STATE OF THE ENVIRONMENT REPORT FOR UGANDA 1996

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY
(NEMA)

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ACKNOWLEDGEMENTS

The State of Environment Report, 1996 was prepared by the National Environment Management Authority (NEMA) in accordance with the Provisions of Sub-Section (2) of Section 87 of the National Environment Statute, No 4 of 1995, and the Environment Management Policy, 1994 It is the second edition following the first prepared in 1994 The 1996 report is organised along the issue-pressure-state-response framework as opposed to the sectoral approach adopted in the 1994 report The exercise is also a follow up of recommendations contained in Chapter 40 of Agenda 21

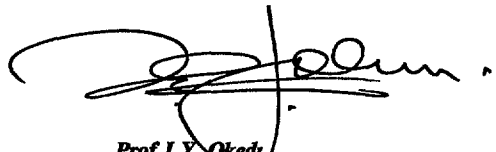
I wish to extend special thanks to the Steering and Technical Review Committees for their Policy and Technical guidance during the report preparation exercise, the Consultants and Research Assistants who worked tirelessly to put the report together and members of the Editorial Committee whose dedication helped to shape the document into its present form Special mention must be made of Dan Tunstall of World Resourses Institute for his valuable support to the Editorial Team

Let me also take this opportunity to thank the World Bank for the Financial Assistance extended to the National Environment Management Authority through the Environment Management Capacity Building Project (EMCBP) which has made it possible to prepare this report

Lastly I wish to acknowledge with appreciation the valuable information provided by experts from Government Departments, Research and Academic Institutions as well as the Private Sector which assisted immensely in the preparation of this report

In looking to future reports, NEMA welcomes comments and suggestions on this report, whether they relate to substance or style This will help us improve on our next edition in 1998

I wish you good reading



Prof J Y Okedi
EXECUTIVE DIRECTOR

FOREWORD

Since the publication of the 1994 State of the Environment Report for Uganda, the country has experienced major development in the areas of policy, law, institutions and the economy

Foremost, the country has promulgated a Constitution which enshrines democratic principles and requires that the natural resources of the country be managed in such a way as to meet the developmental and environmental needs of the present and future generations of Uganda

Second, there has been fast expansion and growth of the economy in the past two years This positive trend needs to be sustained to alleviate poverty and hunger and to pave way for increased productivity of the wider community and ensure sustainable living

Third, decentralisation of environmental management to district and community levels has been undertaken to attain broad public participation in decision-making which is fundamental for sustainable socio-economic development

Arising from past and present human activities, however, is a wider spectrum of environmental problems which are undermining national efforts to enable the people of Uganda to attain a sustainable livelihood These pertinent environmental problems include among others loss of agricultural productivity arising out of land degradation, water, land and air pollution from industrial emissions, effluents and domestic waste, and, acute shortage of energy due to factors such as deforestation and limited as well as alternative unaffordable sources of energy

Inherent in all the above recent developments and environmental problems faced by the country is the need to undertake planned actions based on informed decisions This brings into sharp focus the need for quality, coherent and updated environmental information This information is critical for integration of issues into policy-making in all aspects of socio-economic development It is also crucial in increasing the public's sensitivity to environment and development problems and involvement in their solutions

I am, therefore, happy to present to the country this publication, the State of the Environment Report for Uganda 1996 The Report contains updated information on the current and foreseeable future socio-economic conditions and state of environmental resources for Uganda This Report, therefore, does not only enable us to address issues facing Uganda today, but also prepares us for the challenges of the years to come

It is my conviction that the Report provides a basis for action to achieve sustainable socio-economic development, protection of the environment and alleviation of poverty and human suffering, which are priority goals of Government

