipal tender board.

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9.0 OUTLOOK

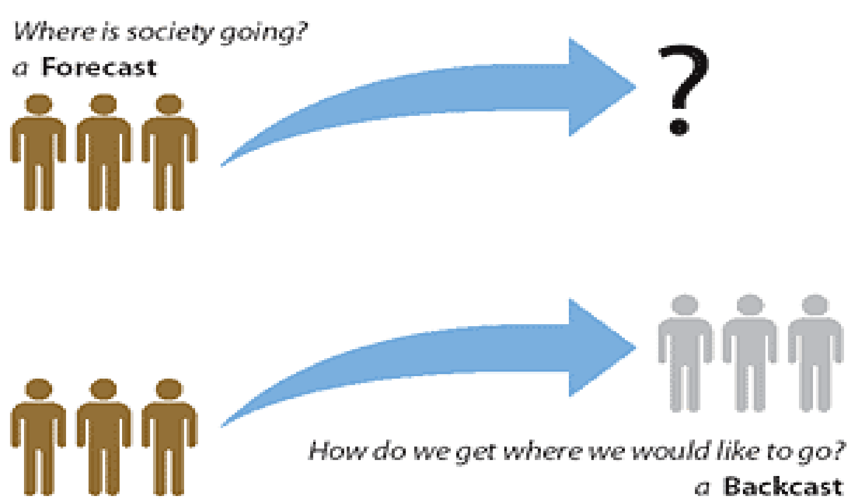
9.1 Introduction

In 2002, the development of scenarios in the African Environment Outlook (AEO) followed the pattern described in the Global Environment Outlook (GEO). The three broad classes of scenarios used were: *Conventional Worlds*, *Barbarization* and *Great Transitions*. For each of the three classes, two variants are defined, giving a total of six scenarios. Thus, in the *Conventional Worlds* class, the two scenarios that were emerging were *Conventional Development* and *Policy Reform*. The two scenarios in the *Barbarization* class were *Breakdown* and the *Fortress World*. In the *Great Transitions* class, the two scenarios were *Eco-communalism* and the *New Sustainability Paradigm* (UNEP, 2002). The '*Conventional Worlds*' class envisioned the global system of the 21st century evolving without major surprises, sharp discontinuities or fundamental transformations in the basis for human civilization. The future is shaped by the continued evolution, expansion and globalization of the dominant values and socioeconomic relationships of industrial society. In contrast, the '*Barbarization*' and '*Great Transition*' classes relaxed the notion of the long-term continuity of dominant values and institutional arrangements (UNEP, 2002). Indeed, these scenarios envisioned profound historical transformations in the fundamental organizing principles of society over the next century, perhaps as significant as the transition to settled agriculture and the industrial revolution. Within the '*Conventional Worlds*' class, the '*Reference*' variant incorporated mid-range population and development projections, and typical technological change assumptions. The '*Policy Reform*' variant added strong, comprehensive and coordinated government action, as called for in many policy-oriented discussions of sustainability, in order to achieve greater social equity and environmental protection. In this variant, the political will evolves for strengthening management systems and for the rapid diffusion of environmentally friendly technology. Whatever their differences, the two '*Conventional Worlds*' variants shared a number of premises (UNEP, 2002): the continuity of institutions and values; the rapid growth of the world economy; and the convergence of global regions toward the norms set by highly industrialized countries. Environmental stress arising from global population and economic growth was left to the self-correcting logic of competitive markets. In the '*Policy Reform*' variant, sustainability is pursued as a proactive strategic priority.

I. The '*Barbarization*' variants envision the grim possibility that the social, economic and moral underpinnings of civilization deteriorate, as emerging problems overwhelm the coping capacity of both markets and policy reforms. The '*Breakdown*' variant leads to unbridled conflict, institutional disintegration and economic collapse. The '*Fortress World*' variant features an authoritarian response to the threat of breakdown. In this scenario, ensconced in protected enclaves, elites safeguard their privileges by controlling an impoverished majority and by managing critical natural resources while, outside the fortress, there is repression, environmental destruction and misery. Further reflections indicated the need to reclassify these into four distinct categories. The four categories, adopted from the GEO, were: '*Conventional Development'*, later renamed '*Market Forces*', '*Policy Reform'*, '*Fortress World*' and the '*Great Transitions*'. These were the four scenarios that are used in the AEO. Six descriptive variables on the four scenarios were selected, namely: population growth; economic scale; environmental quality; social and economic equity; technological change; and the degree of social and geopolitical conflict.

Traditionally, scenario development proceeds in one of two directions. In the first case, one begins with the current position and then proceeds to make projections into the future. Such a strategy may be described as *forecasting*. On the other hand, one can begin with the desirable future, and seeks to manipulate variables and resources to achieve this future. Such an approach is described as *back-casting*. Two of the scenarios described above (the *Market Forces* scenario and the *Fortress World* scenario) may be achieved by methods of *forecasting*, while the other two scenarios (the *Policy Reform* scenario and the *Great Transitions* scenario) are best achieved by methods of *backcasting* (UNEP, 2002).

Figure 9.1: Scenario forecasting and back-casting



Source: (UNEP, 2002)

The current African Environment Outlook (AEO 2) comprises four plausible future paths of Africa's environment (UNEP, 2006). The four scenarios are: *Market Forces* scenario, *Policy Reform* scenario, *Fortress World* scenario and the *Great Transitions* scenario. The four scenarios were premised in the same was as they were in AEO 1. The characteristics of the four scenarios are (UNEP, 2002):

i) *Market forces* scenario: market-driven global development leads to convergence toward dominant values and development patterns;

ii) *Policy reform* scenario: incremental policy adjustments steer conventional development towards environmental and poverty-reduction goals;

iii) *Fortress world* scenario: as socioeconomic and environmental stresses mount, the world descends toward fragmentation, extreme inequality and widespread conflict; and *iv)* *Great transitions* scenario: a new development paradigm emerges in response to the challenge of sustainability, distinguished by pluralism, planetary solidarity, and new values and institutions.

9.2 Driving forces

The scenarios building process for Uganda's national State of the Environment Report for Uganda (NEMA, 2001) commenced with four scenarios, based on Uganda's long-term planning framework Vision 2025 (MFPED, 1999): the flying crane scenario, the moribund scenario, the ostrich scenario, and the peaceful slumber (MFPED, 1999). The *Flying crane* scenario was most desirable with harmony in national interests creating a stable political environment to nurture smooth economic progress: good governance and smooth transition of government; vibrant and competitive economy; sustainable internal debt; rural transformation and modern agriculture; significant improvements in human development; and a beautiful country. The *Moribund* scenario captured the most adverse unfolding of events in the policy and other decision areas which lead to an unstable political environment and non-competitive economy: chaotic politics and poor governance; poor human development; talented people and investors leave the country; degraded environment; poor and non-sustainable economic management; and unsustainable levels of external debt.

In the *Ostrich* scenario a situation where economic progress is sustainable over the perspective period amidst an unstable political environment was portrayed. As political circumstances deteriorate further, economic progress begins to show signs of serious decline, on account of the inextricable linkage between the two critical development forces. The leaders bury their heads in sand against the political circumstances prevailing in the country and their impact on well-being of the nation. Resulting in: unstable politics and poor governance; regional and internal insecurities and hostilities; sound macro economic policies and financial management; and high economic growth vis-à-vis rising levels of corruption and poverty. *Peaceful slumber* scenario is one where the economy is envisioned to be steadily declining over the perspective period, while the political situation is stable. The quest for power compels the political leadership to focus largely on their political credibility at the expense of economic growth and development. The consequential poverty from economic decline begins to take a bigger bite in the well-being of the people, who declare that they cannot just eat peace and political stability. The situation eventually leads to acrimony and unease, with clear signs of possible political instability beyond the perspective period (NEMA, 2001): smooth transition of governments; popular grass roots governance and transparency; emergence of nationalistic and patriotic deals; reversal of stable macro economic policies and financial management; capital flight, low investment and brain drain; and hostile internal and external shocks

In 2006, the national environmental authority with assistance from the United Nations Environment Programme, and in co-operation with Uganda's Ministry of Tourism, Trade and Industry (MTTI) and the department of fisheries resources (DFR) of the Ministry of

Agriculture, Animal Industry and Fisheries (MAAIF), developed a set of scenarios for the integrated assessment of Uganda's fisheries policy (UNEP, 2006). The three scenarios, eventually applied to the national fisheries policy of Uganda, are: the *slumber fish* scenario, the *ostrich fish* scenario and the *flying fish* scenario. The *slumber fish* scenario describes fisheries management before the adoption of National Fisheries Policy (2004). It builds a case for failure to kick start the new policy due to two failures: inability to mobilise sufficient resources for fisheries resources management; and simultaneous failure to learn, in the absence of capacity how to implement new policy. The *ostrich fish* scenario was based on the premise that the fisheries policies could be successfully implemented. The scenario went about showing/exploring the potential sustainability indicators, trade-offs, and win-win situations closely following the script of the policy. In the *flying fish* scenario, the fisheries policy projections/expectations were enhanced based on new knowledge obtained and experiences after the passing on the policy and in hind sight of the integrated assessment process (UNEP, 2006)

9.3 Future outlook of the environment and natural resources and their management in Uganda.

9.3.1 Scenarios for the state of the environment 2006/07

This year's National State of the Environment Report (NSOER) considered four possible scenarios that are likely to influence future environment and natural resource management in Uganda. The scenarios, derived from the African Environment Outlook (AEO) and Global Environment Outlook (GEO) processes, are the *Market forces* scenario; the *Policy reform* scenario; the *Fortress world* scenario; and the *Great transition* scenario. The four scenarios will, however, still be based on the long-term planning framework used for Uganda's Vision 2025 (NEMA, 2001). In addition, the guiding indicator developed for Uganda's first Poverty Eradication Action Plan (PEAP) 1997/98 was to reduce poverty to 10 per cent by 2017.

The market forces scenario characterises an outward look of government aimed at boosting economic development through private sector investments. Foreign and internal direct investments lead to increased foreign exchange earnings and employment. Indeed, the government of Uganda has long adopted a private sector led development as the impetus for economic growth (MTTI, 2005). In addition, Uganda is in the final stages of developing its position on the Economic Partnership Agreement (EPA) under the Cotonou agreement. The EPAs propose a free trade agreement between the European Union (EU) and the Africa Caribbean and Pacific (ACP) countries. Whatever is agreed in the EPA, where Uganda is likely to fall in the East African Community grouping, will determine Uganda's terms of trade with Europe for the next foreseeable future. In addition, Uganda is a member of the Common Markets for Eastern and Southern Africa (COMESA) a 19 country regional grouping aimed at enhancing trade opportunities between the countries. Uganda is also a member of the World Trade Organisation, a beneficiary of the African Growth Opportunity Act (AGOA) and a member of the East African Community (EAC) along with Kenya, Tanzania, Rwanda and Burundi. Domestically, Uganda is concluding the process of developing the National Trade Policy, where the leading sources of foreign exchange earnings include: agriculture (crops – coffee, tea, cereals, and tobacco; fish and fish products) and tourism (UBOS, 2006).

The *policy reform* scenario covers the breadth of institutional and policy reforms in the management of natural resources in Uganda. The Uganda government, in recognition of the high level of poverty in Uganda, 56 per cent headcount poverty in 1992, 38 per cent in 2003 (MFPED, 2005), has implemented the Poverty Eradication Action Plan (PEAP). The PEAP consists of such programmes as the Plan for modernisation of agriculture (PMA), the Northern Uganda social action fund (NUSAF), the Karamoja programme (in the office of the prime minister), and the National agricultural advisory services (NAADS), which is a component of the PMA. Among the new programmes are the Bonna *Bagagawale* (wealth for all) microfinance programme and the Agro-ecological zoning for export oriented agriculture.

The *fortress world* scenario characterises the continued differentiation within, between and among groups of people. For instance the differing livelihood levels for urban people, between urban and rural people in Uganda, between people from different industries in the country. In addition, the different living conditions, and ecosystems also play a role in the presence or absence of differentiation. As Uganda's population grows the differences between Uganda's wealthy and poor is expanding. There underlying evidence of increasing poverty among the poor is found in such issues as landlessness, morbidity among the poor, and mortality, and access to livelihoods enhancing services such as energy and clean water. Uganda's impressive growth led to a large reduction in poverty, but an increase in inequality over the same period worked against further poverty reduction; if inequality had not changed, poverty would have been lower in 2003 with the same rate of growth (Patillo *et al.,* 2006).

The *great transitions scenario* characterises the major shifts within the country and beyond the country level. At country level, emerging transitions include the returning of peace at the end of the war in Northern Uganda; by 2009, Uganda will join the group of oil producing countries; and the continued transition from East African Customs Union to a federation and entry of Rwanda and Burundi into the East African Community; political pluralism was realised in Uganda with the first multiparty elections in over 25 years; Uganda is hosting, for the first time, the Common Wealth Heads of Government Meeting; and the world's scientists have finally agreed that global climate change caused by global warming is one of the greatest dangers to the survival of the earth today. These g*reat transitions* represent a step already taken by government and impeding actions and steps for government to take to realise the long-term growth plan. However, Uganda is also pursuing the Millennium Development Goals (MDGs) and several targets have been achieved while some remain glaring off the mark. In this *Great Transitions* it is envisaged the government will enhance its actions to meet both the national and MDGs, poverty reduction, socio-economic develop and environmental sustainability targets.

9.3.2 The market forces scenario

The *market forces* scenario is defined in terms of prevailing economic growth paradigms based on the experience of the developed countries. It is premised on the belief that the development model, adopted by the developed countries, is appropriate for the rest of the world. In addition this paradigm presumes the existence of the invisible hand of market mechanisms, which control the allocation of resources and the distribution of the benefits of growth. Essentially, the economy is increasingly privatized there is a gradual withdrawal of government as principal actor in the development process. The government provides the enabling environment for economic growth while the private sector is the impetus for this growth. Consequently, opportunities are defined by market mechanisms with no significant intervention from government. The private sector maximizes profits, always seeking out sub-regions with the cheapest labour to produce high value or brand products. People's search for satisfaction is based on increased acquisition and therefore consumerism becomes the socially defining value. The world economic system responds by increasing production of goods and services with increased burdens placed on natural resources.

9.3.2.1 Economic cycle

Uganda's economic growth strategy relies heavily on increased export growth as a means of boosting both national income and individual incomes. Between 2004/05 and 2005/06 (Table 9.1), Uganda's mining and quarrying, manufacturing, electricity and water registered negative developments, agriculture nudged upwards marginally. However, high growth percentages were registered in the construction (indeed even the number of dwelling units for rent increased), transport and communication sectors and wholesale, retail and hotel industry, as was in community service. These growths indicate an increased emergence of a middle class in Uganda who need better housing, hotels, good food. The food industry could have been boosted by the growth in tourism in Uganda. Uganda's revenue from tourism stood at US$ 250 million in 2006, higher than either coffee or fish and fish products the next two highest national revenue commodities.

Table 9.1: Economic growth by sector

Sector	Percentage economic growth
Agriculture	0.4
Mining and quarrying	-1.5
Manufacturing	-1.6
Electricity and water	-1.2
Construction	13.0
Whole sale and retail trade, hotels and restaurants	8.1
Transport and communication	20.7
Community services	7.0
Rent and owner occupied dwelling	3.6

Source: UBOS (2006)

Overall, the terms of trade indicating a balance between national exports and imports (Table 9.2) showed that in 2005/06 Uganda had a growing negative trade balance. In addition it is still the usual sectors, coffee-21 per cent that took the highest followed by fish at 17.6 per cent (UBOS, 2006). The persistent trade imbalance in Uganda is attributed to export off unprocessed items. The exports grew at between 3.5 – 24.5 per cent while the imports grew by 6.7 – 28.1 per cent between 2001 and 2005. In addition to growing at marginally higher rates the base values for imports were nearly two-times as much as the value of exports. In 2009, Uganda is expected to become an oil producing and exporting country. This is expected to reduce the foreign trade deficit of the country considerably.

Table 9.2: Exports and imports and their rate of growth, 2001 - 2005

Category	2001	2002	2003	2004	2005
Imports US $	1,006.6	1,073.7	1,375.1	1,726.2	2,054.1
Rate of growth of imports (%)	---	6.7	28.1	20.3	19.0
Exports US $	451.8	467.6	534.1	665.1	812.9
Rate of growth of exports (%)	---	3.5	14.2	24.5	22.2
Trade balance	-554.8	-606.1	-841.0	-1,061.1	-1,241.2

Source: Adapted from UBOS (2006)

As part of the *market forces* scenario the government is expected to continue its drive to promote market diversification and activities that would be expected to lead to an expansion of export base. In recent years, the government has created industrial parks at Namanve in Mukono district and Sango Bay in Rakai district. In addition, government has leased government estates of forest land, and urban land to industrialists, to ease their production cost burdens and make them competitive in the context of their competitions in the region and other parts of the world: Butamira forest in Kamuli District was leased to Kakira Sugar Works; Bugala Islands in Kalangala District (on Lake Victoria) was leased to BIDCO Ltd, to process vegetable oil and bio diesel from palms (*there seems to be a reversal of consent to take up the land on the part of the investor*); More recently, government was debating whether to allocate 7 100 hectares of Mabira Central forest reserve to SCOUL (Sugar Corporation of Uganda Ltd) to expand on their sugar estate; In urban areas, as part of improving urban infrastructure particularly hotel facilities, government allocates several plots of land including part of Kitante Golf Course, the plot formerly housing Uganda Television, and Shimoni Demonstration Schools which consist of both a primary school and a National Teacher (primary school) College.