Hon Gerald M Ssendaula
Minister of Natural Resources

EXECUTIVE SUMMARY

1 INTRODUCTION

STATE OF REPORTING IN UGANDA

Uganda participated in the United Nations Conference on Environment and Development in Rio de Janeiro, in 1992, and supported the provisions of Agenda 21 and other Declarations and Statements of Principle Part of Agenda 21 calls for the periodic preparation of national state of environment reports At the national level, Chapter 17, Article 278(1) of the Constitution of Uganda, states that " *Parliament shall, by law provide for measures intended to protect and preserve the environment from abuse and degradation and to manage the environment for sustainable development"* In more specific terms, the National Environment Statute, 1995, Section 7(1) states that one of the functions of the National Environment Management Authority is to " *prepare and disseminate a (national) State of the Environment Report once in every two years"* In addition, the National Environment Statute, 1995, Section 15(2), also requires every district to prepare a District State of Environment Report every year

The National State of Environment Report, 1996, is the second one and differs from the previous one (1994) in terms of organization and content It is organized along the **issue-pressure-state-response** framework, as opposed to the sector-approach used in the 1994 report The content of this report also includes detailed sections on climate change and the water hyacinth

This Report is structured as follows

- **Chapter One** Outlines Uganda's placement in terms of location/size and natural resources endowment

- **Chapter Two** Focuses on the relationship between Environment and Development (socio-economic aspects)

- **Chapter Three, Four, Five and Eight** Deal with matters concerning Land Resources, Terrestrial Ecosystems, and Biodiversity

- **Chapter Six** Illustrates the impact of human activities (anthropological factors) on the natural resources-base, and the linkage between the Human environment and Social Development

- **Chapter Seven** Focuses on Industrial Development and its relationship with exploitation of the natural and impact on the environment

- **Chapter Nine** Discusses Legal, Policy and Institutional Framework for environmental management in Uganda

LOCATION AND NATURAL RESOURCES

Uganda is located in the eastern region of Africa and lies between latitude 1°30 South and 4°North and Longitude 29° 30 East and 35°East, and occupies an area of about 241,500 sq km of which 15 3% is open water, 3 0% permanent wetlands, and 9 4% seasonal wetlands Uganda's perimeter is about 16,630 km long It is bordered by the Republic of Kenya in the east, Tanzania and Rwanda in the south, Demographic Republic of Congo (former Zaire) in the west and Sudan in the north

Most of Uganda forms part of the interior plateau of the Africa continent It is characterised by flat-topped hills in the central, western and eastern parts of the country The rise of the plateau in the eastern and western parts of the country is represented by spectacular mountainous topography found along the borders, for example, the Rwenzori mountains and Mufumbira volcanoes in the west and Mt Elgon and Mt Kadam in the east

Most of the rivers in the southern part of the country drain into Lake Victoria The waters of Lake Victoria then drain through the Owen Falls Dam, along Victoria Nile through Lake Kyoga to Lake Albert, the Albert Nile and White Nile in Sudan, down to the Mediterranean Sea through Egypt The drainage pattern represents past geological adjustments, which include the reversal of the direction of flow of some of the rivers which originally flowed westwards of Lake Victoria Areas of impeded flow are due to influence of warping and are associated with the wetland areas The lakes in Uganda covers almost one-fifth of the total area of the country Lake Victoria is the most dominant and having spectacular scenic contrasts, and is the second largest freshwater lake in the world Other lakes of interest are the crater lakes in the western part of the country, associated with the Western Rift Valley

The geological formations of Uganda reveal rocks formed between 3000 and 6000 million years ago (pre-Cambrian era), hence, they are very old The younger rocks are either sediments or of volcanic origin, formed from about 135 million years ago (Cretaceous period) to the present Hence, there is a gap in the geological history of Uganda of about 460 million years The soils of Uganda are defined by a number of parameters which 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 were 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) nil productivity

The climate of Uganda is influenced by the Inter-Tropical Convergence Zone (ITCZ) and air currents such as the southeast and northeast monsoons In most parts of the country, the seasons are fairly well marked as rainy and dry seasons The mean temperatures over the whole country show great variation, depending on elevation and landscape For areas adjacent to water bodies such as Lake Victoria, maritime conditions tend to modify the temperatures The variation in mean monthly and annual evaporation rates is much smaller than corresponding variations in rainfall (10-20% in the southern and 20-40% in the northern parts of Uganda) The movement of the ITCZ is to a great extent responsible for the variations in meteorological factors that determine evaporation

Uganda has five climatic zones, using rainfall received in a given area as the dependent variable They are a) Zone I, the Lake Victoria zone, b) Zone II, the Karamoja region, c) Zone III, Western Uganda, d) Zone IV, the Acholi-Kyoga region, and, e) Zone V, Ankole-Southern zone

The vegetation classification and descriptions used in Uganda are still based on concepts/studies of Langdale-Brown and Osmanson (1967) There are 11 main categories of vegetation types, namely High Montane Moorland and Heath, Medium Altitude Forests, Forest/Savanna Mosaic, Moist Thicket, Woodland, Wooded Savanna, Grass Savanna, Steppe, Bushland and Dry Thicket, Swamp (Wetlands), and Cultivation Communities

ENVIRONMENT AND DEVELOPMENT

Sustainable Development for Uganda

Uganda is primarily an agrarian country, with agriculture contributing over 50% of the Gross Domestic Product (GDP) Agricultural activities are mainly supported by peasant (subsistence) farmers The current Government effort is towards modernizing agriculture, which entails transforming the Ugandan society from being agrarian to industrial Apart from this major challenge, the transition period is certain to register both agricultural and industrial environmental problems This chapter outlines the broad linkage between environment and socio-economic development, and is traced in key macro-economic trends and indicators In contrast, the rest of the chapters provide specific sectorial or resource contributions to development, and how the environment is impacted by development The National Environment Action Plan (NEAP) for Uganda has set its vision is that of attaining sustainable socio-economic development, which enhances environmental quality and resource productivity on a long-term basis - meeting the needs of the present generation without compromising the ability of the future generation to meet their needs

The basic requirements for sustainable development brings into focus the significance of economic policies, international cooperation, trade relations, funding, and investment in human capital It equally puts tremendous emphasis on effective environmental management, public participation, and decision-making process which integrates environmental considerations The ultimate aim is to maintain complementarity between development and the environment

The history of Uganda's economy illustrates that the level of environmental and human quality today is a reflection of past events and activities which date more than three decades ago Features of this period included the following a) collapse of fiscal responsibility, b) decline of administrative systems and efficiency in both government and parastatals, c) expulsion of Asians and flight from the country of many entrepreneurs, managers, administrators and professionals, and, d) haphazard reform of the parastatal sector

Furthermore, external shocks such as the rise in price of petroleum products (1973) had an adverse impact on the balance of payments, and increased production costs throughout the economy The slump in coffee prices aggravated the problems further because of heavy dependence on coffee, the predominant foreign exchange earner The break-up of the East African Community further isolated the country and had a negative bearing on trade relations and access to infrastructural services such as

the railways and posts and telecommunications It is only of recent that the East African countries have come together to rekindle the spirit of cooperation with the 1996 Agreement

The impact of both internal and external shocks are reflected in the key economic and social indicators such as the gross domestic product (GDP) and its growth rates, savings and investment rates, and value of exports and imports It is worth noting that GDP at (1966 prices) basically stagnated from 1970 to 1978, implying falling per capita incomes (especially in the industrial and agricultural sectors) Savings rate fell sharply by 8% from 1971-1978, and investment was cut down High inflation rate eroded producer incentives, with a steady deterioration in marketing infrastructure Tourism which ranked third after coffee and cotton as a foreign exchange earner, virtually ceased The breakdown in law and order meant that laws and regulations pertaining to environmental management could not be effectively enforced