One of the leading non-traditional exports contributing 17.6 per cent of Uganda's exports is fish and fish products. The need for increased fish exports has resulted into increased investment in facilities for fish exports such as fish cold storage and handling systems, monitoring, control and surveillance of the Lake Victoria to prevent destructive fishing behaviour (UBOS, 2006, NEMA/UNEP, 2006). In addition, market opportunities based on market forces have emerged for organic agriculture. In March 2007, Uganda exported certified organic cotton finished clothes to the United States, under the African Growth Opportunity Act (AGOA) Scheme of the US government. The clothes exported were worth US$ 125 000 (New Vision, 2007). It has emerged recently that the interest in organic clothing exists in Europe and other parts of North America (Canada and USA).

As such, the government of Uganda has expressed a willingness to support the development of an organic agriculture policy of Uganda.

In the economic cycle of the *market forces* scenario, by 2025, it is likely that Uganda's export revenues will grow on the basis of Uganda's oil exports. According to the Whitaker Group (2006) the country's oil potential is 120 000 barrels a day. However, the likely exports by 2009 based on the information provided by Hardman and Tullow Oil are just under 14 000 barrels (Table 8.3) by March 2007 (New Vision, 1997). Uganda's oil exports alone would bring a value of total exports of US$ 344 million between 2009 and 2013 and US$ 248 million between 2014 and 2025. However, if the projections made by the Whitaker Group (2006), that is 120 000 barrels per day were achieved the annual revenues, considered for the 2014-2025, would be US$ 2 146 million.

Table 9.3: Projected revenues from oil exports from Uganda

Description of oil valuation items	2009-2013	2014-2025	2014-2025
Price US$/ barrel	68	49	49
Production from Uganda (barrels/day)	13,893	13,893	120,000
Number of days (per year)	365	365	365
Production per annum (without breaks) barrels/ year	5,070,945	5,070,945	43,800,000
Value of oil exported (US$ million)	344.8	248.4	2,146.2
Shares Investor (40%)	137.9	99.5	858.5
Government (60%)	207.0	149.1	1,287.7

Source: (Adapted from EIA (2007) and Whitaker Group (2006)

Taking the average growth of imports (19.0 per cent) and exports (16.1 per cent) by 2025 Uganda trade balance will have a deficit of US $ 60 231 million (Table 8.3). The contribution of oil exports will add another US$ 248.4 to US$ 2 146 million by 2025, which will only marginally cut down the deficit. Therefore the export-led growth would consider more effectively cutting down on the growth of imports through increased production of substitutes domestically in addition to other strategies as increasing the value of Uganda's exports or the volume of Uganda's high value exports.

Table 9.4: Projected imports, exports and trade balance by 2025

Category	2005	2025
Imports US $ (millions)	2,054.1	76,373.4
Rate of growth of imports (%)	19.0	19.8
Exports US $ (millions)	812.9	16,142.0
Rate of growth of exports (%)	22.2	16.1
Trade balance (millions)	-1,241.2	-60,231.4

Source (Adapted from EIA (2007) and Whitaker Group (2006)

9.3.2.2 Social cycle of market forces scenario

The *market forces* scenario will boost exports revenues and productivity leading to an increase in employment opportunities, and incomes. In addition, the *market forces* are an independent means of redistributing wealth and therefore higher rewards will go to the mot efficient producers and the most innovative products. The pursuit of market reforms to encourage private sector led growth, at one level generates opportunities such as employment, access to goods and services, incomes within the target industry and other industries linked to the value chain, where primary support was targeted. Indeed the fisheries sector is said to provide livelihoods support for nearly two million Ugandans, although only 350 000 people are directly employed in it (Bahiigwa *et al.,* 2004). The coffee sector supports the livelihoods of close to seven million people, one-quarter of Uganda's population.

Industry leaders and employees of industry will be the main beneficiaries. Indeed, Uganda has already seen stability in fisheries exports, coffee exports and more recently there has been a re-ignition of the cotton with the African Growth Opportunity Act (AGOA) exports. Nationally, it is envisaged that the scenario will encourage greater efficiency in industry with regard to utilisation of resources because companies in Uganda have to compete with other companies in the world. It is likely that there will be an increase in technology transfers to Uganda and in the productivity of workers.

Conversely, the growth of the *market forces* scenario is also likely to reduce the opportunities for many smallholder subsistence farmers because they cannot afford to be too efficient. Because they usually have small plots of land (MFPED, 2006), these farmers grow food for domestic consumption and what is left over is for the market.

Landlocked countries like Uganda cannot compete in several markets such as fresh horticultural produce because of the higher costs linked to transportation. Indeed, the Ugandan producer has in many cases had to accept a smaller return, than their non-landlocked neighbours, just to stay in the industry. However, such industries have to cut costs elsewhere including lower wages and much fewer workers. In many cases the workers linked to the exportable sectors suffer a deplorable state f health. This is evident from Uganda's fisheries sector, where the fishers have the over 10 percent higher prevalence rate for HIV/AIDS and also suffer high rtes of malnutrition (UNEP, 2006).

9.3.2.3 Environment cycle of the market reform scenario

There are several arguments that the poor rely on the environment more than the rich (MA, 2005; UNEP/NEMA, 2007 unpublished). Yet the same natural resources are the main source of wealth for countries such as Uganda as exemplified by the countries top two exports, coffee and fish. The poor need natural resources to sustain their livelihoods in subsistence agriculture, low-technology fishing, forest goods and services (timber, fruits, wild game). In addition, the natural resources provide public goods and services such as carbon sequestration; repository for biodiversity from which medicines, new food items and other inventories/discoveries are found; hydrological services for water; water for consumption, building, farming and industrial use; fuel as wood or bio fuels; timber; and several other products. Many of these products can be harnessed and converted into private producer goods bought and sold. However, what has been clearly articulated are two defaults of acknowledging natural resources: the sources of the goods and services provided by private sector such as value added crops, timber and animals do not recognise natural resources. The reward of the entire product, incomes are kept by the industry and manufacturers; and secondly, when the acknowledgement is declared it is either not properly valued or deliberately undervalued (UNEP, 2006). Generally, the natural resources in Uganda have not been valued and therefore there is no way of determining whether the process leading from the source to value addition provide adequate compensation to ensure that natural resource goods and services (ecosystem services) can be sustainably produced.

The plan for modernisation of agriculture (2000) noted that 4 -12 per cent of the country GDP was lost as a result of environmental degradation and 85 per cent of this was due to soil erosion. The pilot national ecosystem assessment for Uganda (NEMA/UNEP in print) indicates that the extensive deforestation in Nakasongola district between 1990 and 2006 reduced the surface cover by about 20 times; based on an area GIS map. In the eastern part of the Lake Kyoga catchment, River Manafwa has been diverted and nearly one-quarter of the river is now used to irrigate rice farms and gardens. The drive to grow more paddy rice in Mazimasa sub-county in Butaleja district has ensured that more and more of the wetland in Doho rice scheme area has been converted into farm lands.

Market reforms per se are not the causes of degradation, indeed several mechanisms are employed in the country e.g. co-generation of power by Kakira, Kinyara and SCOUL sugar works; and even the bio fuel palm oil by BIDCO. However, it is market failures that characterise the decisions to take on market reforms that ensure that these projects area by large environmentally unsustainable. The sites chosen and the way they are implemented and the reward/compensation mechanism do not acknowledge all the contributing resources. Entrepreneurship is for example reward more than the environment and natural resources continue to get a higher share of revenues the environment degrades.

The *market forces* scenario outlook for Uganda envisages increase support from the Government of Uganda to boost performance of industry. Such support has included government offering land to private sector such as Butamira forest for sugarcane production, and the offer of Bugala Islands for palm oil production. In addition, Namanve Forest, a plantation forest found in Mukono district, was converted into an industrial park and a similar industrial park is being created in Rakai district. However, in some cases the resources may have been offered without a proper evaluation of the environmental implications. Moyini and others (2007) have shown that if part of Mabira Forest Reserve was offered for sugarcane production there are several environmental services, including those which have commercial value (recovered by the current forest inhabitants, the National Forestry Authority, and those of a public good nature such as carbon sequestration); hydrological services; and biodiversity services, that if lost cannot be recovered by producing sugar of replacing the forest with another elsewhere.

9.3.3 The policy reform scenario

The *policy reform* scenario is in many ways similar to that of the *market forces* scenario. However, unlike the *market forces* scenario, there is the realization of the need to address the negative fallouts of the driving forces through concerted efforts by governments and civil society. Consequently, the impact of market mechanisms is tempered by the inclusion of programmes to mitigate the negative impacts of such development (UNEP, 2006). The argument is that the socioeconomic and political considerations may make it expedient for governments to take actions that favour citizens, rather than wait for the operation of the market to correct these ills. For instance, to address the increasing numbers of poor people within a long-time frame, policies and programmes are adopted to actively counter serious negative social and environmental impacts.

In the *policy reform* scenario policies are put in place and executed to address specific and anticipated problems that arise from the operations of the market. The state can be expected to intervene through policy and planning development in the management of fragile ecosystems (UNEP, 2002). Essentially, policy reforms focus on engineering development through positive and proactive interventions even on such issues as privatization. While accepting the desire for a gradual withdrawal of government as principal actor in the development process, government is not content with just providing the enabling environment for economic growth, and it puts in place a monitoring and evaluation system that ensures that these operators of the economy follow laid-down policies which are beneficial to the people (UNEP, 2006).

9.3.3.1 Economic cycle for the policy reform

Uganda has long adopted the World Bank inspired poverty reduction strategy papers (PRSP) in the Poverty Eradication Action Plan (PEAP). The recent PEAP document has also been developed in such a way that it integrates the millennium development goals (MDGs) (MFPED, 2005). As part of PEAP, other economic enhancement programmes emerged such as the Plan for modernisation of agriculture (PMA), the National agricultural advisory services (NAADS), and the current *Bonna Baggagawale* ‘wealth for all’ programme. Sector and ministry policies are also aimed at enhancing the equity of resources distribution.
For instance, Uganda is developing an oil exploration and production policy; however, several groups such as the Kingdom of Bunyoro Kitara where a lot of the oil discoveries have been made have already indicated a need for retention of some of the revenues generated from the oil. In the fisheries sub-sector integrated lake management organisations were created for Lakes Kyoga, George and Edward (ILM, 2004). In addition, beach management units (BMUs) were created to ensure local fisheries community participation in fisheries production activities.

Evidence from the poverty reduction strategies leaves a mixed picture. The economy recovery programmes of the 1990s led to a reduction in the prevalence of poverty from 56 per cent in 1992 to 35 per cent in 2000 before the headcount poverty went back up to 38 per cent (MFPED, 2005). It has been reported that the poverty incidence has declined again to 31 per cent (DFID, 2007). The PEAP came into effect in 1997 and the claim to poverty reduction of the 1990s is largely attributed to the economic recovery programmes that boosted the coffee, cotton and sugar industries, among others. The recent PEAP programmes have effectively only contributed the reversal of poverty reduction from 35 percent to 31 percent.

9.3.3.2 Social cycle of the policy reform scenario

Uganda's policy approach to social equity has come through sub-sector policies and programmes. For instance, the health sector strategic plan (HSSP), programmes targeting poor vulnerable communities in Northern Uganda, the Karamoja region and the former Luwero Triangle. For national resource exploitation and management policies such as fisheries, minerals and energy the government has included vulnerable groups, by gender and poverty. For example the beach management units have 30 per cent of the leadership of the units left to women. In addition there is an explicit requirement for the poorer fishers to be included in the running of the fisheries.

Statement of intention of policies is not always evident in the implementation. For instance, while the BMUs are operational there are still the richer fishers who own several boats that seem to benefit a lot more than their poorer counterparts (UNEP, 2006b; UNEP, 2007 in print).

However, social programmes such as the Universal Primary Education (or the current Universal Secondary Education) to accompany other national poverty reduction programmes may be the only way of ensuring that the poor have an opportunity to overcome poverty. The opportunities of employment in primary sectors such as crop production, livestock production, forestry, fisheries and mining may not support the large population. Yet it seems that there are increasing opportunities in white collar employment for education (teachers), environment and natural resource managers, machine operators in industries, and employment in services sectors, where skilled labour I required. While 50 percent of crop farmers were below the poverty line in 2003/04, only 13 percent of those employed in government serves were poor (MFPED, 2005).

9.3.3.3 Environment cycle of the policy reform scenario

At the national level the environment and natural resources offer a sector-wide approach (SWAp) for managing the environmental implications of national development actions and policies. However, the ENR sector also is affected by government actions which pull in different directions. For instance, in 2006 the government created the Ministry of Land and Urban Planning, which seems to have extracted the lands resources department from the former Ministry of Water, Lands and Environment (MWLE) now the Ministry of Water and Environment (MWE).

The *policy reform* scenario is held captive by chances in orientation by the central government. For instance, it seems that the central government policies while aimed at poverty reduction are also aimed at enhancing industrial growth. Environmental management concerns have in many ways been seen as antagonistic to national industrial growth (New Vision, 2007). However, the fundamental difference seems to be in the perception by several stakeholders that environmental management should never have a value placed on it as it is priceless, there by leading to a perception that environment management does not generate revenue on its own and only drains resources from government and development partners. However, as Moyini *et al.* (2007) while the current value is from appropriate environment management is low the potential revenues from sustainable management environment and natural resources may outstrip several cotemporary industrial projects.

9.3.4 The fortress world scenario

The *fortress world* scenario emerges as a result of the struggle for power between two or more groups of people in a nation, identified here as the elites and the masses. The elites have access to resources of economic growth and monopolize them for their own development, while the masses have few resources and are left at the mercy of the elites (UNEP, 2006). The masses depend on the leftovers from the elites and are often not in a position to decide their own destiny. As a result of the need to protect themselves and their investments, the elites organize themselves into enclaves, strongholds or garrisons. Two variants of the *fortress world* scenario, with similar consequences, may occur. The first may result from conflicts around religion and ethnicity, while the second is based on global relations. The second is a global fortress world where the forces of separatism derive from the collapse of the world economic, social and political systems (UNEP, 2006a).

The f*ortress world* scenario is a crystallization of certain patterns of historical behaviour among peoples and nations where inequalities abound, and where efforts have not been taken or mechanisms put in place for the mitigation of effects of inequalities (UNEP, 2002). Economic and social welfare are not directed at improving the general well-being of everybody, but at protecting the privileges of the rich and powerful elite. In this scenario there is a growing divide between rich and poor people. This situation paves the way for increasing disputes between individuals, institutions and governments over resources for production, particularly land, and increases the likelihood of tensions over issues of wealth and its distribution. The degree of social inequity can be measured using various tools including the *Gini* coefficient, gender-related development index (GDI) and gender empowerment measure (GEM). Another indication is the constant agitation over resources (UNEP, 2006).

9.3.4.1 Economic cycle

Discussions of the most recent PEAP document (Table 9.5) indicated that inequity between the poor and the well off was growing. The *Gini* Coefficient indicating the poverty inequity rose from 0.36 to 0.43 between 1992 and 2002/03 (MFPED, 2005).

Table 9.5: People below the poverty line and inequality, by per cent

	1992	1993/4	1994/5	1996	1997/8	1999/2000	2002/3	2005/06
National	55.7	51.2	50.2	49.1	44.4	33.8	37.7	31.1
Rural	59.7	55.6	54.3	53.7	48.7	37.4	41.1	34.2
Urban	27.8	21	21.5	19.8	16.7	9.6	12.2	13.7
Central	46				28	19.7	22.3	16.4
Western	53				43	26.2	31.4	20.5
Eastern	59				54	35.0	46.0	35.9
Northern	72				60	63.7	63.6	60.7
Gini coefficients								
National	.36	.35	.36	.37	.35	.39	.43	0.41

Source: MFPED (2006)

Table 9.6: Percentage of people below the poverty line by occupation

	1992	1996	1999/2000	2002/3	2005/06
Occupation of household head					
Food crop	64	62	45		
Cash crop	63	46	34		
Crop farmers			39	50	36.8
Noncrop agriculture	55	40	42	34	28.1
Manufacturing	44	34	23	28	21.8
Construction	37	35	20	23	27.1
Trade	26	21	13	17	14.9
Government services	37	32	15	13	8.5
Not working	59	60	43	38	37.2

Source: MFPED (2006)

In the *fortress world* scenario it is envisaged that the inequity between the wealthy and the poor will continue to grow. Indeed, as indicated in the discussions for the *market forces* scenario, in Table 9.1, while agricultural production grew by only 0.4 per cent between 2005 and 2006 other sectors that catered for, or are owned by, the wealthier class such as transportation (20.7 percent), construction (13 per cent), and wholesale and retail (8.1 per cent) grew at a much faster pace. It would seem therefore that the current initiatives that boost private sector and industrial growth are also inadvertently creating a *fortress world* scenario where the industrialists and those employed in white collar jobs are much better off than the poor farmers.

9.3.4.2 Social cycle of the market forces scenario

The f*ortress world* scenario is likely to create continued large differences in the services available to the poor and those available to the rich. There is considerable evidence of the substantial differences in the levels of education. For example the leading secondary schools in the country are located in the highly urbanized Districts of Kampala, Mukono and Wakiso, while the poorer districts such as Nakasongola (central Uganda), Kotido and Moroto (North Eastern), Kitgum and Pader (Northern), and Rukungiri, Kanungu (Western Uganda) have poor performing schools.

The quality of health infrastructure and water and sanitary standards are higher in urban areas than in rural areas. For example, although considerable waste accumulates in Kampala City it is the urban poor in areas like Bwaise, Kalerwe and Mulago who seem to come worse off. This is because the urban rich can pay for private garbage collectors while the poor have to rely on the city councils and municipal councils to collect the garbage. In Lwampanga sub-county, in Central Uganda's poorest district of Nakasongola, the shop owners in urban areas pay potters to collect water from boreholes, and in many cases can afford to repair the boreholes. The poor either have to fetch water on their own from far off boreholes, as the ones in their community have collapsed, or settle foe collecting dirty water from Lake Kyoga which in turn leads to a high prevalence of diarrhoreal diseases (UNEP, 2007 in print). Over the last one-year Uganda has observed several factory workers strikes as a result of the poor working conditions and pays that factory operators offer.