Uganda's GDP is essentially natural resource-based That is, the whole of agricultural sector (cash and food crops, livestock, fisheries, and forestry) is based on using or harvesting the natural resources About 50% of the construction and 30% of the manufacturing sectors are directly dependent on natural resources, for instance, in 1995, the nature-based GDP was about 56% Another aspect of the trend of economic development in Uganda is that, since independence there have occurred structural shifts in the contribution of agriculture, industry and services to the GDP, in that, from 1965-1970, agriculture's contribution to GDP fell from 65% to 44%, as industry and services picked up This was considered a normal shift for a country that is developing The reverse, however, occurred between 1970 and 1980, where agriculture's contribution was as high as 80% in 1980, while industry and services declined

Uganda's gross national product (GNP) per capita in 1966 was US$ 160, and was higher than that of Kenya (US$ 120), Tanzania (US$ 90), and Thailand (US$ 150) The country's average growth between 1966 and 1990, however, was the lowest in sub-Saharan Africa (SSA), basically due to political turmoil during this period Furthermore, high inflation rate undermined the economy In 1996, GNP per capita was estimated at only US$ 220 Thus, controlling inflation rate has been a key pre-occupation of Government since 1986 Positive results have already been registered, for instance, inflationary rate has been reduced from as high as 200% in 1987 to about 5% in 1996, while GNP per capita was estimated at US$ 220

Domestic savings have generally remained low over the years, thus forcing the Uganda government to rely on external assistance to finance domestic investment In 1986, gross domestic savings stood at 5 5% of GDP, but have since then fallen to between -1 2% and 1 1% Increasing savings is extremely important for the growth process From 1986, investment recovered rapidly through 1989/90, driven by the rehabilitation of infrastructure and productive capacity Correspondingly, Uganda still has a heavy debt burden, and generally external assistance to the country has been on a downward trend, since reaching a peak (at US$ 652 million) in 1990 The proportion of grants to total external assistance fell from 55 3% in 1993 to 35 1% in 1994

The long-term solution will lie in increasing production by increasing savings and investment Debt relief, cancellation and debt-for-nature swaps are growing in popularity as incentives to developing countries on environmental grounds The Heavily Indebted Poor Countries Initiative was launched in Uganda in 1996 under the joint IMF/World Bank Reform Programme This initiative is meant to provide relief to countries with a three year track record of good economic performance Uganda is set to benefit from this initiative in 1998

Economic Reforms

Since 1987, government has been pursuing an economic reform programme intended to achieve sustainable economic growth and to stabilise the economy The principle aims of the reform programme are a) to restore producer incentives through proper pricing policies, b) to improve capacity utilisation of industry, c) to mobilise and allocate public sector resources effectively, and, d) to bring about financial stability by lowering the rate of inflation, reducing imbalances in external accounts, promoting economic growth and instilling financial discipline Thus, government has set itself to creating "*an independent, integrated and self-sustaining economy*"

Since 1987, macro-economic stability has not only greatly improved, but has led to increased investment rates, faster economic growth, and a shift from printing of money to fiscal savings Revenue collection has also improved and dependence on coffee as a major foreign exchange earner has fallen Other positive aspects of macro-economic stability include increased financing of natural resources management by government, decline in speculative investment in short-term enterprises, and longer-term perspective of investment that the public is taking

In its quest to eradicate poverty, the country has set itself the following goals a) improvement of the economic infrastructure, b) increasing investment in the various sectors, c) maintenance of macro-economic stability, d) human resource development, e) security and good governance

LAND RESOURCES AND TERRESTRIAL ECOSYSTEMS

Land Resources

Land may be defined as a complex system comprising its topography, spatial dimensions, its soils, minerals, water and *biota* (including plants, animals and micro-organisms in all their diversity) Uganda's land area is about 236,000 sq km, comprising cultivated areas, arable but uncultivated land, rangelands, mountains, and built-up areas The country's land and processes which take place on it are an important component of the global biogeochemical cycle

The key issues regarding land resources include fragility of ecosystems, tenure arrangements, and, land-use planning

There are two types of fragile ecosystems, namely, the highlands in the southwestern, eastern, western and northeastern parts of the country, and the rangelands (*Cattle-corridor*) The highlands are unique ecosystems, well endowed with productive soils and favourable climate, hence, they are densely populated and intensively used Livestock production is the dominant activity in the drylands, and is associated with emergence of desert-like conditions as a result of improper land-use practices Thus, the fragility of these ecosystems emphasizes the issue of their sustainability The land tenure systems recognized in Uganda are customary, *mailo* freehold, and leasehold, each of which has varied impacts on the environment The present land-use pattern in Uganda is quite haphazard and tends to disregard actual potentials, carrying capacities and other limitations of land resources This implies that there is real danger that the country's environment will suffer irreversible damage and where rehabilitation is possible, the costs are likely to be prohibitive

Agricultural Resources (Crops)

As stated above, Uganda's economy is predominantly agrarian and supports over 90% of the country's population which is rural based The crop sector alone contributes 67-75% of the agricultural output while the export crops account for over 70% of total earnings Agricultural exports are in two categories, namely, the traditional cash crops (coffee, tea, tobacco, cotton, sugar (raw), and cocoa) and the non-traditional export crops (maize and beans, spices and essential oils cut flowers, and vegetables) Earnings from these crops are greatly affected by world prices Overall agricultural sector policy objectives are to increase agricultural productivity, improve food security, enhance self-sufficiency in raw materials for the agro-processing industry, diversify exports through promotion of non-traditional exports, and, reduction of poverty and increase in incomes

Uganda is considered to have a significant competitive advantage for supplying the east and central African market with maize and beans It has, however, been noted that increased production of maize and beans, spices and oils, vanilla and pyrethrum will require increased use of agro-chemicals (fertilizers, herbicides and pesticides) which are known to have adverse effects on the environment The spices and essential oil crops include chillies, vanilla and pyrethrum The introduction of spices and essential crops serves to increase diversity within the agro-ecological systems in Uganda, and is therefore, likely to have a positive impact on biodiversity The main concern pertaining to vegetable growing is that there is a likelihood of increase in demand for more farmland which will lead to increased clearing of forested and other virgin lands, hence, aggravating soil degradation problems

The major issues pertaining to the crop sub-sector include i) soil degradation, ii) inadequate land tenure arrangements and their impact on agricultural productivity iii) impact of farming systems on the environment, iv) food insecurity, and, v) inadequate agricultural (crop) production technology in terms of access to improved technology and affordability

Rangelands and Livestock Resources

Rangelands occupy about 43% of the total area of the country These form what is known as the "cattle-corridor" stretching diagonally from northeast to the southwestern parts of the country It has been difficult to draw up a comprehensive strategy to improve the condition of these rangelands, since the overall condition of the pastures has not yet been accurately established It is believed that periodic assessment of the condition of rangelands should provide some indication of potential and sustainability of these resources

The livestock sub-sector contributes about 9% of total GDP, and at least 90% of the livestock is in the hands of traditional herders and the remainder under commercial enterprises There has been considerable growth in this sub-sector and the growth rate is expected to maintain an upward trend to the year 2005 Uganda has great potential for a profitable livestock industry There are plans for livestock development based on ecologically sound management practices Five zones based on climate, productivity of the land and human population have been identified in the country and each will require specific prescriptions under this plan It is envisaged that greater potential lies in the areas that are largely under-utilized

Issues regarding livestock sub-sector are a) shrinking grazing land, b) inadequate water supply and water resources, c) lack of effort to determine the viability of wildlife ranching, and, d) insufficient market facilities