9.3.4.3 Environment cycle of the market reform scenario

Governance of the environment and natural resources in Uganda is distributed between government ministries and local governments, largely on the basis of national priorities. For instance, the Ministry of Water, Lands and Environment has been reorganised, leaving the Ministry of Water and Environment (MW&E). The lands sub-sector was moved to form the new Ministry of Lands and Urban Development (MLUD). Indeed, this new ministry should also be under the ENR sector since many of the lands and urban development concerns have a lot of implications on the environment. This re-organisation by government is intended to enable government mainstream its economic development priorities. However, the changes leave out a section of stakeholders from the environment and natural resources sectors. Even if some stakeholders stay, for example in the new ministry (MLUD), they do so under differing arrangements.

On the other side, environmentalists are gradually developing into an important lobby group over the environment and resources. For the most part environmentalists push for preservation of the environment. The natural beauty of these resources, it is argued, will create tourism revenue, better health, and sustainability of key natural systems.

9.3.5 The great transitions scenario

The *great transitions* scenario seeks to adapt the good aspects of the other scenarios to strengthen the three pillars of sustainable development – environment, society and economy. In this scenario it is envisaged that there will be a cultural renaissance that de-emphasizes the current "craze" for imports of food items, consumables and luxury goods (UNEP 2002a). Central to the *great transitions* scenario is the general disillusionment with dominant societal values, such as consumerism, and the prioritization of the economy over the environment with its negative impacts on human well-being, development, and the environment itself. The attributes of the *great transitions* scenario are based on visions of a desirable and environmentally sustainable future. The g*reat transitions* scenario can be made to embrace the MDG, as a mechanism for turning around both strategy and methods of development. Achieving these targets necessitates constant and extensive interactions between all stakeholders, a process that, though cumbersome, becomes beneficial as it is inclusive and democratic.

The great transitions scenario characterises the major shifts within and outside the country that are likely to have a significant effect on the country's environment and natural resource management regime. For instance, peace seems to be returning to Northern Uganda as negotiations taking place in Juba, Southern Sudan to end the armed conflict of the Lord's Resistance army (LRA) rebels are getting closer to conclusion. Uganda has also moved away from the Movement "one-party' system of government and embraced a Multi party system of government. This is the system of government preferred by most international institutions including the United Nations, although the implications for a smooth political process in Uganda are only being tied out.

By 2013 Uganda will join the other countries of the East African Community to form the East African Federation. The East African countries will become federal states of one federal state. The process of sensitising citizens of the EAC started in 2006. However, there is a lack of clarity on what the EAC means for ENRM in Uganda. In November 2007, Uganda will host the Common Wealth Heads of Government Meeting (CHOGM) and since January 2007, government has turned its resources towards preparation of CHOGM. This process has involved increased infrastructure development in the Capital City, Kampala and its suburbs. The increase in infrastructure development has created additional pressure on the public utilities in Kampala, and has led to several land use changes. The impact of these changes has not been explored, however, it is likely

9.3.5.1 Economic cycle

For Uganda, 2007 and 2010 represent a period of great transitions. For instance, Uganda recently discovered oil and by government projects, the country will become a petroleum producer and exporter by 2009. There is a ray of hope that the war in northern Uganda is coming to an end. The government is negotiating with the rebels, the Lord's Resistance Army (LRA). Indeed several of the 1.5 million people in the Internally Displaced (IDPs) camp in Northern Uganda (UNDP, 2005) have already returned to their homes to embark on restoring their livelihoods. For the large part, most of the world's scientists now agree that global climate change caused by global warming as a result of the green house gases (GHGs) is one of the world's greatest threats to sustainable survival.

In February 2006, Uganda for the first time in 25 years held multi-party presidential elections. The country moved from a single party-movement system into a multi-party system. In November 2007, Uganda will for the first time host the Common Wealth Heads of Government Meeting. The meeting will provide an opportunity for the country to showcase its environment and natural resource beauty; the level o economic and social/human achievement to the countries of the common wealth in a single forum.

Globally, Uganda is party to several multilateral environmental agreements (MEA) made prior to and after the Rio Summit, the United Nations Conference on environment and development held in 1992 in Rio de Janeiro, Brazil. In addition, Uganda is a beneficiary of the global movement of capital, goods and services in trade as a member of the World Trade Organisation (WTO), Common Markets for Eastern and Southern Africa (COMESA), the East African Community (EAC) and the Inter Governmental Agreement on Development (IGAD). Furthermore, Uganda has been a beneficiary of the Millennium Development Agenda of the United Nations and the country's development agenda also integrates the Millennium Development Goals (MDGs) in the country's poverty reduction strategic plan, the Poverty Eradication Action Plan (PEAP)

The *great transitions* scenario envisages that Uganda's development path will be determined by its ability to participate effectively at the global platform in which it is engaged, as well as utilising the domestic transitions. As such if the transition to a multi party government and peace in Northern Uganda are achieved smoothly there will be enormous incentive for increased production in the country. Increased production in Northern Uganda will reduce pressure on government's resource spent in fighting the war in Northern Uganda and supporting livelihoods of the IDPs. Likewise development assistance from development partners will instead target national development programmes.

In 2009, Uganda becomes oil producing and exporting country. While no analyses in the actual output to be produced and new discoveries of oil are still going, the country may for the first time in its life time achieve an income surplus. Many other African countries that have transitioned oil production have been export revenue rich countries for example Angola, Sudan, Nigeria etc.

The global debate of the MDGs and climate change may provide an opportunity for countries like Uganda to effectively overcome poverty. Uganda may participate in projects and activities that promote poverty reducing enterprises and mitigation of GHGs such as CO_2

9.3.5.2 Social cycle

The great transitions scenario is likely to lead to an improvement in social welfare-if the revenues earned from oil are used for socially equitable programmes. Indeed, revenues from the petroleum could be used to fund the Poverty Eradication Action Plan, until the MDG targets, and the targets set under PEAP 2000, of reducing poverty to 10 percent by 2017 (MFPED, 2000) are achieved.

For many countries where oil wealth has been discovered, considerable inequity has resulted. For example, in Nigeria, the majority of the country remains poor, even as the country is the world's seventh largest exporter of oil. As a result, frequent civil unrest, abduction of oil workers occur in Niger State (Nigeria) where most of the oil is produced. A term 'Dutch Disease' was coined to characterise natural resource rich nations such as the Democratic Republic of Congo where the wealth has not been able to benefit nationals (Hamilton and Clemens, 1999; Masiga and Moyini, 2005).

9.3.5.3 Environmental cycle

The great transitions scenario presents a great opportunity as well as threat for the country's environment and natural resources. On the one hand, the country celebrated the discovery of oil on the other the threat posed by oil is enormous. The oil was discovered in a bay area where Kyoga Nile flows to join Lake Albert and Albert Nile flows up to Northern Uganda and Southern Sudan (New Vision, 2006b). The immediate danger from oil spillage into the river flow is suffocation of the flora and fauna in the lake. Moreover, because government plans to also set up an oil refinery, the oil processors have to plan for proper disposal of oil. If the oil waste is left in the environment it endangers the lands, fish, forest, the food chain for livestock, wildlife and animals, and the flora in the area would also be affected.

The end of the war in Northern Uganda, will allow the communities to return to their farmlands and grow their own crop. Concentration in small areas led to cutting of forest trees for timber (Gulu district State of the Environment Report, 2004) and environmental pressure on small strips of land. However, in the absence of farming many lands remained fallow in excess of two years and would have rejuvenated their fertility when the next crop is produced. The return of IDPs to their lands presents an opportunity for sustainable land management. If the farmers are left on their own additional pressures to produce a lot of food for their own households and for the national and regional market may motivate the communities to over exploit their land. This could in future lead to considerable degradation.

Over the last 10 years when much of Eastern and Southern Africa experienced a crop (cereal) failure, Uganda acted as the food basket (UBOS, 2004). Proposals for a Green Revolution for Africa are a threat to the African market that Uganda secures. But also increases the prospects of Ugandan farmers meeting their production targets. Surplus products if it is ever realised will be an opportunity for secondary industries such as feeds for livestock and bio fuels. The Green Revolution however, endangers subsistence farming systems based on: traditional knowledge, community networks, subsistence systems and regular supply of seed and low cost inputs. The farming systems in Uganda are of the type described as Non-Certified Organic Farming (FAO, 2003). The systems are sustainable with extremely low inputs. While the Green Revolution presents an opportunity and may be a worthwhile option as the food burden across the country grows, there may be a need to preserve the traditional farming systems.

Uganda has been a party of the global climate change focus since it signed onto the Kyoto Convention of the United Nations Framework Convention on Climate Change (UNFCCC). Indeed, Uganda has already benefited from the Clean Development Mechanism (CDM) where polluting industries in the West (developed countries) pay developing-country institutions to mitigate their carbon dioxide releases by planting forests and setting up other enterprises that sequester carbon dioxide. There is a growing focus on development of bio fuels. In Uganda, the Sugar Industry has been engaged in co-generation of electricity since the mid-1990s (Isingoma, 2004). The power crisis experienced by the country which intensified in 2005 has further strengthened government's commitment to support electricity co-generation. Kakira Sugar Works and Sugar Corporation of Uganda Limited (SCOUL) are engaged in this co-generation (USCTA, 2005). Uganda has considerable potential for carbon dioxide sequestration in the cattle corridor areas of the country where reforestation projects and solar energy projects can be used to reduce on the country's use of heavy oils to generate electricity for industry (NEMA/UNEP, in print).

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Section 4: Conclusions and policy options for action

- **Conclusions**
- **Policy options for action**

10.0 CONCLUSIONS

The theme for this year's SOER is planning for re-emerging opportunities and threats from the environment. The state of the environment at different levels provides a framework for national and sub-national integrated environment assessment and planning. Since the last State of the Environment, the new opportunities and threats that have emerged include exploration and future production of oil, climate change, innovations that encourage cleaner and more environmentally friendly sustainable consumption and production.

BACKGROUND TO THE STATE OF THE ENVIRONMENT

As evidence that Uganda is ready to market the economy from the environment, in 2005, the Government of Uganda injected US$ 1 million in a campaign to promote the country's tourism potential on the Cable New Network (CNN). The Uganda: gifted by nature promotion was the first ever media campaign to market the country's tourism abroad. Once described by the former British prime minister Sir Winston Churchill Uganda is truly gifted by nature, for example, Uganda is the source of the River Nile, home to the second largest lake in the world, Lake Victoria. Seven of Africa's plant kingdoms are represented in Uganda which is more than any other country on the continent, Uganda ranks among the top ten countries in the world in terms of the diversity of its mammal groups along with Rwanda and Democratic Republic of Congo. The country has the last remaining population of the great ape (Mountain Gorilla).

Since 2004, the number of administrative units in Uganda has increased from 56 Districts to 75 districts and this has led to an increase in the administrative costs for environment and natural resources management at local government and nationally.

Uganda's population growth continues to be amongst the highest in the world. The population in 2007 stands at 28.4 million an increase of 70 per cent since 1991 and 16 per cent since 2002. The country's population is expected to exceed 50 million and 127 million by 2025 and 2050 respectively.

ATMOSPHERIC RESOURCES

The intergovernmental panel on climate change indicated, in 2006, that the African continent has the greatest risk to climate change. Uganda's atmospheric resources of temperature, rainfall, sunshine and wind show trends which suggest the possible influence of climate change. In 2005, Uganda along with other countries in East Africa experienced a severe drought that led to a decline in the water levels of Lake Victoria. In 2007, Uganda has experienced its heaviest rains since the el nino of 1997/98. Moreover, it is the poorest regions of the country that have been most affected; north eastern Uganda: the Karamoja region, Teso region and the Lango region.

TERRESTRIAL RESOURCES

Uganda has 7.2 million hectares of arable land under crop agriculture which is less than 50 per cent of the arable land (16.8 hectares). It has been suggested that available arable land for agriculture will run out in most parts of Uganda by around 2022. The land available in the eastern region is expected to run out faster by 2010. The rapid decline in land available land resource is attributed to the very high population growth rate. In addition the annual cropping practices that encourage high soil erosion and increased reclamation associated with new crop enterprises such as rice will also lead to the decline in the quality and quantity of the available land and soil resources.

The indicative annual cost of setting up and running institutions required under Uganda's land bill is US$ 400 million. This amount is so large that it could prevent an otherwise good law from being implemented because it imposes a huge financial burden on the government. Moreover, it is unlikely that the reforms suggested in the law, will led to significant increase in the supply of credits by commercial banks and agricultural productivity in the short term and medium term.

Several studies have produced evidence showing a large decline in grasslands and land cover as a result of pastoralists' activities. Nearly 50 per cent of all grasslands in Nakasongola district have disappeared since 1990 due to the activities of pastoralists in the district. As a result the amount of bare land has increased, further increasing pressure on the productive land available.

FORESTS

Uganda's forest cover declined from about 5 million hectares in 1990 to 3.7 million hectares in 2005. This was a result of encroachment for agricultural production, deforestation to produce woodfuel, urbanisation, industrial growth and problems of internally displaced people and migration.

In Uganda, forest governance is split at three levels: NFA for Central forest reserves, District forest services for community and the privately owned and managed forests. There has been increasing pressure to degazatte Central forest reserves for industrial purposes from the Central Government. This has been a case for Namanve, Wabisi-Wajala (in Nakasongola district), Butamira forest reserve and more recently the intention to allocate part of Mabira central forest reserve to sugar cane growing.

The rapid increase in Uganda's population has increased pressure on forest ecosystems for ecosystem services such as timber, fuelwood and food. This increases the risk of encroachment and deforestation unless viable alternatives are found. Opportunities for forest enterprises have emerged from commercial timber production and the cleaner development mechanism. The forest sector has one of the fastest rates of investment.

WILDLIFE

There has not been significant change in wildlife resources and their management since the last National State of the Environment Report apart from the encroachment on Queen Elizabeth National Park by the Basongora pastoralists. The invasion of Basongora has increased pressure on the available food resources for the animals in the park and generated debate on pastoralists' activities vis a vis wildlife protected areas. There are emerging opportunities in wildlife use rights such as trade, research and a wildlife sector trade strategy has been developed in this regard.

AQUATIC RESOURCES

Uganda's wetland resources cover 13 per cent of the country's land surface. Increasingly, these wetlands are under pressure from reclamation for agriculture especially rice production. While no estimates exist as yet, several districts have reported an increased use in wetlands for rice production as a result of the current government campaign (upland rice growing) in Uganda. Although upland rice can be grown far away from wetlands communities have preferred growing it near or within wetlands.

WATER RESOURCES

Uganda's water resources cover about 16 per cent of the country's total area. The biggest pressure on the water resource is from the growing population and poor waste management practices of industries located near the water system. Uganda is on track to meeting the Millennium Development Goals for access to improved water within the country of 100 per cent by the year 2015.

FISHERIES

Fisheries activities provide an important source of livelihood to many Ugandans and foreign exchange to the country. Between 2002 and 2006 Uganda's fisheries export increased by value from US$ 78.15 million to 142.69 million an 82.5 per cent increase. Fish catches increased from 249 000 metric tonnes in 2004 to 416 000 metric tonnes in 2005. Fifty per cent of Uganda's fish catches come from Lake Victoria followed by 16 per cent from Lake Kyoga and the remaining lakes and rivers contribute 26 per cent of fish catches.

The major pressures on Uganda's fisheries resources come from the growth in international market demand for Nile Perch and tilapia, deterioration of water quality due to excessive pollution, re-invasion of the lakes by the water hyacinth, poor fishing practices and prevalence of diseases especially HIV/AIDS in the fishery communities.

BIODIVERSITY

Uganda is located in an area where seven of Africa's distinct biogeographic regions or phytochoria converge. Given Uganda's location in a zone between the ecological communities that are characteristic of the drier East African Savannas and the more moist West African rain forests, combined with high altitude ranges, the country has a high level of biological diversity. Recent survey reports reveal the occurrence of 18 783 species. Although the country covers just 241 551 square km and accounts for only 0.18 per cent of the world's terrestrial and freshwater surface.

The principle threats to biodiversity in Uganda continue, including habitat loss, modification and alteration along with unsustainable harvesting, pollution and introduction of alien species.

RURAL WATER SUPPLY AND SANITATION

Access to safe water supplies in rural areas has increased steadily. Between 2004/2005, 2005/2006 it increased from 57 per cent to 61 per cent. Latrine coverage has increased from 51 per cent in 2003/2004 to 58 per cent in 2005/6. This level of latrine coverage is still very low. The lowest coverage was found in the Karamoja region from 2 per cent to 10 per cent. In the districts were the funding for sanitation programmes and enforcement of bi-laws were weak latrine coverage declined for example Busia and Kibale district declined by 2 per cent and 5 per cent respectively. Seventy-five per cent of Uganda's disease burden is preventable since it is caused primarily by poor hygiene and inadequate sanitation.

TOURISM

There have been increases in the number of tourists arrivals since 1997 from 175 000 to 468 000 in 2005. The arrivals were mostly from Kenya, Tanzania and Rwanda. Europe contributed 10 percent mostly of United Kingdom and German and a good number from USA. The tourism industry plays an important economic role for Uganda. The world tourism council predicated that Uganda would generate US$ 840 million in 2005 at the same time tourism accounted for 9.2 percent of GDP and was envisaged to generate 42 000 jobs.

ENERGY

Uganda has an abundant although unexpected variety of potential energy sources from solar, biomass, hydro, petroleum and geothermal. The energy sources that have been exploited so far include biomass, petroleum and hydro power. The National consumption of energy sources by type is 93 per cent, 6 per cent and 1 percent for bio-mass, petroleum and hydro power exploited. Only 5 per cent of Uganda's population has access to electricity such 293 000 households out of 5.5 million households. Two-thirds of the power generated in Uganda is consumed in residences, 14 per cent in commercial buildings, and 10 per cent in industry and the reminder in the transport sector.