Forest Resources

Uganda's forest can be classified into two broad categories, namely, tropical high forest (THF) and plantations Records indicate that around 1890 forest and woodlands covered about 10,800,000 ha (45%) of Uganda's land area Since then, the area has shrunk to 20 3% according to the 1996 estimates This reduction in area under forest has been attributed to a number of factors which include population pressure, and breakdown in law and order during the periods of civil unrest

Essentially, forests in Uganda occur as gazetted areas (forest reserves), protected areas (national parks), and on private and ungazetted public land Although agro-forestry is not a new practice in Uganda, it has of recent attracted growing attention as a way to address problems associated with high population pressures and shortage of land in some parts of Uganda Plantations cover only 2 2% of the area under gazetted forests Apart from providing wood products, forests also provide services/functions, and an opportunity for developing eco-tourism

Issues pertaining to the forestry sub-sector are i) deforestation, ii) pest and disease control, and, iii) harvesting and processing practices Over the years, soft-wood plantations have been invaded by pests and diseases, which have proved difficult to control due to the associated high costs Harvesting practices such as pit-sawing, are considered a wasteful forms of technology for wood utilisation

Wildlife resources

Uganda is rich in wildlife resources, which occur in both protected and private or public ungazetted public land There are four types of wildlife protected areas, namely, national parks, wildlife reserves, wildlife sanctuaries, and community wildlife areas The national parks cover 4 6% of the total area of the country Wildlife reserves cover 3 6%, wildlife sanctuaries 0 35%, and community wildlife areas 11 4% The main economic benefit derived from the wildlife estate is tourism earnings In addition, conservation of Uganda's wildlife also generates benefits of global significance

The issues pertaining to wildlife sustainability are i) population pressure, ii) encroachment and poaching, iii) expanding settlements and fishing villages, iv) inadequate financial resources, and, v) tourist behaviour Most of the national parks are adjacent to high-density settlements which exert considerable pressure on the park resources Poaching activities have rendered some animal species extinct The integrity of these protected areas depends heavily on financial support from government and external sources

WATER RESOURCES AND AQUATIC ECOSYSTEMS

Water resources

The water resources of Uganda comprise open water bodies groundwater, and rain-harvest On a regional basis, 39 1% of the water bodies are found in the central, 30 3% in the eastern, 3% in the northern, and 8% in the western regions The whole of Uganda lies within the Upper Nile catchment

which consists of numerous rivers and streams flowing into principle lakes such as Victoria, Kyoga, Edward and Albert, and eventually into the River Nile Rainfall is the principle contributor of water to the surface water bodies There is great potential for harvesting rain-water Groundwater is found in aquifers which are water-bearing formations from which it can be drawn in significant amounts through the use of dug-wells and bore-holes There are also numerous protected and non-protected springs The coverage of water services in nine major towns is about 60-75%, while for the rest of the smaller towns, coverage is below 50%

Government's overall policy is to manage and develop the water resources in a sustainable manner to ensure adequate quantity and quality There is, however, a paucity of data on the quality of the country's surface and groundwater The water policy is influenced by the current economic liberalisation/privatisation and decentralisation reforms The water sector's goal and strategy include systems sustainability enhanced by community participation, capacity-building and a demand-driven approach The Water Action Plan, 1995, and the Water Statute, 1995, are the cornerstones of water resources management

The major areas of concern pertaining to water resources management are i) poor watershed management ii) inadequate water accessibility and quantity, iii) poor water quality iv) inadequate institutional capacity, and, v) international water rights

Water hyacinth (Eichhornia crassipes)

The water hyacinth is an outstanding example of problems caused by the uncontrolled introduction of alien species in Uganda It is a very important weed in Uganda's lakes and rivers Under favourable conditions (a high level of nutrients and warm temperatures) this water weed multiplies very rapidly It has now seriously affected all the major water bodies of Uganda, large mats have clogged important landing sites, numerous water sources, transport routes and fishing grounds, caused financial loss to fishing communities, water transport operators and hydro-power generating concerns It has also aggravated the problem of eutrophication in these water bodies

Controversy surrounds the most suitable way to eradicate the water hyacinth Three methods are available biological, mechanical and chemical control Each has impacts on the environment Environmental impact assessments are currently being undertaken by Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) to evaluate the suitability of the various methods

Fisheries resources

Uganda has substantial fisheries resources due to its many freshwater lakes and rivers In 1995, the fisheries sub-sector contributed about 2% of the total GDP Lake Victoria alone contributes about 25% of the total annual catch Fish and fish products contribute over 60% of the country's total protein supply and are accessible to a large segment of the population During 1994 and 1995, however, the catch stagnated around 103,000 metric tonnes due to the impact of the water hyacinth Uganda is endowed with over 200 freshwater fish species The challenge is to sustain this genetic heritage which produces valuable food for the country and export Far-reaching changes have taken place in the ecology of Lakes Wamala and Victoria, where the number of some endemic fish species fell due to the introduction of alien species such as the Nile perch Over-fishing is another threat to the sustainability of fisheries

The issues pertaining to the fisheries sub-sector are i) sustainability of the fisheries resources, ii) impact of introduction of alien species, iii) high post-harvest losses, iv) pollution of the fisheries, v) impact of the activities of the fisherfolk communities on fisheries resources, and, vi) inadequate institutional and administrative structures

Wetlands resources

Uganda's wetlands can be categorised as papyrus swamps, swamp forests, riverine wetlands, lake edges, flood plains, dambos and artificial wetlands Wetlands possess distinct trees, shrubs and grasses, and their soils are quite unique They are found throughout Uganda, but varied and often conflicting definitions have led to inconsistent data/information on their size The most recent comprehensive data from the National Biomass Study, reveal that wetlands occupy an area of about 30,100 sq km

There are basically two broad distributions of wetland ecosystems a) the natural lake and lacustrine swamp/wetlands, and, b) riverine and flood plain swamp/wetlands The wetlands of Uganda serve four major physical functions i) regulation and conservation of water, ii) sediment and nutrient trapping, iii) climate modification, and, iv) provision of habitat for flora and fauna They also provide products and services, including plant products, grazing, water supply, and nutrient and toxic chemicals retention Since 1994, there have been significant policy developments in wetlands management The most significant are those included in the National Environment Statute, and the National Wetlands Policy The issues concerning Uganda's wetlands are i) draining of wetlands, ii) over-harvesting of wetlands products, and iii) increasing levels of pollutants in some wetland ecosystems

BIODIVERSITY

Biodiversity gained prominence at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992, and with the coming into force of the Convention on Biological Diversity (CBD) Biodiversity refers to a range of variations or differences in living organisms and their environments, distinguished by three levels of biological hierarchy genes, species and ecosystems Biodiversity is concerned with the conservation of natural ecosystems and their components in the face of human activities/influence Recently the main concern has been the role of biodiversity in maintaining the functioning and resilience of ecosystems and the implications of ecological disruption

Straddling the equator with a wide range of altitudes and climatic conditions, Uganda is endowed with rich biological diversity There are seven major biogeographic regions (or phytochoria) in Uganda, each with distinct flora and possibly a similar distribution of fauna Each phytochorion has at least more than 50% of its species confined to it, and this is the basis of Uganda's endemism Uganda, with only 2% of the world's total area, is estimated to have altogether half a million species, with flowering plants numbering over 4500 In addition, Uganda has over 11% and 7% of the known world total of bird and mammal species, respectively The biological diversity of Uganda contributes well over 50% of the GDP

The major biodiversity issues in Uganda are i) loss of biodiversity resulting from habitat conversion, ii) introduction of alien species, iii) pollution, iv) over-harvesting and trade in live plants and animals and derived parts, and, v) climate change Habitat conversion is associated with population pressure and expansion of farmland and settlements Alien species causing concern include the Water hyacinth, Nile perch, exotic livestock and non-indigenous crop varieties Pollutants have caused problems, in-

cluding eutrophication of water bodies Trade in various species has led to extinction and near extinction of some species Climatic change is evidenced by the increasing frequency of droughts and floods in Uganda which alter the ecosystems