Biomass comprises of firewood, charcoal and agricultural residues and it constitutes 93 per cent of total energy consumed in the country. Woodfuel (firewood and charcoal) is the biggest source of energy for residential households. Per capita firewood consumption is 680 kg per year.

Petroleum is the main source of non renewable source of energy used in Uganda. Sales of petroleum products increased from 646 839 cubic meters in 2004 to 681 249 cubic meters in 2005. Representing 5.3 per cent increase. Diesel was the biggest product consumed at 49.3 per cent, followed by gasoline/ petrol at 24.6 per cent, aviation fuel at 12.7 per cent, fuel oil at 7.3 per cent and Kerosene at 5.4 per cent.

Uganda's electricity production increased to 1 896 GigaWatt hours in 2004 from 1 757 GWh in 2005. In 2004 Uganda's nominal generation capacity was 303 MW and peak demand of 265 MW of capacity. By May of 2005 the prolonged drought in East Africa reduced Uganda's MW capacity. The resulting shortage of power led to load shedding and higher costs. The government has since intervened through supporting the private sector interventions such as the diesel fed power generation at Lugogo with the capacity of 50 MW (Aggreko).

In May 2006, a consortium affiliated with the Aga Khan Development work signed an agreement to build the Bujjagali hydro power station. The project is valued at US$ 500 million and it has already started. There are two other electricity co-generation projects one at Kakira sugar cooperation and SCOUL and 15 other mini-hydro stations.

CULTURAL HERITAGE

So far about 357 sites and monuments have been identified and documented as part of Uganda's cultural heritage. The areas included in the world heritage list are the Kasubi tombs, Bwindi national park and Rwenzori Mountain and national park. However, Uganda has several other cultural heritage sites found in all regions of the country some of which have been documented.

POVERTY AND THE ENVIRONMENT LINKAGES

Two of the greatest global challenges are elimination of poverty and the reversal of environmental degradation. Income derived from the environment is a major constitute of the livelihood of the poor and this direct dependency on nature does not appear to be decreasing. The most frequently mentioned causes of poverty in Uganda are: poor health, limited access or shortage of land, lack of market access for produce, unemployment, high taxes, lack of education, large family size, excessive alcohol consumption, and low productivity and lack of credit facilities.

Crops are the most dominant source of rural household income contributing 70 per cent of rural income, fallowed by non-farm activities 25 per cent and livestock 5 per cent. Livestock is increasingly becoming a major asset and source of income for the rural households especially in central and southwestern Uganda. Between 2001 and 2005 livelihood contributed 13 per cent of total agricultural GDP. Fisheries have created livelihoods for over 1.5 million people and direct employment for 350 000 people.

LANDUSE AND POVERTY

A typical farm size in Uganda in 2005 ranged from 0.5 and 1 hectare as compared to an average of 0.75 to 1.5 hectares of land. The reasons for the landlessness include: lack of proper land regulations and effective land management structures which encourages corruption, poor land planning and conflicts. In Kibale and Nakasongola districts, the large number of absent land lords has meant that few indigenous people have access to a strong ownership of land.

ENVIRONMENTAL HEALTH PROBLEMS

Malaria is the most prevent illness in Uganda with 51 per cent of outpatients cases reported between 2002 and 2005. In 2004, the estimated annual number of deaths from malaria was 70 000-100 000 people.

Diarrhoeal diseases, is the major killer of young children in Uganda and it alone is responsible for 19 per cent of all infant mortality rates in Uganda. However cholera cases fatality rate declined from 6 per cent in 2000-2001 to 2.5 per cent in 2004-2005 although WHO recommends that cholera case fatality rate should be below 1 per cent.

National adult HIV prevalence was 6.7 per cent in 2005 significantly higher among women nearly at 8 per cent than among men at 5 per cent. While HIV /AIDA epidemic cases declined allover the country prevalence rules in some rural areas, from as low as 5.6 per cent in men and 6.9 per cent in women to 6.5 per cent in men and 8.8 per cent in women in 2004.

PAYMENTS FOR ECOSYSTEM SERVICES (PES)

Payments for ecosystem services (PES) represent a set of new financing mechanism for funding conservation activities. Existing opportunities for PES include: payments for water shade services, payments for bio-diversity services e.g. organic agriculture, payments for carbon cycle sequestration services and payments for reuse of waste

Among the barriers to implementing PES in Uganda are; the lack of adequate information for businesses and government, technical barriers to put in place adequate policy evaluation and acceptance, and absence of policy and inadequate institutional capacity to organise PES activities.

FUTURE OUTLOOK

This year's National State of the Environment Report (NSOER) considered four possible scenarios derived from the African Environment Outlook (AEO): the *Market forces* scenario; the *Policy reform* scenario; the *Fortress world* scenario; and the *Great transition* scenario.

The *market forces* scenario characterises an outward look of government aimed at boosting economic development through private sector investments. Foreign and internal direct investments lead to increased foreign exchange earnings and employment. Uganda is in the final stages of developing its position on the Economic Partnership Agreement (EPA) under the Cotonou Agreement. Whatever is agreed in the EPA will determine Uganda's terms of trade with Europe for the next foreseeable future. Uganda is concluding the process of developing the national trade policy, where the leading sources of foreign exchange earnings include: agriculture and tourism.

The *policy reform* scenario covers the breadth of institutional and policy reforms in the management of natural resources in Uganda. The Poverty Eradication Action Plan consists of such programmes as the Plan for Modernisation of Agriculture (PMA), the Northern Uganda Social Action Fund (NUSAF), the Karamoja Programme, and the National Agricultural Advisory Services (NAADS), which is a component of the PMA. Among the new programmes are the Bonna *Bagagawale* (wealth for all) microfinance programme and the Agro-ecological zoning for export oriented agriculture.

The *fortress world* scenario characterises the continued differentiation within, between and among groups of people. For instance, their differing livelihoods levels for urban people, between urban rural people in Uganda, between people from different industries in the country. Uganda's impressive growth led to a large reduction in poverty, but an increase in inequality over the same period worked against further poverty reduction; if inequality had not changed, poverty would have been lower in 2003 with the same rate of growth (Patillo *et al.,* 2006).

The *great transitions* scenario characterises the major shifts within the country and beyond the country level. At country level, emerging transitions include the returning of peace at the end of the war in Northern Uganda; the prospect of becoming an oil producing country; and the continued transition from East African Customs Union to a federation; and Uganda is hosting, the Commonwealth Heads of Government Meeting (CHOGM). On the other side of the world, scientists have finally agreed that climate change caused by the accumulation of Green House Gases (GHGs) is one of the greatest dangers to the survival of the earth today. These *great transitions* represent a step already taken by government and impeding actions and steps for government to take to realise the long-term growth plan. However, Uganda is also pursuing the millennium development goals (MDGs) and several targets have been achieved while some remain glaring off the mark.

11.0 POLICY OPTIONS FOR ACTION

11.1 Policy options

1. Land scarcity is an emerging threat as the population of the country grows. Yet there is evidence that farm productivity is low there is a need to encourage technologies that improve farm productivity. These include provision of appropriate training to farmers on how to improve soil fertility management even before soil additives (fertilisers) are suggested. Some farming systems, especially in central Uganda, have been extremely depleted and the use of fertilisers is the only recourse. However, in some areas soil erosion rates are high and population density is also quite high requiring a different set of interventions.

2. Researchers have noted that many of the soil and water conservation practices such as strip cropping and the use of terraces have disappeared as the different regimes of extension services have changed farmers' outlook to what practices to maintain. As a result the high erosion rates can only get worse since there are no similar institutions in place to encourage farmers on soil and water conservation. Therefore, for areas where there is a strong vulnerability to soil erosion there may be a need for restoration of some of the older institutional arrangements including setting by-laws to reduce the rate of soil degradation.

3. In eastern Uganda's Mount Elgon region the population density and growth rate are so high that the area will run out of available land for agriculture by 2010 and the rest of the country in the medium term. The government has a number of options among these are training rural communities on family planning practices, however, an appropriate family size can also be suggested after carrying out sufficient studies on the subject.

4. Secondly, there is an urgent need to increase the number of non-farm jobs available to rural communities. The government has embarked on several initiatives to encourage private sector investment yet the rate of job creation seems to be fundamentally lower. Governemnt could consider supporting commercial agriculture that is labour intensive as an alternative.

5. Much of north-eastern Uganda and several parts of Uganda have been under floods causing a fundamental destruction of people's livelihoods. One of the major causes of this series of events was the poor relaying of information both by the Meteorology department and its partners such as the Local Governments and the Ministry of Agriculture Animal Industry and Fisheries (MAAIF). In future there should be a rapid and usually Early Warning Systems or mechanisms in place to prevent possible human fatality but also the high level of economic loss as is clearly evident in the affected areas. The Early Warning Systems could involve transfer of information by

radio and other media, mobilisation of community leaders and development of evacuation practices for natural disasters.

6. An underlying feature of the threats noted in this State of the Environment Report is that they could also be addressed if the country had a land use policy in place. However, the added time available means that some of the concerns above can be addressed in the current land policy draft, which should be handled expediently. Indeed, District level Land use Policies are on hold as they await the national land use policy.

7. For several years now international researchers on climate change have been warning that the African continent is most vulnerable to climate change. The floods in north-eastern Uganda are evidence of the level of vulnerability. The country ought to quickly adopt the regime of climate change and desertification adaptation techniques and develop a medium term and long term plan for Uganda. Some of these techniques involve increasing efficiency in production practices, developing and supporting social safety nets and having a long term plan for the vulnerable groups and ecosystems.

8. Natural resources are under increased threat from the growing population, to the demands on them by private investors and the communities that sometimes do not use them sustainably. There is a need to consider an additional set of tools outside the formal regulations and management structure and advocating for greater participation of other stakeholders. Some of these are being addressed in the Kyoto Protocol's clean development mechanism, and similar mechanisms under the United Nations Convention on combatting desertification (UNCCD) and the Convention on biological diveristy (CBD). Still, a large set of tools some of which are market based payments (or compensation) for ecosystems services and insurance arrangements exist and could be adapted to the Ugandan context.

9. There is a need to build consensus of stakeholders on the use of natural resources and environment management on one hand and the need for economic development on the other. Some decisions taken by one group over the other might have large economic, environmental or social impacts that they could be irreversible. The current forum seems to lack participation of key actors and decision makers, at least from the perception of the public, based on the recent demonstrations for the preservation of the integrity of Mabira central forest reserve. There is a need to build a stronger consensus on the governance of key ecosystems in the country.

10. Aquatic resources are increasingly under pressure as competition for fisheries increases as the international exports increase, and the domestic industry expands. Efforts to develop aquaculture alternatives to capture fisheries require a new effort in addition to research on commercial aquaculture production of the most important commercial fishes such as Tilapia and Nile Perch, and ornamental fishes.

11. Uganda's growing population and poor industrial practices pose a threat to water systems, from inefficient use and pollution of rivers, lakes and wetlands. Urban growths that destroy wetlands also reduce the potential for water prurification before waste water reaches the main water systems. Therefore, increased efforts will be needed in the short-terma and medium term to strengthen regulations and enforcement of water quality monitoring and effluent management by firms located close to water systems. The country shouls also develop a long-term strategy on water harvesting, increasing urban water demand and water for agricultural and industrial production.

12. Agricultural expansion from small plots into estate production, conversion of wetlands and deforestation pose a strong threat to the country's biodiversity. Information on biodiversity and threats to biodiversity is not widely spread or understood by stakeholders engaged in activities that are likely to lead to biodiversity loss. Current information dissemination strategies should target the potential violators more strongly.

13. Increasingly woodfuel is under pressure to provide fuel to rural households and urban households for domestic cooking. The high population growth rate means that the forested areas will disappear at a much faster pace than before. However, there are sufficnet alternative sources of energy, although largely unexploited. The country should move hastly towards increasing the energy options available and making the energy options available for the major consumers households and industrial users. In the medium and long-term the country should move away from heavy fuels as sources of energy as they increase the country's carbon foot print.

14. Environmental health problems still contribute about four-fifths of the country's morbidity. Malaria and diarrheal diseases are still major causes of illness and deaths. There is a need for increased research on the environmental linkages and what options, outside the current set of practices, can be implemented cost-effectively.

15. There are several commercial opportunities from sustainable production and consumption and the environment conservation economy. Many developing countries, Uganda inclusive, are re-positioning themselves to better benefit from the clean development mechanism of the Kyoto Protocol on the United Nations framework convention on climate change. However, opportunities exist elsewhere as well in biodiversity conservation through promoting niche markets such as organic agriculture, well planned biotrade opportunities (Gum Arabica, wildlife trade, and fisheries). Private sector and public sector participation in the economy based on promoting conservation is still in the early days and needs added support from policy makers and government and private investment in conservation initiatives.

Section 5: Annexes

- **Socioeconomic and environmental data**
- **Wetland status by districts**
- **Forest status by districts**
- **Land degradation by agroecological zones**

Annex 1: Socioeconomic and Environmental Data

Socio-economic Data Description			**2004/05**	**2005/06**
1. Population	Total population		26.9	28.4
	Population growth rate		3.2	3.2
2. Economic performance				
	GDP (million Ushs) at current prices		15,165,610	19,497,930
	Exports (US$)		665.1	962.2
	Imports (US$)		1,726.2	2,557.3
	Trade balance (US$)		-1,061.1	-1,595.1
3. Poverty			**2002/03**	**2005/06**
	Head count poverty	Northern	63	63.6
		Eastern	46	46.0
		Western	31	31.4
		Central	22	22.3
		Rural	12	12.2
		Urban	42	41.1
		National	38	37.7
	Occupation of head			
		Crop farmers	50	36.8
		Non-crop agriculture	34	28.1
		Manufacturing	28	21.8
		Construction	23	27.1
		Trade	17	14.9
		Government services	13	8.5
		Not working	38	37.2
4. Energy Resources				
	Wood fuel energy usage (% of population)		60.5	59.8
	Electricity access (% of population)		5.0	5.0

Sources: UBOS 2006; UBOS 2007

Annex 1: Socioeconomic and Environmental Data (cont'd)

Socio-economic Data Description			**2004/05**	**2005/06**
6. Safe water and Sanitation	Access to safe water (%)		57	61
	Latrine coverage (%)		51	57
7. Health (Morbidity)	Illnesses		**2002/03**	**2005/06**
	Malaria prevalence		55.9	60.8
	Respiratory infections		14.3	14.2
	Diarrhoeal diseases		4.0	9.5
	Skin infections		3.2	3.2
	Injury		1.1	2.7
	others		21.4	9.7
	HIV/AIDS prevalence		6.1	6.4
Environmental Data				
1. Vegetation type			**2000**	**2005**
	▪ Built-up areas		365.7	365,7
	▪ Bush lands		12,223.9	11,893.6
	▪ Commercial farmlands		684.5	684.5
	▪ Cultivated lands		94,526.7	99,018.4
	▪ Grasslands		51,152.7	51,152.7
	▪ Impediments		37.1	37.1
	▪ Plantations – hardwoods		153.3	138.8
	▪ Plantations – softwoods		80.0	121.7
	▪ Tropical High Forest Depleted		2,248.2	2,036.3
	▪ Tropical High Forest Normal		5,333.5	4,830.7
	▪ Water Bodies		36,902.8	36,902.8
	▪ Wetlands		4,840.4	4,840.4
	▪ Woodlands		32,601.4	29,528.1
	▪ Total		241,550.7	241,550.1

Sources: UBOS 2006; UBOS 2007

Annex 2: State of wetlands resources by district

District	State	Pressure	Impact	Response
Apac	The high demand for land meant that IDPs are made to settle in wetlands and most indigenous vegetation has disappeared. There is however a big problem with Apac town council which is surrounded by Arocha wetland and yet she doesn't have a dumping site ground, leave alone garbage collection skips. The solid waste is disposed in the wetlands and yet the community uses the many hand dug wells in town. There is yet no sewerage system and piped water supply for less than a quarter of the town population. A survey by the health department showed that most hand dug wells were not good for home consumption. This meant that Apac town council must urgently plan for their waste disposal management, sewerage and water supply to ensure a healthy population. A lot of rice is grown in kwania (Arocha) wetlands) especially in Abongomola and Aduku sub counties. Upland rice needed to be encouraged instead of growing paddy rice in such fragile ecosystems. These catchments provide water to Lake Kwania and R. Nile and needed to be protected from abuse. There is urgent need to address this	-Population increase -Poverty -Lack of awareness -Insecurity -Poverty	-Loss of wetland -Loss of water catchments - Loss of goods services and tributes from wetlands -Increased water born diseases	-There is a functional environment office -Environmental committees are in place and functional and district levels. -Mainstreaming environmental issues into the DP and DPP is slowly taking root - Awareness by most of the communities on environmental issues.

	dangerous trend. Wetland biodiversity is seriously under a threat as land is being converted to agricultural land day by day.			
Busia	75% of the district's wet lands are seasonal and the rest are permanent. However, about 235 of the district's wetlands are modified through reclamation as a result of various activities such as cultivation, brick making and grazing.	-Rapid population growth leading to demand for agriculture land -Development that depends on wetlands -Poverty. Poor people mainly depend on natural resources - -Lack of enforcement that leaves bad practices unchecked such as bush burning. - Unstable climate condition-prolonged drought period during certain times of the year leading farmers to turn to wetlands and river banks for farming.		-Regulations on the management of wetlands, river banks and lakes are in place. However, implementation of the regulations has not yet taken root. Creation of awareness on wetland management is an on going activity under the department of environment. It is also important to note that government has passed the national wetlands policy and is now in place. -There is need to in crease community involvement in the management of wetlands, river banks and lake shores.
Gulu	Wet lands have been greatly invaded by the community for various purposes. Most of the wet lands especially those relatively close to the settlements are susceptible to reclamation for agriculture purposes. Most swamps have been reclaimed for growing horticultural crops like sugar cane, vegetable sand fruits for sale in the urban areas. In some cases, rice growing has also contributed to swamp reclamation more so in the sub	-Insufficient soil moisture content to sustain crops away from wetlands. -Increased urban population -In adequate laws and regulations -There is a tendency to degrade lands with out due considerations of their ecological importance. -Rigidity of the community to abide by the national policy and the guide lines	The Constitution of 1995, spells it clearly that the Government holds the Wetlands in trust for the benefit of all the citizens of Uganda; in this case therefore, no particular person owns the wetlands. But many people seem to be ignorant about this policy or misinterpretation. This has resulted into massive destruction/reclamation of the	

	counties.		wetlands.	
Iganga	**Wetlands Resources** Wetlands cover an area of 777.63 sq km of the total land area. Most wetlands systems drain to Lake Kyoga, the main ones being Lumbuye, Naigombwa and Mpologoma. Legally, wetlands are public land but very few have the status. The most outstanding environmental issue concerning wetlands is the increasing level of degradation mainly through agricultural conversion and over harvesting of the wetland products.	**Major Threats**. The most outstanding environmental issue concerning Iganga district wetlands is the increasing level of degradation mainly through agricultural conversion and over harvesting of the wetland products. The main practices include; **-Draining of wetlands**: An extensive area of the district wetlands has been drained mainly for cultivation. It is estimated that about 64% of the total seasonal wetlands have been reclaimed increasingly for rice and sugar cane growing. The impact of perennial reclamation of those wetlands have been a reduction in the number of permanent streams, disappearance of permanent springs, low ground water yield in the walls, permanent change in land use, intensified conflicts amongst different users, and soil fertility exhaustion in some parts of wetlands. **-Vegetation Depletion:** An extensive area of mainly the seasonal wetlands shows a massive vegetation depletion resulting from thorough agricultural conversion, deforestation and burning. Deforestation of wetlands for wood and craft materials is rampant in the wetlands of Iganga and other neighboring districts. In addition, wildfires are rampant during drought spells and have triggered off a succession or replacement of the natural wetland vegetation.	The impact of the massive vegetation depletion has been a reduction or total loss of values and attributes depending on the level of depletion of a particular wetland. The current decrease in farm holdings and soil fertility has resulted into increased land value leading to a dramatic change in the use of wetlands. New rules to own wetlands have emerged, and the farmland boundaries have been extended by individual households to the center of the wetland where a river course form the new farm boundary. Hence, the wetlands are being forcefully changed from the original communal property to private property. Consequently, some community members have lost free accessibility and control of the wetland resources. Those whose land borders the wetlands have imposed themselves as landlords and any encroachment on such wetland parcels tends to generate immediate claims of ownership. While individual owners carry out cultivation, the other resources are still	

			harvested by all the community. In such a tenure arrangement existing in the district, it has become extremely impossible to implement common strategies for sustainable management of the district wetland resource.	
Kabale	There are a few wetland areas that have remained intact because of strong community resolutions to have them remain intact. It should be noted that wetland areas in this category are indeed very few. Currently, the Dept. of Environment is aware of only six such wetland areas. Nyangirire, Nyakasa-Kalimbanya , Kanyambogo (Kaarukara) (omumbuga + 2 other patches only), Rushoma Bugira-Kabali-Choogo (Kabali area only), Murago-Kinyarushengye No pollution of wetlands is reported. However, no efforts should be spared to ensure that pollution does not take place. Therefore every effort should be undertaken to establish the quality of the wetlands, particularly those that are near Kabale Municipal council (South Kiruruma, Nyakijumba, North Kiruruma).	**1. Silting:** All the wetlands in the District are highly prone to silting. This is because all the surrounding hillsides are intensively cultivated without much in the way of soil and water conservation measures. Therefore, a lot of eroded materials move down into the wetland valleys, during the rainy season. **2. Flooding:** In some cases, the most phenomenal thing that threatens a wetland is flooding. Some wetlands have been getting flooded such that when the floods subside, the silt there is not overwhelming and the wetland quickly recovers. South Kiruruma (Every Year), Rushaki-Nyakijumba (Every year) As a rule, flooding is much more sharply marked in converted wetlands **3. Conversion** This was, in the past, the most far-reaching threat to wetlands. Today this is no a serious threat because nearly all those wetland areas that could be converted have been converted. Largely, the remaining intact wetlands or parts of wetlands are in that state because they are not convertible. There are, however, a few noteworthy cases of encroachment which have occurred in recent years, that is the illegal	As far as animal and crop production is concerned in converted wetlands, these wetlands are seen as part of the land resource. Indeed economic outputs in some converted wetlands, for example Ruhuuma wetland, are currently very good.	However, part of the mission of this department is to discourage the tendency to view wetlands as being most useful when converted to farmland resources, because wetland conversion eliminates water from the hydrological system and changes microclimates.

		conversion of Nyamuriro and the construction of a house in Rushebeya-Kanyabaha. **3. Fires** From time to time in the few remaining intact wetland patches. In the dry season of 2004 fires occurred in Rushebeya-Kanyabaha and Bugira-Kabali-Choogo wetlands.		
Kalangala	In general, wetlands of Kalangala district are still intact. This is attributed to fact a large population of Kalangala is engaged in fishing. And another fact is that land up stream has not been exploited fully as a result little attention is given to carrying out agriculture in the wetlands. Even if utilization of wetlands would have been preferred, most of them are in accessible as they either protected in the forest reserves or surrounded by thick impenetrable forests. Those that have been destroyed as a result of lack land use plans and failure to implement government laws as well as lack of awareness regarding planning, conservation, and management of natural resources. The situation has been worsened by existence of some landings in the wetlands where by fishing village have been created in the wetlands. Regardless of the fact that there is destructive exploitation wetland, the population still sees the importance of having a stake in the management of their wetlands as a result they advocate for community	Various activities do occur in the wetlands, which include cultivation, fishing, hunting watering animals, sand and brick mining, harvesting craft and building materials and brick making as well as human settlement. Some wetlands have become threatened by these activities. Over harvesting of forests and burning as well as lack of soil conservation in the catchment areas of some wetlands is likely to accelerate siltation of the wetlands. Wetland abuse has taken place on Lulamba Island in Bufumira subcounty where by agricultural activities namely the growing bananas, sugar canes, as well as human settlement and trees have been cleared for fuel or to expand for agriculture. The wetlands around Lutoboka and Mwena on Buggala Island in Town Council have been cultivated and settle in Banda and Kitobo islands of Bufumira the wetlands have been destroyed to extent of destroying the original vegetation. A number of wetlands in the district have either a plant or animal species, which is threatened by the way it is hunted or harvested. The destructive harvesting of beetle larvae locally called Masinya by inducing the Raphia farinifera to rot and the hunting of Hippopotamus amphibious and Sitatunga threatens the existence of these species. Most		The major wetlands are still intact, however, at present is no enough measures to safe guard and control the utilization of natural resources and wetland resources in particular. Hence a need to carry out awareness campaign at national, district, sub-county and community level. Furthermore there is need to strengthen the enforcement of environment legislation and byelaws to be formulated and implemented so as to halt the abuse of wetlands. Protection and management plans ought to be put in place for some of the wetlands, which are found outside the protected areas. To ensure the continuity of the wetlands in controlling flooding, trapping impurities in the water, providing the breeding grounds for fish, regulate and conserve water, and provision of habitat to flora and fauna and other roles, there is great need to conserve and sustainably utilize

	Wetlands located in forest reserves are protected by the law and as a result of this, they are safe. These include: Luku, Luku point, Kalibata, Nkoma, Buswa and Nkoma swamp, Towa – Njoga, Lutobazi and part of Bukuzindu allfound on Bugala Island as well as Kukutu wetland of Bunyama Island. On the other hand, for wetlands outside gazetted areas, though exploitation is not yet rampant, they face a risk of encroachment due to the increasing human population in the district. At present, there are measures to govern / control the utilization of resources in these wetlands.	seasonal wetlands in the district burning of grass. Tomi swamp is likely to get threats from herbicides fertilizers and effluent from industries when palm oil project starts. Management of wetlands by local communities will remain difficult unless the community is aware of its role, responsibility and values of wetland. This is because there is still lack of awareness with regard to environmental awareness and in particular wetland conservation.		resources in Kalangala District. And the following are the proposed interventions or conservation measures in and around the wetland: • Sensitization and awareness campaigns especially on Soil and water conservation education • Promotion of collaborative management of wetland resources • Afforestation • Contour / ridge cultivation and fallowing • Restriction on methods of drainage and agriculture • Enforcement of the wetlands, lakeshores and riverbank management regulations. • Formulation and Enforcement of bye-laws. • Pressure of Pro-conservation NGOs. • Mulching The Local Governments Statute (1997) decentralizes services and activities, which include the management of the district's wetlands. The decentralization process transfers the administrative, financial and planning authority from the center to local government councils. As far as wetlands are concerned, this means that the

				districts are responsible for managing the wetlands within the framework of the National Environment Statute and other relevant laws. In order to be able to do so, the districts need comprehensive wetland knowledge and wetland management skills, so that they can produce realistic wetland management plans, carry out wetland resource monitoring and surveillance, and if needed, enforce adherence to the National Environmental Statute and regulations. One of the tasks of the National Wetlands Program is to help build capacity at district level to enable local administrations to fulfill their role in wetland management and conservation effectively.
Kamwenge	It is estimated that 60% of the districts wetlands are still intact and 30% have been encroached on and turned into Agriculture fields and farmlands in parts of Kahunge sub county, Kicheche sub county, Ntara sub county and other areas in Mahyoro, Bwizi and Nkoma sub counties. 10% of wetlands are still intact but encroachment in terms of Agriculture, settlement is eminent e.g. wetlands of Kyakanyemera in Kahunge sub county,	The major threats to wetlands include the following: reclamation and drainage of these areas for Agriculture purposes and conversion into farmland. This is likely to reduce the total wetland area in the district leading to a distortion of the hydrological cycle and loss of goods and services provided by these areas. So far in some parts of Kamwenge like Nkoma Sub County, some parts of Nyabbani and Ntara sub county, shortage of water is being experienced leading to people	Pollution of wetlands is most common in Kamwenge Town Council where settlement in wetlands is very common; some people tend to put their toilets in wetlands, which pollute the water bodies with fecal matter hence increasing chances of coliform bacteria contamination.	-Ultimately Kamwenge district strives to reach a situation where wetlands are well understood, appreciated and utilized at all levels of society, while sustaining enhancing all their beneficial functions. -There are laws in Uganda that relate to wetlands use, access and ownership. These include constitution (1995) the land act (1998). The National

	Lake George wetland and Mpanga wetlands along river Mpanga. Wetlands in Kamwenge cover 75.2km2 which is 3% of total district area (Biomas study).	walking for along distance to water their animals and to fetch water for domestic use. Pollution in Kamwenge wetlands is manifested in form of waste water from hotels, individuals' homes, lodges and other institutions which find their way in wetlands. Run off from agricultural fields especially in hills of Kabuga, Mpanga hills, Iryangabi hills ends up in wetlands in the respective valley hence leading to pollution, which leads to wetlands, change their natural states.		Environment Act 1995, Local Government Act (1997) and wetlands policy 1995 among others. Therefore, Kamwenge District under Environment office has started enforcing these laws due to high pressure, which is exerted on wetlands. -Also capacity building of lower local leaders NGOs,CBOs, and general public has so far taken place with technical support from NEMA and wetlands inspection division respectively. -The Environment Officer at district level is the over all person responsible for wetland management in the district and plays a coordination and advisory role to district council and DTPC as far as integration of environmental issues in the DDP is concerned. -Further more NGO's such as KAFRED aims at conservation of existing natural resources in Bigodi in particular Magombe swamp which is conserved for eco-tourism development purposes.
Kisoro	Although most of the intact wetlands in Kisoro are found in the protected areas of the Mgahinga gorilla National park, Bwindi Impenetrable National park and	Drainage for crop production, which is reported to have started in the 1940's, has greatly threatened wetlands of Gitundwe, Murugyege and Nyarutovu.	Massive conversion of wetlands has intensified the scarcity of papyrus, which was in the past	

	Echuya forest reserve, others outside these areas for instance Nyabarongo and Murongo which are found in the Northern end of the district are heavily degraded.	Cultivation up to the lakeshores that leads to silting considerably reduces the breeding ground (nursery ground) for fish threatening fisheries in the lakes of Mutanda and Mulehe. This results into erosion related problems such as silting because of the destruction of the wetland vegetation that would other wise trap the silt and sediments. Crops grown in the converted wetlands include sweet potatoes, Irish potatoes, beans, cabbages and sorghum. Over harvesting of the swamp products especially papyrus and clay has also contributed tremendously to the degradation of wetlands. For instance Muchuya swamp surrounded by Echuya forest reserve has always not been given priority in conservation. A drainage system has been created right along the valley to drain the swamp to create more land for cattle farming (Byaruhanga 2001). Also the Batwa have traditionally lived in the forest and continue to earn a living from various forms of resources extraction. Before conversion and encroachment on the wetlands the dominant vegetation was papyrus, sedges and swamp forest. After depletion secondary vegetation mainly cyperus subscript developed and now dominates most of the wetlands, which has also affected the wildlife habitat.	commonly used for thatching houses and making mats used as bedding. This is a concern especially for rural people who cannot afford buying mattresses, iron sheets and tiles.	

		However, some of the original wetland vegetation can be identified in some wetlands such as Chotsa bay and scattered areas around Lake Mutanda. Assumed ownership of most wetlands by individuals has denied free access to wetland resources and hence reduced the benefits to the majority. This has compromised efforts and made it almost impossible to conserve such wetlands.		
Mayuge	**Wetland:** Over 90% have been reclaimed for agriculture especially sugarcaneout growers scheme which accounts for over 54%.			
Mbale		**Threats and opportunities** The wetlands are protected by the NES 1995, but they are still being reclaimed and degraded. The destructive uses of wetlands include among others: **Drainage** Draining of wetlands for agricultural use and their subsequent conversion is common practice. Traditional crops such as maize, millet, potatoes have replaced wetland crops such as coco yams and sugarcanes. This is a clear indication that the water or hydrological regimes in these wetlands have changed and are likely to disappear within 10-15 years. Within the municipality and urban centres the wetlands are drained for construction purposes. Almost all the municipal wetlands have been leased out for development.	**Biodiversity and habitat loss** The conversion, pollution, and devegetation of the wetlands have led to biodiversity loss. The wild game hunting no longer practiced. Wetland fishing is also limited. Breeding centers for birds have been cleared. There is thus deterioration in the biodiversity and habitats within the district wetlands. **Climatic changes**: When there is an increase in the mean air temperatures, there is great range of daily and seasonal temperature fluctuation reductions which leads to reduction in local	

		Vegetation depletion and changing land use Wetlands were previously considered to be wastelands; that is the reason for draining them by planting of Eucalyptus trees. Overtime, they have been converted for farming and settlement. This inevitably leads to the loss of wetland vegetation including endemic flora such as *Pistia straotis, Spirogyra* among others. Their use has also changed. Recreational activities such as bull fights in wetlands such as Nabalosi and Namasho have been lost. The salt licks in "**Nabalosi"** have been lost to sugarcane production. Fish farming is being undertaken at the wetland edges. Rice growing is on the increase in areas such as Bungokho-Mutoto, Bungokho and Butiru since it is regarded as a high value crop. Sugarcane is being grown in almost all wetlands for the commercial value. Of the cultural sites that existed in wetlands, only small portions have been left for visits by circumcision candidates, the rest being cleared of wetland vegetation. Sand mining for the construction industry has left pits that accumulate water that is a habitat for mosquitoes that transmit the malaria parasite. Such pits also increase accident risks in their locality. In 2003, a child aged about five years drowned in such a pit in Bungokho sub county- Nasasa village. **Land Tenure** Land ownership is very important in the management of wetlands. Their management is legally a government responsibility.	rainfall and reduced humidity. **Prevalence of mosquitoes** directly results from disorganisation of the ecological system of the wetland. Subsequently, this increases treatment costs in malaria and also reduces on productive time for the mothers who spend more time in health facilities and later have food insecurity. **With reduction in water quantity and quality**, water supply shortages, lowered water tables, water wells will dry up and need deepening; there will be increased droughts (Water stress) for crops; flood problems especially in townships and urban areas and reduced water quality. **Consequently, crop yields will reduce** due water stress and reduced soil fertility because of lack of nutrient recycling. **Acidification of soils** due to drainage may occur because of exposing organic matter to oxidation thus creating acidic soils.	

		Wetlands were previously looked at as community land. Over time, there was loss of this community responsibility and claim of ownership by people adjacent to them. **Lack of knowledge and understanding of wetlands** The lack of knowledge and understanding of wetland laws, uses and functions among the stakeholders remains a challenge. The enforcement capacity is limited both in the will and human resource.	**Socio-economic impacts** include damage to roads, bridges and other structures e.g. health units schools; loss of productive time to search of water and other materials obtained from wetlands. Economic benefits from the crafts, materials, fishing, pottery, mulching materials will be lost. **Culturally, traditional benefits attributed to wetlands will not be realised.** **Frequent floods** will increase costs on controlling them and repairing damaged structures thus reducing on funds for other development purposes.	
Moyo		**Reclamation.** The main pressures behind this would include; Population pressure, which has resulted in scarcity of land in some parts of the district, could be forcing people to cultivate wetlands for growing vegetables, rice and maize. Unreliable rainfall has forced people to cultivate wetlands to increase crop production. Brick making is mostly done in wetland areas	The reclamation of wetlands affects the flora and fauna of the wetlands and the lowering of the water tables in areas near wetlands. The impact of pollution could be ramified through wetland laws, which could prohibit the disposal of harmful products in the wetlands.	There would be need to conserve the wetlands through the passing of by-laws and education on proper management of wetlands in the district. The community and the urban authority should participate in the management of the wetlands. This (the impact of inappropriate laws) can be

		near towns like Moyo where the demand for these has increased. The construction of feeder roads especially to the refugee settlements (e.g. Morobi II Settlement) could lead to the reclamation of the wetlands in the district. **Utilization.** In Moyo District, wetlands are being used for crop growing and livestock grazing as noted above. Fishpond constructions are being proposed for development in the wetland areas. Wetlands are also used for brick making as well as water supply for Moyo town. The main pressures causing this include; • Unreliable climate in the district. • Increasing needs for wetland products e.g. the clayish soils for making bricks, malting, basket etc materials. Scarcity of water and grass for livestock in the dry season. **Pollution** Pollution in wetlands could result from a number of factors with future development of the district which include: • Agricultural use of the wetlands. • Expansion of the manufacturing. • Sewage disposal • Brick making. **Policy/Laws and Regulations** There had been no effective policy or regulations regarding use and management of wetlands before 1995 in Uganda. In 1996, the	While appropriate policies can lead to the wise management of wetlands to sustain ably supply a multiplicity of goods and services, inappropriate policies or lack of policy implementation can lead to the deterioration of the wetlands There is a growing threat of water hyacinth in Moyo District section of the Albert Nile. There is an observed and potential impact of the water hyacinth on the reduction of the fisheries resources in the district. Existence of this weed in the district has caused the following problems; • Complicated accessibility to the district via Laropi • Reduced fish catch and incomes from fish • Decline in water quality of the Nile River through rotting leaves and stems suffocate aquatic life. • Habitats for dangerous animals such as snakes. Generally, decline in households, which used to depend on the river for income	averted by building local and district institutions like the DEC/LEC and structures necessary to educate the people about the policy, laws and regulations of wetlands while offenders of the laws could be apprehended if found liable There are a number of suggestions to control the weed, some of which are not yet verified. Physical removal using manual/ or mechanical means; chemical and biological control; alternative control; water level control; water shed management and integrated control have been suggested (FAO, 1991). None of these has been applied in Moyo District. The main pressures stopping this include; • Lack of research to find cheaper alternative control method. • Fear of environmental control e.g. chemical methods. • Lack of funds to implement water hyacinth programmes. Lack of intervention will perpetuate the negative impacts of the weed while the water bodies will get polluted.

		wetlands policy was formulated and its effectiveness is yet to be felt. Ineffectiveness of laws and regulations is a result of; • Low literacy rate of the population. • Lack of extension services. • Anti-people and biased regulations. • The laws are considered foreign and more often are resisted. **The water hyacinth problem** **The problem** Water hyacinth, *Eichhornia crassipes* has become an issue in Moyo District because it is well established throughout the slow-flowing, fish-rich section of the River Nile up to Nimule. It affects the people of the district in a variety of ways especially, fisher folks in the district. It also lowers the quantity of water because of its obnoxious nature.	generation	
Mbarara		• Conversion of wetlands for crop agriculture and animal farm establishment. • Soil mining for brick making and construction materials for building • Season bushfires setting directly or spreading from dry land. • Urban developments as most upcoming towns are in lowland adjacent to wetland. • Waste dumping. • Water hyacinth infestation in Rivers Rwizi Kagera and Kizimbi wetlands. • Industrial pollutions from milk factors within Mbarara Municipality, which are located on Riverbanks of River Rwizi.		
Mpigi	Originally, wetlands covered 1053 km2 almost 16% of the former Mpigi district.	The stability of this resource is being threatened by increasing wetland degradation		

	Wetlands in the current Mpigi district cover 719 km2 (including open water). Most permanent wetlands lie on the fringes of lake Victoria.	due to human activities like deforestation, reclamation for farming, fishing, hunting, grazing, and sand extraction, brick-making and burning. The several activities of consumptive utilization have resulted in serious degradation consequences among others are pits as a result of sand/gravel extraction, creating breeding grounds of disease vectors and accidents to animals and humans. Burning has resulted in loss of biodiversity as some of the flora and fauna lose their habitats and may not be fire tolerant. (MDC, 2003). **Encroachment for Agriculture** Conversion/drainage of wetlands for agriculture more so seasonal wetlands subjected to intensive cultivation for crops such as sugarcane, sweet potatoes, yams and eucalyptus and these have been done without proper management. **Sand and clay mining** Excavation of sand and extraction of clay for brick making has left open pits that accumulate stagnant water creating habitats for disease carrying vectors (mosquitoes and snails) and posing threat to humans and animals. These economic activities have been linked to lack of jobs, where people (especially youths) have resorted to free natural resources in a bid to earn a living and there is also a link to urban centre developments where current construction boom has created a high demand for clay bricks. **Deforestation and Loss of Biodiversity**		

		Deforestation of swamp forests in search for wood and crafts products has posed a great danger to the forests in the district. Rattan canes that are restricted mainly to central Uganda are under threat of over harvesting. Forests, once a pre-requisite for rain and climatic factors governing the success and thriving of the agricultural production sector, have drastically reduced. **Burning** The district experiences rampant swamp fires caused by deliberate attempts by hunters to catch their prey and herders who may wish to encourage regeneration of new vegetation for their economic gains. This has continued to be a threat to the wetland bio-diversity. **Pollution** Wetland pollution in the district has mainly occurred due to dumping of solid wastes in these areas. There is some limited pollution from industrial wastes/effluents particularly from the existent small-scale industries. These do seem to change the quality of water bodies, yet wetlands are effective bio-filters only under low nutrient load and abundant swamp vegetation. In general, the most outstanding environmental issue concerning wetlands is the increasing level of encroachment worsened by pressures like apparent ownership of wetlands as common property, drainage and over harvesting of products. There is need for an inventory to determine actual change in natural wetland area.		
Mubende	Mubende district mainly has permanent and seasonal wetlands. Permanent	The uses of wetlands in Mubende in some cases have led to threats of depletion e.g.		

	wetlands have fresh water with emergent reeds and swamps, typically dominated by single reed species. These include; a) Papyrus swamps with floating or usually anchored on firm soils of L. Wamala area. Miscanthus swamps, vossia swamps, (L. Wamala) phragmites swamps evenly distributed and typha swamp are also common. b) Fresh water floating leaves but vegetation communities dominated by Nyampaea swamp is also common. c) Fresh water surface floating vegetation communities dominated by Pistia statioes, lemna (Azolla swamp) and Enchonia Grassipes are also common especially on slow moving water. d) Floated herbaceous wetlands with variable species like Echimochloa panicum rupens, cynodon swamps "teete") are also common especially in Kasambya and Kiganda sub counties, loudetia-cynodon-setenia swamps are also common in Buwekula and Kassanda counties. Seasonally Cyperus wetlands are common. e) Seasonally flooded wooded grassland especially around kattabalanga and Nabakazi areas are also common. f) Fresh water palustine forests g) Permanent swamp forests in Buwekula and Busujju counties still exist and are dominated by Phoenix or Raphia calmus, Ficus (Mivule) and ' Migavu' are common. h) Seasonal swamp forests dominated by	deforestation by excessive charcoal burning and brick burning in catchment areas. Over cultivation is another threat, this leads to wetland degradation and encroachment on wetlands. Watering livestock at times causes water pollution and this is supplemented by overgrazing in these areas. Encroachment on wetlands in Mubende is ranked as follows from most encroached to least encroached; a) Mayanja-Kato (Wabirombe is a threatened wetland) b) Kutumbi - encroachment for agric c) Wamala d) Nabakazi e) Katonga f) Nkuzizi g) Nkusi Serious encroachment is on wetland around L. Wamala, Mayanja-Kato and Kitumbi for agricultural expansion. This is due to pop expansion in areas of Mityana, Busujju and parts of Kassanda counties. In Nkusi, kuzizi and Nabakazi wetlands, encroachment is basically due to economic activities like timber harvesting and charcoal burning in catchment areas. In Mubende, the expansion of Agricultural land, extraction of fuel and removal of clay from the swamps has caused a drastic reduction in the area covered by swamps. This has gone hand with encroaching on forests for the same purpose in catchment areas. Consequently there has been a drop in the water table in some of the areas. However		

	phonex , Sapirm and Ficus. These have been heavily encroached upon for agriculture. i) Most areas of Mubende district are dominated by fresh water riverine with Acacia, Ficus, combretum, phoenix pseudospondias erythrina and Alchornea among others as major species	lowering of the water-table and reduction in the water catchment's area may yet have reaching consequently which may include drying up of wells and reduction in rainfall. Reduction in vegetation and especially tree cover may also result in the increased temperature which may have adverse efforts on the agriculture in the region. **Over Use:** Over using a wetland is dangerous to be environment. Over harvesting papyrus without leaving it rest and grow back naturally and this is unsustainable user go wetland. Drainage/excavation in the form of sand mining clay is the most serious abuse than any other and is most wide spread. **Digging trenches** Channelling water away in order to allow for the development of the areas for agricultural land and Brick making **Rampant swamp fires** Wetland burning destroys a lot of insects, animals and plants. This should be highly discouraged. While the consequences of wetland burning are not exactly known, this poses a threat to the diversity in these areas, some of which may not be fire tolerant and also triggers succession changes leading to replacement of natural wetland vegetation.		
Mukono	Wetlands have various attributes, goods and services they render to the district thus wetlands located in the central region of the district have been greatly affected and modified. This is because of the high population levels compiled with the high demand for food and building materials.	Population growth rates as well as the increasing rate of urbanisation are greatly impacting on the wetlands in Mukono in that areas with high urban development have had increased brick baking activities, settlements, road networks, solid waste disposal sites as well effluent releases. All these greatly affect		

	The northern part of the district mainly has seasonal wetlands which have been modified by the existence of animal rearing, charcoal burning plus the hostile climate.	the wetlands and such areas include Mukono, Seeta, Lugazi, Njeru, Nkokonjeru and other upcoming trading centres. - Farming systems in terms of vegetable growing in wetlands, sugarcane, potatoes, tea and eucalyptus trees are another threat to the wetlands in Mukono District. Areas for instance SCOUL in Lugazi are an example of degradation of wetlands for cultivation. - The increasing rate of industrialisation is also threatening our wetlands. It has been observed that most industries tend to locate in or close to wetlands for reasons of easy access to water as well as a means of disposing off of liquid waste. - Land management and ownership in Mukono is yet another factor that has a big impact on the rate of conservation of wetlands both negatively and positively. Wetlands that fall into the category of lease hold, customary, mailo, and free hold have been greatly modified while those that are gazetted are still intact due to the restrictions regarding their encroachment. - In addition, the Government policy has also played a positive role in wetland management in that all those wetlands in forest reserves like Namyoya, Kifu, Mabira, Zirimiti and the like have been conserved. **Pollution** Most of the water sources especially Lake Victoria as well as rivers Nile and Sezibwa are mainly polluted by sediments. These sediments are a result of soil erosion caused by the destruction of vegetation cover along		

		the lakeshores and riverbanks. Other contaminants of these water bodies come from the various factories located along the banks and shores of these water bodies. These include: • Breweries at Njeru where caustic soda, yeast, alcohol, fermenting barley and other solid wastes directly drain into R. Nile. • Nytil textile also in Njeru also disposes its waste (Bleaching agents and dyes) directly into R. Nile. • Sugar Factory at Lugazi discharges its waste material directly to River Musamya in their vicinity rendering it completely dead for a distance of 20 Km. This has however reduced resulting from continuous monitoring by the environment department and the Wetlands Inspection Division (WID) and compliance by the SCOUL management. • Schools are also contributing to wetland pollution through releasing a lot of waste water directly into the wetland and construction of sewage lagoons.		
Nakasongola		Generally, wetlands in Nakasongola district are not under serious threats of degradation, apart from those along River Sezibwa system where extensive crop cultivation is currently taking place. Seasonal wetlands conditions are sound but drop only during the drought because such are the only areas palatable pastures are sought. This leads to overgrazing due to high livestock numbers being grazed in these wetlands. Burning is the major wetland abuse in the district. It is associated within grazing and hunting for new pasture regeneration and driving of animals respectively.		In bid to curb the current threats, the following have been done: • Wetland inventory was done 1999 to compile the status of wetland in the district • Awareness raising workshops for District leaders, sub county leaders cultural and religious leaders, law enforcement officers were carried out (2002-2003). • District wetland action plan (DWAP), 9-sub county wetland

		Subsistence cultivation is another major threat on high increase especially along the showers of Lake Kyoga. The problem is prominent in Lwampanga, Kalungi and Kalongo subcounties. The intensity of crop cultivation is high during drought periods. Crops grown include among others: Bananas, Yams, Maize, Potatoes, Cassava, Sorghum, and Tomatoes. Wetland fencing off is becoming common as seen **in plate 2.** This is done to safe guard pastures for individual's livestock since wetlands become the only grazing areas during drought. Chemical pollution is another threat associated to crop cultivation due to spraying of crops. Common insecticides used are, Ambush, Sherpa, Mancozeb, Roundup. Sand and clay mining is another threat which is on increase due to infrastructure developments in upcoming urban/trading centers scattered within the district. Fencing off wetlands by source individuals is still a large task to handle especially the vital wetlands like Mukote, Namusaga, Katamandwa and Kambu		action plans (SWAP) were developed. - Implementing district and community wetland action plans - Enforcing the national (river banks, lake shores and wetlands) management regulation 1998 - Two draft community wetland management plans have been formulated (Sezibwa wetland and Lwampanga Lakeshore stretch)

Source: Respective 2004 DSOERs

Annex 3: Forest status by districts

Zone	Area of CFR	No of encroachers	No of h/holds	Area under cultivation (ha)	No of livestock	No of individual houses	No of schools	No of churches	No of mosque	No of illegal land titles	No of permanent individual houses	No of cattle dip	No of health centers	No of kraals	No of markets
Arua	47,360	4,737	819	765.65	1,162	1,879	2	1	1	3	0	0	0	17	0
Budongo	98,541	1,993	134	872.05	2,478	367	0	0	1	2	11	1	0	16	0
Bugoma	41,256	14,187	60	2,049.35	4,309	1,221	0	1	0	0	16	22	0	47	0
Bushenyi	60,539	444	0	715.50	1,539	127	0	0	0	0	0	0	0	10	0
Gulu	14,392	1,599	0	1,912.00	2	1,187	0	0	0	0	0	1	0	0	0
Kitgum	65,546	180	24	75.00	0	65	0	0	0	0	18	0	1	0	0
Lango	14,215	2,542	256	935.38	2,428	458	2	0	0	0	13	0	0	22	0
Lendu	17,137	529	39	278.50	174	31	0	0	0	2	0	0	0	2	0
Luwero	50,019	10,773	1,202	5,550.72	24,269	2,211	10	7	0	69	0	213	0	1,107	0
Mabira	84,571	20,204	865	6,646.93	4,219	4,651	3	8	2	1	117	0	0	14	2
Mafuga	8,000	1,212	0	341	136	6	0	0	0	0	4	0	0	1	0
Masaka	55,423	78,291	2,837	18,546.88	66,546	17,913	32	24	4	10	964	29	9	1,975	2
Mbale	45,972	2,921	449	565.50	50	175	4	2	1	1	34	0	0	0	0
Mbarara	14,738	217	167	152.40	5,555	104	5	3	0	0	16	0	0	34	1
Moyo	28,345	3,971	516	2,072.76	1,160	291	0	0	0	0	0	0	0	19	0
Mpigi	29,194	3292.00	347	485.53	13575	3	0	0	0	0	3	0	0	0	0
Mubende	52,536	20,279	1077	11428.50	5,743	3,436	12	11	2	0	260	11	1	182	6
Muzizi	42,942	12,246	449	3,773.60	2,828	868	2	3	0	1	17	97	0	12	1
Teso	10,136	883	0	422.20	344	72	0	0	0	12	0	0	0	2	1
Total	780,862	180,500	9,241	57,589.20	136,517	35,065	72	60	11	101	1,473	374	11	3,460	13

Source: NFA (2006)

Annex 4: Land degradation by Farming systems

Farming systems	Area	Land degradation
Intensive-banana coffee system	Shores north of Lake Victoria, Mukono, south-east of Mubende, southern Luwero, Ssese Islands, Kampala and Entebbe, Jinja, Iganga, Mpigi, south Kamuli and eastern Masaka and Rakai	Perennial crops and intercropping though advantageous has not stopped soil degradation dueto continuous use of small plots that do not benefit from restorative measures, mailo land tenure system
Western banana – coffee – cattle	Bushenyi, Kabale, Rukungiri and parts of Mbarara	Highly fragemente land holdings due to population pressure, alarming deforestation, poor farming practices and steepe slopes, resulting in soil erosion; customary land tenure
Kigezi Afro-montane (Southwest highlands)	High altitude areas in Kabale and Kisoro as well as the northern slopes of the Muhavura Mts.	Soil fertility is dwindling fast; land fragementation increasing due to population pressure; contour bunding increasingly eroded for more farmland therefore increased soil erosion leading to landslides
Northern and eastern cereal-cototn-cattle	Apac, Gulu, Kumi, Tororo, Oyam, Dokolo and parts of Mbale	High wind and water erosion; bunding and fallowing virtually abandoned
West Nile cereal-cassava-tobacco	Arua, Nebbi, Moyo, Adjumani, Koboko, Yumbe	Declining soil fertility, increased soil erosion

Source: NEMA (2002)

Annex 5: Acronyms and Abbreviations

ACP	Africa Caribbean and Pacific
AEO	Africa Environment Outlook
AFDB	African Development Bank
AFRREI	African Rural and Renewable Energy Initiative
AGOA	African Growth Opportunity Act
ANS	Adjusted Net Savings
ARI	Acute Respiratory Infection
BBC	British Broadcasting
BINP	Bwindi Impenetrable National Park
BMU	Beach Management Unit
CBD	Convention on Biological Diversity
CBOs	Community Based Organisations
CDM	Clean Development Mechanism
CFCs	Chloro Floro Carbons
CFR	Central Forest Reserve
CHOGM	Common Wealth Heads of Government Meeting
CM	Collaborative Management
CNA	Climate Network Africa
CNN	Cable News Network
COMESA	Common Market for Eastern and Southern Africa
COMESA	Common Markets for Eastern and Southern Africa
CSOs	Civil Society Organisations
CWA	Community Wildlife Areas
DDT	Diochlorodiphyneltrichloroethene
DFID	Department for International Development
DGSM	Department of Geological Survey and Mines
DNA	National Drug Authority
DPSIR	Driving Forces-Pressure-State-Impact-Response
DRC	Democratic Republic of Congo
DSOER	District State of Environment Reports
DWD	Directorate of Water Development
DWSCG	District Water and Sanitation Condition Grants
EAC	East African Community
ECA	Economic Commission for Africa
EIA	Environmental Impact Assessment
ENR	Environment and Natural Resources
ENSO	El Nino/ Southern Oscillation
EPA	Economic Partnership Agreement
EPOPA	Export of Organic Products from Africa
ERA	Electricity Regulatory Authority
ERT	Energy for Rural Transformation Programme
EU	European Union
FACE	Forests for Absorbing Carbon Emissions
FAO	Food and Agriculture Organization
FD	Forest Department

FR	Forest Reserve
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GEO	Global Environment Outlook
GFS	Gravity Flow Scheme
GHG	Green House Gas
GMO	Genetically Modified Organisms
GMP	General Management Plans
GoU	Government of Uganda
GTS	Global Telecommunication Systems
HBMF	Home-Based Management of Fever
HDPE	High Density Polyethylene
HEP	Hydro Electric Power
HMIS	Health Management Information System
HSSP	Health Strategic Sector Plan
IAEA	International Atomic Energy
IAS	Invasive Alien Species
ICB	Institutional Capacity Building
ICCM	Interagency Coordination Committee on Malaria
ICEIDA	Icelandic International Development Agency
ICSU	International Council for Science
ICT	Information and Communication Technology
IDA	International Development Agency
IDP	Internally Displaced Peoples
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IGAD	Inter Governmental Agreement on Development
IGBP	International Geosphere-Biosphere Programme
IGCP	International Gorilla Conservation Programme
IHDP	International Human Dimensions Programme
IIED	International Institute for Environment and Development
IISD	International Institute for Sustainable Development
ILM	Integrated Lake Management
IPEP	International POPs Elimination Project
IPSIR	Issue-Pressure-State-Impact-Response
IPT	Intermittent Preventive Treatment
ITCZ	Inter Tropical Convergence Zone
ITN	Insecticide Treated Nets
IUCN	World Conservation Union
KCC	Kampala City Council
KSW	Kakira Sugar Works
KWS	Kenya Wildlife Services
LG	Local Government
LPG	Liquid Petroleum Gas
LRA	Lord’s Resistance Army
LRSY	Long-Run Sustainable Yield
LVEMP	Lake Victoria Environment Management Project

MAAIF	Ministry of Agriculture Animal Industry and Fisheries
MBIFCT	Mgahinga and Bwindi Impenetrable Forest Conservation Trust
MCCD	Ministry of Culture and Community Development
MDGs	Millennium Development Goals
MEA	Millennium Ecosystem Assessment
MEMD	Ministry of Energy and Mineral Development
MFPED	Ministry of Finance Planning and Economic Development
MLUD	Ministry of Lands and Urban Development
MoES	Ministry of Education and Sports
MoH	Ministry of Health
MoLG	Ministry of Local Government
MTTI	Ministry of Tourism Trade and Industry
MW	Mega Watt
MWE	Ministry of water and Environment
MWLE	Ministry of Water Lands and Environment
NAADS	National Agricultural Advisory Services
NAFIRRI	National Fisheries Research Institute
NAPE	National Association of Professional Environmentalists
NARO	National Agricultural Research Organisation
NEHP	National Environmental Health Policy
NEIC	National Environment Information Center
NEMA	Environmental Management Authority
NEPAD	New Partnership for Africa’s Development
NFA	National Forestry Authority
NGOs	Non Governmental Organisations
NHF	Natural High Forest
NHS	National Household Survey
NIPs	National Implementation Plans
NP	National Parks
NSOER	National State of Environment Reports
NTEs	Non Traditional Exports
NTR	Non-Tax Revenue
NUSAF	Northern Uganda Social Action Fund
NWSC	National Water and Sewerage Corporation
OECD	Organisation for Economic Development and Cooperation
PA	Protected Areas
PAMSU	Protected Area Management and Sustainable Use
PCBs	Polychlorinated Biphenyls
PEAP	Poverty Eradication Action Plan
PES	Payment for Ecosystem Services
PFE	Permanent Forest Estate
PMA	Plan for Modernisation of Agriculture
PV	Photovoltaic
QENP	Queen Elizabeth National Park
RDC	Resident District Commissioner
RGCs	Rural Growth Centres
RUWASA	Rural Safe Water and Sanitation
RWH	Rain Water Harvesting

SCOUL	Sugar Corporation of Uganda Limited
SHS	Sanitation and Hygiene Survey
SIDA	Swedish International Development Agency
SMMRP	Sustainable Management of Mineral Resources Project
SOER	State of Environment Report
SWIFT	Special Wildlife and Tourism Protection Force
SWM	Solid Waste Management
THF	Tropical High Forests
TOE	Tonnes of Oil Equivalent
UBOS	Uganda Bureau of Statistics
UEB	Uganda Electricity Board
UEDCL	Uganda Electricity Distribution Company Limited
UEPB	Uganda Export Promotion Board
UHDR	Uganda Human Development Report
UIA	Uganda Investment Authority
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNCDF	United Nations Capital Development Fund
UNCED	United Nations Conference on Environment and Development
UNCST	Uganda National Council for Science and Technology
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational Scientific and Cultural Organisation
UNFCCC	United Nations Framework C Convention on Climate Change
UPDF	Uganda Peoples' Defence Force
UPE	Universal Primary Education
UPPAP	Uganda Poverty Participatory Assessment Process
UPPRE	Uganda Photovoltaic Pilot Project for Rural Electrification
UPS	Uganda Population Secretariat
URA	Uganda Revenue Authority
USCTA	Uganda Sugarcane Technologists Association
UTB	Uganda Tourist Board
UWA	Uganda Wildlife Authority
UWASNET	Uganda Water and Sanitation Network
WAP	Water Action Plan
WB	World Bank
WCRP	World Climate Research Programme
WENRECO	West Nile Rural Electrification Company Limited
WHO	World Health Organisation
WR	Wildlife Reserves
WRI	World Resources Institute
WS	Wildlife Sanctuary
WTO	World Trade Organisation

Annex 7: Comparison of main features of SOE for 2004/05 and 2006/07

2004/05	2006/07
ATMOSPHERIC RESOURCES	
▪ Climate is an important resource. Of concern to Ugandans are issues of climate change and climate variability, both imposing adverse impacts on livelihoods, especially of the rural poor. Global research indicates that biodiversity is particularly sensitive to climate change. The country is a net sink for greenhouse gases. But atmospheric gases know no national boundaries; hence Uganda is also impacted adversely by increases and fluctuations in the earth's temperature. Increased frequencies of floods and droughts are manifestations of climate change. The erratic onset and cessation of rains as a result of climate variability makes it difficult for farmers to plan when to plant crops. There have been instances of frequent crop failures of late. Hence, to reduce vulnerability to the deleterious effects of climate change and climate variability, adaptation plans including early warning systems need to be put in place.	▪ The intergovernmental panel on climate change indicated, in 2006, that the African continent has the greatest risk to climate change. Uganda's atmospheric resources of temperature, rainfall, sunshine and wind show trends which suggest the possible influence of climate change. In 2005, Uganda along with other countries in East Africa experienced a severe drought that led to a decline in the water levels of Lake Victoria. In 2007, Uganda has experienced its heaviest rains since the El Nino of 1997/98. Moreover, it is the poorest regions of the country that have been most affected; north eastern Uganda: the Karamoja region, Teso region and the Lango region.
TERRESTRIAL RESOURCES	
Land resources and agriculture	
▪ Land is a limiting factor of production. Access to land is increasingly becoming difficult, especially for the poorer segments of society. Land degradation, especially through soil erosion is the single largest contributor to the annual cost of environmental degradation. Loss of soil nutrients is the reason the country's adjusted net savings are negative, in the absence of other compensatory factors. ▪ With respect to agriculture, the country's dominant development pathways are: expansion of cereals production; expansion of banana-coffee production; non-farm development; expansion of horticulture; expansion of cotton; and stable coffee production. Each of these development pathways has implications for the environment which will have to be addressed whichever pathways are followed.	▪ Uganda has 7.2 million hectares of arable land under crop agriculture which is less than 50 percent of the arable land (16.8). It has been suggested that available arable land for agriculture will run out in most parts of Uganda by around 2022. The land available in the eastern region is expected to run out faster by 2010. The rapid decline in land available land resource is attributed to the very high population growth rate. In addition the annual cropping practices that encourage high soil erosion and increased reclamation associated with new crop enterprises such as rice will also lead to the decline in the quality and quantity of the available land and soil resources. ▪ The indicative annual cost of setting up and running institutions required under Uganda's land bill is US$ 400 million. This amount is so large that it could prevent an otherwise good law from being implemented because it imposes a huge financial burden on the government. Moreover, it is unlikely that the reforms suggested in the law, will led to significant increase in the supply of credits by commercial banks and agricultural productivity in the short term and medium term.

Annex 7: Comparison of main features of SOE for 2004/05 and 2006/07 (cont'd)

2004/05	2006/07
Forestry resources	
▪ Except for some recent policy failures, the loss of forest cover in the gazetted areas has been reducing and total cover is stabilising. Unfortunately, forests in protected areas make up only 30% of the national forest cover. The remaining 70% are on private and customary lands where deforestation rates are high as a result of conversion of forest areas and bushland into agricultural and pastoral land. Furthermore, the country's harvestible timber resources are almost exhausted. Hence, to increase forest cover and ensure increased supply of timber, the Sawlog Production Grant Scheme and other licensing measures including charging economic rents for timber are in place. Furthermore, to ensure that rural communities living adjacent to forest reserves receive equitable benefits, collaborative forest management is being promoted. In recognition of the scarcity of land and goods and services provided by trees, agroforestry systems are also being promoted as integral aspects of farming practices.	▪ Uganda's forest cover declined from about 5 million hectares in 1990 to 3.7 million hectares in 2005. This was a result of encroachment for agricultural production, deforestation to produce woodfuel, urbanisation, industrial growth and problems of internally displaced people and migration. ▪ In Uganda forest governance is split at three levels: NFA for Central Forest Reserves, District forest services for community and the privately owned and managed forests. There has been increasing pressure to degazatte Central Forest Reserves for industrial purposes from the Central Government. This has been a case for Namanve, Wabisi-Wajala (in Nakasongola district), Butamira forest reserve and more recently the intention to allocate part of Mabira central forest reserve to sugar cane growing. ▪ The rapid increase in Uganda's population has increased pressure on forest ecosystems for ecosystem services such as timber, fuelwood and food. This increases the risk of encroachment and deforestation unless viable alternatives are found. Opportunities for forest enterprises have emerged from commercial timber production and the Cleaner Development Mechanism. The forest sector has one of the fastest rates of investment.
Rangeland resources and livestock production	
▪ Rangelands, mostly found in the *'cattle corridor'* occupy 107 000 km^2 or 44% of the country's land area. In some places, the conditions of the rangelands are deplorable - over-grazed, and through wind and soil erosion, bare. The rangelands are also located in arid and semi-arid areas, themselves fragile ecosystems. In the extreme, pasture and water scarcities are contributing to frequent conflicts between cultivators and pastoralists in the first place, and among pastoralists themselves. ▪ The number of cattle, goats and sheep is on the increase and hence there is need to pay attention to the carrying capacities of Uganda's rangelands. There is anecdotal evidence that in some locales the carrying capacities of the rangelands are being exceeded. Unfortunately, nobody knows for sure. Quantitative studies of rangeland conditions are sorely lacking and ought to be addressed. Carrying capacities of various rangelands have also not been established.	▪ In an ongoing integrated assessment study conducted on the Kyoga Basin catchement area (UNEP/NEMA, 2007 in print) has been shown that close to 50 percent of the grasslands in Nakasongola District disappered between 1990 and 2004, largely due to the activities of pastoralists. The area under grasslands in Nakasongola District decline from 78 100 ha to just 40,182 ha due to overstocking of livestock and regular bush burning (UNEP/NEMA, 2007).

Annex 7: Comparison of main features of SOE for 2004/05 and 2006/07 (cont'd)

2004/05	2006/07
Wildlife resources	
▪ Conservation or resistance to it, are the driving forces influencing Uganda's wildlife resources. Wildlife constitutes an important resource base for the country – as a source of food and material, recreation, tourism, nature study and scientific research. Wildlife resources occur in protected and un-protected areas. By 1994, wildlife populations whether inside or outside protected areas represented a small fraction of what they were in the 1960s, with some species such as both the black and the white rhino becoming extinct. By 2004, the populations of wildlife in protected areas had stabilised, and some even increased, although marginally so. Outside protected areas, the decline in wildlife populations continues almost unabated as a result of increased off-take, the blocking of migratory routes and habitat conversions, among others. The Uganda Wildlife Authority is piloting the conservation of ▪ wildlife populations outside protected areas through measures such as the operationalisation of the different classes of Wildlife Use Rights provided for in the Wildlife Act. Also, communities adjacent to wildlife protected areas are being encouraged to appreciate the prescence of wildlife through benefit (including revenue) sharing.	▪ There has not been significant change in wildlife resources and their management since the last National State of Environment Report apart from the encroachment of Queen Elizabeth National Park by the Basongora pastoralists. The invasion of Basongora has increased pressure on the available food resources for the animals in the park and generated debate on pastoralists' activities vis a vis wildlife protected areas. There are emerging opportunities in wildlife use rights such as trade, research and a wildlife sector trade strategy has been developed in this regard.
Mineral resources	
▪ Reading from geological formations, there is a significant mineral potential in the country. However, the exact locations of commercially-exploitable deposits in most cases are unknown. Of the ones that are known, on a base case scenario, the value of mineral production is expected to rise from the 2003 figure of $12 million to over $100 million/year; while on a best case scenario basis the value is expected to increase to over $200 million/year. However, the realisation of these projections is contingent upon availing sufficient capital to the mining sector. ▪ When increased mineral production is realised, it will bring with it higher levels of pollution which will have to be mitigated, through among others, the use of the *EIA Guidelines for the Mining Sector* and regular supervision of mining operations.	▪ in 2005, there was increased production of limestone and pozzalanic materials which led to more cement production in the country hence increase in royalty. But the production of some minerals like gold, cobalt and wolfram was less than that of 2004, contributing little to Non-Tax Revenue. This was because one major wolfram mine was under receivership and; Cobalt price had fallen below economic recovery and consequently production was suspended. The increased production and revenue from cement production, however, outweighed the declines elsewhere, resulting in the improvement in sector incomes.

Annex 7: Comparison of main features of SOE for 2004/05 and 2006/07 (cont'd)

2004/05	2006/07
AQUATIC RESOURCES	
Wetlands	
▪ Wetlands cover about 13% of the area of Uganda and provide a number of direct and non-direct values to the people of the country. Up to late 1980s, wetlands were generally considered 'wastelands' to be reclaimed for agriculture in rural areas, and 'drained' as an anti-malarial measure in urban settings. By 1994, the need for conservation was realised and the process of formulating an appropriate policy of wetlands. ▪ Despite a wide array of achievements, wetlands degradation is still evident – some for basic survival needs of the poor, others as a saving measure where land purchase prices are high, and yet others are the result of ignorance about ownership and legal boundaries of wetlands. Perhaps the most important reason for continued wetland degradation is weak enforcement of the applicable environmental laws and fairly low levels of awareness among policy makers and rural communities.	▪ Uganda's wetland resources cover 13 per cent of the country's land surface. Increasingly these wetlands are under pressure from reclamation for agriculture especially rice production. While no estimates exist as yet, several districts have reported an increased use in wetlands for rice production as a result of the current government campaign (upland rice growing) in Uganda. Although upland rice can be grown far away from wetlands communities have preferred growing it near or within wetlands.
Water RESOURCES	
▪ Water is life, and Uganda has significant quantities of the resource. From both hydrological and social water scarcity considerations, at the moment Uganda is not water stressed. However, by 2025, indications are that there will be reason to worry as a result of increasing demands for human, livestock, wildlife, irrigation and industrial water. Uganda is ranked in a group of countries that must plan and secure more than twice the amount of water they used as of 1998 inorder to meet reasonable future requirements. ▪ The quality of the water from available sources is another area of concern principally as a result of pollution – residential, industrial and agricultural land discharges into the open waterbodies. To some extent the buffering capacity of wetlands is making a contribution towards reductions in pollution, but this will continue only if the integrity of the wetlands can be sustained.	Uganda's water resources cover about 16 percent of the country's total area. The biggest pressure on the water resource is from the growing population and poor waste management practices of industries located near the water system. Uganda is on track to meeting the Millennium Development Goals for access to improved water within the country of 100 percent by the year 2015.

Annex 7: Comparison of main features of SOE for 2004/05 and 2006/07 (cont'd)

2004/05	2006/07
Fisheries Resources	
▪ The fisheries resource of Uganda has been an important source of high quality solid animal protein. On average Ugandans were consuming about 13kg/person/year by 1994. As of 2005, this consumption was estimated to have declined to about 10kg/person/year, mainly as a result of increasing scarcity and cost. Exports of fish and fish products are also on the increase. The twin effect of increases in domestic consumption as a result of population growth and higher levels of export demand has pushed capture fisheries close to its long-run sustainable supply and is threatening to exceed it. There is evidence of localised over-fishing in certain waterbodies. Two lakes (Victoria and Kyoga) and two species (Nile Perch and Tilapia) account for over 80% of annual harvest, implying a high level of selectivity. On the other hand, the Nile Perch, a carnivore, is having a devastating effect on the fish biodiversity of lakes Victoria and Kyoga.	▪ Fisheries activities provide an important source of livelihoods to many Ugandans and foreign exchange to the country. Between 2002 and 2006 Uganda's fisheries export increased by value from US$ 78.15 million to 142.69 million an 82.5 per cent increase. Fish catches increased from 249,000 metric □iber in 2004 to 416,000 metric □iber in 2005. 58 percent of Uganda's fish catches come from Lake Victoria followed by 16 per cent from Lake Kyoga and the remaining lakes and rivers contribute 26 percent of fish catches. ▪ The major pressures on Uganda's fisheries resources come from the growth in international market demand for Nile perch and Tilapia, deterioration of water quality due to excessive pollution, re-invasion of the lakes by the water hyacinth, poor fishing practices and prevalence of diseases especially HIV/AIDS in the fishery communities.
CROSS-SECTORAL RESOURCES	
Energy	
▪ The dominant source of energy in Uganda is biomass and this is expected to remain so in the foreseeable future inspite of plans to increase hydropower energy production. However, the share of clean energy in total consumption is gradually increasing, in part as a result of programmes like the Energy for Rural Transformation. Production of energy has also been □iberalized, attracting an increasing interest among private investors. The adverse environmental effects of clean energy production are mitigated through the *EIA Guidelines for Uganda 1997* and the *EIA Guidelines for the Energy Sector*. ▪ Biomass energy will continue to be an important source of energy, especially for the rural poor, who constitute the majority of Ugandans. In some districts, the scarcity of biomass is already beginning to have impacts on the quality of food prepared. Households are opting for easy to cook but often less nutritious foods. There is need to encourage agroforestry practices so that households can raise their own biomass energy requirements in conjunction with farming practices.	▪ Uganda has an abundant although unexpected variety of potential energy sources from solar, bio-mass, hydro, petroleum and geothermal. The energy sources that have been exploited so far include bio-mass, petroleum and hydro power. The National consumption of energy sources by type is 93 per cent, 6 per cent and 1 percent for bio-mass, petroleum and hydro power exploited. Only 5 per cent of Uganda's population has access to electricity, two-thirds of the power generated in Uganda is consumed in residences, 14 per cent in commercial buildings, and 10 per cent in industry and the reminder in the transport sector. ▪ In May 2006, a consortium affiliated with the Aga Khan Development work signed an agreement to build the Bujjagali hydro power station. The project is valued at US$ 500 million and it has already started. There are two other electricity co-generation projects one at Kakira sugar cooperation and SCOUL and 15 other mini-hydro stations.

Annex 7: Comparison of main features of SOE for 2004/05 and 2006/07 (cont'd)

2004/05	2006/07
Biodiversity	
▪ Uganda is endowed with a very rich and varied biodiversity due to its biogeographical setting, varied altitudinal range and extensive drainage systems. This biodiversity is a national asset supporting rural livelihoods and contributing to commercial economic activities. The contribution of Uganda's biodiversity resources, organisms or parts thereof, populations or other biotic component of ecosystems with actual or potential value for humanity has been estimated at $1000 million per year, balanced against economic costs of $ 202 million plus losses to other economic activities of about $49 million per year. ▪ While Uganda continues to lose some of its rich biodiversity, the rate of loss has been reduced somewhat. Reflected in terms of Living Uganda Index, the country out-performs planet Earth as a whole when the Living Planet Index is considered. The loss of biodiversity in protected areas has to a great extent been stopped and the trend reversed between 1990 and 2005. Outside protected areas biodiversity loss was still continuing as of 2005. The loss of biodiversity is largely the result of habitat conversion and introduction of alien species.	▪ Given Uganda's location in a zone between the ecological communities that are characteristic of the drier East African Savannas and the more moist West African rain forests, combined with high altitude ranges, the country has a high level of biological diversity. Recent survey reports reveal the occurrence of 18,783 species ▪ The principle threats to biodiversity in Uganda continue, including habitat loss, modification and alteration along with unsustainable harvesting, pollution and introduction of alien species.
Tourism	
▪ The rich biodiversity is one of the reasons tourists come to Uganda. The projections of tourist arrivals from a base of 68 000 in 1993 was about 140 000 by 2002. In retrospect this projection turned out to be conservative because by 2002, actual tourist arrivals reached an impressive number of 254 000; and by 2004, this number had increased to over 500 000 tourists who generated gross foreign exchange earnings of $316 million. Still more tourist revenues are needed if protected areas are to move towards higher levels of financial self-sufficiency instead of depending on government subventions and development-partner assistance.	▪ There have been increases in the number of tourists' arrivals since 1997 from 175,000 to 468,000 in 2005. The arrivals were mostly from Kenya, Tanzania and Rwanda. Europe contributed 10 percent mostly of United Kingdom and German and a good number from USA.

Annex 7: Comparison of main features of SOE for 2004/05 and 2006/07 (cont'd)

2004/05	2006/07
POVERTY AND THE ENVIRONMENT LINKAGES	
Human settlements, housing and urbanisation	
▪ The quality of housing Ugandans live in has improved over the years. When compared to the situation in 1991 where over 85% of the houses in both urban and rural areas had rammed earth for floor, by 2002 only 29% urban and 77% rural houses had the same. The use of mud and pole for walls has also declined relieving the pressure somewhat on natural forests and woodland areas, but this change may also mean more clay mining for bricks and stone quarrying both of which have adverse impacts on the environment unless mitigated. ▪ Although Uganda is one of the least urbanised countries in the world in absolute terms, the urban population is growing. Beginning from about 635 000 in 1969, the urban population increased to 938 000 in 1980, 1 890 000 in 1991 and 2 922 000 in 2002. The urban population is also growing faster (3.7%) than the national average (3.4%). The growth in the urban population means that pollution issues such as solid waste management, and the provision of adequate safe water and acceptable levels of sanitation coverage will have to be addressed.	▪ Two of the greatest global challenges are elimination of poverty and the reversal of environmental degradation. Income derived from the environment is a major constitutents of the livelihood of the poor and this direct dependency on nature does not appear to be decreasing. The most frequently mentioned causes of poverty in Uganda are: poor health, limited access or shortage of land, lack of market access for produce, unemployment, and high taxes. ▪ A typical farm size in Uganda in 2005 raged from 0.5 and 1 hectare as compared to an average of 0.75 to 1.5 hectares of land. The reasons for the landlessness include: lack of proper land regulations and effective land management structures which encourages corruption, poor land planning and conflicts. ▪ Malaria is the most prevent illness in Uganda with the 51 per cent of out patients cases reported between 202 and 2005. In 2004, the estimated annual number of deaths from Malaria was 70-100,000 people. Diarrhoea is the major killer of young children in Uganda and it alone is responsible for 19 per cent of all infant mortality rates in Uganda.
Safe water and sanitation	
▪ Access to safe water and sanitation in both urban and rural areas has increased compared to the situation 10 years ago. For example in 1991, only 11 towns had the services of the National Water and Sewerage Corporation. Now, the Corporation covers 19 towns. By 2004, rural access to safe drinking water had increased to 57% while the urban one was at 65%. If current trends continue, and incremental investment funds are procured, Uganda should meet its Millennium Development Goal on water supply. ▪ While safe water access *per se* has improved, functionality of water points is another key issue. Also, the cost of water in urban areas and the distance traveled to and queuing at water points in rural areas can easily undermine accessibility. ▪ As far as sanitation is concerned, latrine coverage, the broad indicator (as a measure) of environmental health has improved from 41.7% in 1999 to 56% in 2002.	▪ Access to safe water supplies in rural areas has increased steadily from 57 per cent in 2004/2005 to 61 per cent in 2005/2006. Latrine coverage has increased from 51 per cent in 2003/2004 to 58 per cent in 2005/6. This level of latrine coverage is still very low. The lowest coverage was found in the Karamoja region from 2 per cent to 10 per cent. In the districts were the funding for sanitation programmes and enforcement of bi-laws were weak latrine coverage declined for example Busia and Kibale district declined by 2 per cent and 5 per cent respectively. Seventy-five per cent of Uganda's disease burden is preventable since it is caused primarily by poor hygiene and inadequate sanitation.

Annex 7: Comparison of main features of SOE for 2004/05 and 2006/07 (cont'd)

2004/05	2006/07
Pollution and solid waste	
▪ As Uganda's urban areas increase in number and the urban population grows, pollution, whether air, noise, water or solid waste, is emerging as a significant issue in environmental management. Standards have been established for noise and air pollution and effluent discharge, enforcement of the standards notwithstanding. However, while guidelines have been developed for solid waste management, a stronger law is required and the pre-requisite is a national policy on solid waste management. ▪ The Uganda Cleaner Production Centre is assisting several companies to reduce on waste generation, by conserving raw materials, substituting toxic and dangerous materials, and recovering, recycling and re-using by-products, among others.	▪ In Uganda, the responsibility for solid waste management (SWM) lies with local governments as specified in the Public Health Act 1964 and the Local Government Act 1997 (KCC 2000). The solid wastes generated in the urban areas of Uganda, typically consist of 73% organic matter, 5.4% paper, 1.7% saw dust, 1.6% plastics, 3.1% metals, 0.9% glass, 8.0% tree cuttings and 5.5% street debris and others constitute 0.8%. Unfortunately, there are no data on the composition of solid waste generated by households in rural areas. However, it probably consists of more organic matter than that of urban areas (Walyawula 2004). ▪ The composition of this waste is a function of income levels, education and other activities. It is estimated that vegetable matter will reduce from 73.0% down to 30% over the next twenty years while amount of paper, as a percentage of the total is expected to increase from 5.4% in 2000 to 30.9% in the year 2020. Substantial increases are also projected for metals, plastics and glass.
Poverty	
▪ Headcount poverty has declined from 56% of the national population in 1992 to 38% by 2004. On the other hand, the gap between the rich and the poor is widening. For the poor, natural resources constitute important 'gifts of nature' and social safety nets on which their livelihoods depend all the time or at certain critical periods such as droughts. ▪ The poor are agents of environmental degradation because they have limited livelihood alternatives. They are also at the same time victims of environmental degradation because their coping abilities are limited.	▪ Headcount poverty decreased from 56 per cent of the total population in 1992 to 35 per cent by 2000 and 38 per cent by 2002/03. However, according to the recent 2005/06 National Household Survey (NHS), nationwide, headcount poverty levels have further dropped from 38 per cent to 31.1 per cent (UBOS 2006).
Environmental health	
▪ Over 80% of all diseases in Uganda can be ascribed to poor environmental conditions. Malaria is the number one killer disease because mosquitoes have fertile breeding grounds. Waterborne diseases are a result of poor sanitation. Respiratory diseases are encouraged by poorly ventilated houses and dusty environments as well as congestion in such dwellings.	▪ National adult HIV prevalence was 6.7 percent in 2005 significantly higher among women nearly at 8 percent than among men at 5 percent. While HIV /Aids epidemic cases declined allover the country prevalence rules in some rural areas, from as low as 5.6 percent in men and 6.9 percent in women to 6.5 percent in men and 8.8 percent in women in 2004.

Annex 7: Comparison of main features of SOE for 2004/05 and 2006/07 (cont'd)

2004/05	2006/07
Cultural heritage	
▪ Cultural heritage is part of humanity's relationship with the world and past achievements and discoveries. The National Environment Act provides for the protection of the country's cultural heritage. Approximately 187 cultural, historical and para-archeological sites have been identified and their specific locations recorded. ▪ Unfortunately, Uganda's cultural heritage has not featured prominently among the country's tourist attractions. Yet, the promotion of cultural heritage as a tourist attraction could enhance community participation and even bring districts on board with respect to tourism. Some 15 tourist attractions in 10 districts have been highlighted in this report.	▪ So far about 357 sites and monuments have been identified and documented as part of Uganda's cultural heritage. The areas included in the world heritage list are the Kasubi tombs, Bwindi national park and Rwenzori Mountain and national park. However, Uganda has several other cultural heritage sites found in all regions of the country some of which have been documented.
POLICY RESPONSES	
▪ Increase levels of enforcement, especially at the local government levels.	▪ Encourage technologies that improve farm productivity. These include provision of appropriate training to farmers on how to improve soil fertility management even before soil additives (□ertilizers) are suggested.
▪ Formulate a national solid waste management policy to facilitate the development of appropriate laws to govern the management of solid waste.	▪ Many of the soil and water conservation practices such as strip cropping and the use of terraces have disappeared as the different regimes of extension services have changed. For areas where vulnerability to soil erosion is strong there may be need to restore some of the old institutional arrangements including setting by-laws to reduce the rate of soil degradation.
▪ Create awareness among policymakers that environmental management can complement national economic development in fulfillment of the objectives of sustainable development.	▪ In eastern Uganda's Mount Elgon region the population density and growth rate are so high that the area will run out of available land for agriculture by 2010 and the rest of the country in the medium term. The Government has a number of options among these are training rural communities on family planning practices, however, an appropriate family size can also be suggested after carrying out sufficient studies on the subject.
▪ Prepare a manual to guide local governments on how to mainstream environment into district development plans so that the practice becomes routine.	▪ An urgent need to increase the number of non-farm jobs available to rural communities. The government has embarked on several initiatives to encourage private sector investment yet the rate of job creation seems to be fundamentally lower. Governemnt could consider supporting commercial agriculture that is labour intensive as an alternative.

Annex 7: Comparison of main features of SOE for 2004/05 and 2006/07 (cont'd)

2004/05	2006/07
POLICY RESPONSES	
▪ Create appropriate incentives and disincentives to encourage the more active participation of local communities and the private sector in environmental management, and discourage wrong doers.	▪ Much of north-eastern Uganda and several parts of Uganda have been under floods causing a fundamental destruction of people's livelihoods. In future there should be a rapid and usually Early Warning Systems or mechanisms in place to prevent possible human fatality but also the high level of economic loss as is clearly evident in the affected areas.
▪ Encourage the Plan for Modernisation of Agriculture and the National Agricultural Advisory Delivery Services secretariats to increase interventions addressing soil erosion as a matter of priority since it is the main cause of soil nutrient loss and the largest share of the annual cost of environmental degradation which has led to negative adjusted net savings.	▪ An underlying feature of the threats noted in this State of Environment Report is that they could also be addressed if the country had a land use policy in place. However, the added time available means that some of the concerns above can be addressed in the current land policy draft, which should be handled expediently. Indeed, District level Land use Policies are on hold as they await the national land use policy.
▪ Complete the formulation and the subsequent adoption of the Land Policy and the Landuse Policy so as to facilitate the preparation of land use plans.	▪ For several years now international researchers on climate change have been warning that the African continent is most vulnerable to climate change. The floods in north-eastern Uganda are evidence of the level of vulnerability. The country ought to quickly adopt the regime of climate change and desertification adaptation techniques and develop a medium term and long term plan for Uganda.
▪ Seek international assistance in the compilation of more current inventory data (forests, wildlife, fisheries, land use changes, rangeland conditions, etc.) to allow for more informed decisionmaking in environmental and natural resources management.	▪ A need to consider an additional set of tools outside the formal regulations and management structure and advocating for greater participation of other stakeholders. Some of these are being addressed in the Kyoto Protocol's Clean Development Mechanism, and similar mechanisms under the United Nations Convention on Combating Desertification (UNCCD) and the Convention on Biological Diveristy (CBD). Still, a large set of tools some of which are market based payments (or compensation) for ecosystems services and insurance arrangements exist and could be adapted to the Ugandan context.

Annex 7: Comparison of main features of SOE for 2004/05 and 2006/07 (cont'd)

2004/05	2006/07
POLICY RESPONSES	
▪ Encourage different sectors to prepare annual reports as this will provide a rich source of information which can be used to prepare other reports including the state of environment reports.	Build consensus of stakeholders on the use of natural resources and environment management on one hand and the need for economic development on the other. Some decisions taken by one group over the other might have large economic, environmental or social impacts that they could be irreversible. The current forum seems to lack participation of key actors and decision makers, at least from the perception of the public, based on the recent demonstrations for the preservation of the integrity of Mabira Central Forest Reserve. There is a need to build a stronger consensus on the governance of key ecosystems in the country.
▪ Revise both the National Environment Management Policy and the National Environment Action Plan to accommodate emerging issues such as greater levels of investment in aquaculture, solid waste management and payment for environmental services.	▪ Efforts to develop aquaculture alternatives to capture fisheries require a new effort in addition to research on commercial aquaculture production of the most important commercial fishes such as Tilapia and Nile Perch, and ornamental fishes.
▪ Encourage Government ministries and agencies, civil society organisations and the private sector to identify innovative financing mechanisms for environmental management including creating markets for Uganda's ecosystem services.	▪ Increased efforts will be needed in the short-term and medium term to strengthen regulations and enforcement of water quality monitoring and effluent management by firms located close to water systems. The country should also develop a long-term strategy on water harvesting, increasing urban water demand an water for agricultural and industrial production.
	▪ Information on biodiversity and threats to biodiversity is not widely spread or understood by stakeholders engaged in activities that are likely to lead to biodiversity loss. Current information dissemination strategies should target the potential violators more strongly.
	▪ The country should move hastily towards increasing the energy options available and making the energy options available for the major consumers households and industrial users. In the medium and long-term the country should move away from heavy fuels as sources of energy as they increase the country's carbon foot print.
	▪ Need for increased research on the environmental linkages and what options, outside the current set of practices, can be implemented cost-effectively.