POPULATION AND SOCIAL DEVELOPMENT

Development is a multi-dimensional concept that encompasses not only the economic and social aspects of national activity, but also those related to population and the use and management of environmental resources The relationship is very complex because population, environment and development interact in different ways The challenge is to ensure that the environment's life-supporting capacities are not jeopardised In 1995, government endorsed a national population policy whose goal is "*to influence the future demographic trends and patterns in desirable directions in order to improve the quality of life and standards of living of the people*"

The 1996 mid-year population is estimated at 19 8 million compared to 16 7 million and 12 6 million in 1991 and 1980, respectively The annual growth rate during 1980-1991 was 2 5% and is considered high About 89% of Uganda's population is rural, deriving its livelihood directly from the natural resource base Only 11% of the population is urban, with Kampala City alone accounting for 41% of the total urban population Average density is 85 persons/sq km, but higher densities have been recorded in Kisoro, Mbale and Kabale districts The lowest densities are in Moroto Kitgum and Kotido districts The fertility rate for Uganda, at about 7 children per woman, is considered high by sub-Saharan African standards The use of family planning is still very low One consequence of the high fertility rate and youthful age structure is the building-up of "population momentum" This therefore implies that Uganda's population will increase rapidly in subsequent years, exerting pressure on the natural resources and aggravating further the prevailing problems of environmental degradation

Life expectancy in Uganda is among the shortest in Africa With the current HIV/AIDS prevalence, life expectancy is projected to drop to 40 7 years by the year 2000 (World Bank, 1993) The national average literacy rate stands at just 54% (45% and 64% for females and males, respectively) Social services, such as education and health, and infrastructure, such as transport and communication systems, are still inadequate

The key issues in population and social development for Uganda are i) increasing population growth and population pressure, ii) inadequate provision of and increased demand for social services and infrastructure, and iii) poor environmental health

TRADE, TOURISM, INDUSTRY AND MINING

Agenda 21 recognises that the development process will not gather momentum if the global economy lacks dynamism and stability and is beset with uncertainties Nor will it gather momentum if countries like Uganda are weighed down by external indebtedness, if barriers restrict access to markets and if commodity prices and terms of trade remain depressed as they were in the 1980s To improve opportunities for its citizens, the country has pursued policies to stimulate regional and international trade The government's overall objective is to "*build an independent, integrated and self-sustaining national economy*" There is therefore a considerable interest in the linkage between trade and the environment that is, how changing trade regimes affect the environment and how stricter environment regulations affect trade

Some of these regulations are in treaties to which Uganda is signatory Despite the benefits of growth, trade is not necessarily environmentally benign and must be monitored Exports are important because they bring in foreign exchange, improving balance of payments and financing imports Until recently, traditional cash crops like coffee, cotton, tea and tobacco dominated exports The volume of coffee, which accounts for 96% of exports, has remained relatively constant over the years, more so than that of other crops The recovery of the traditional cash crops sub-sector must be seen in the context of changed farmers' preferences, export diversification and incentives to the agricultural sector Since 1986 government has encouraged export diversification by promoting non-traditional agricultural exports (NTAEs) This has been financially and economically rewarding, but the benefits from NTAEs must be offset by the environmental costs associated with them Regarding other exports, mostly minerals, steps are being taken to revitalise production Currently the biggest mineral contributor is gold However, it is hoped that cobalt exports will account for 5% of the world's total output once production starts at Kasese Notable market destinations for Uganda's exports include Common Market for Eastern and Southern Africa (COMESA), the European Union and the Middle East

Historically, petroleum products and chemicals have dominated Uganda's imports, accounting for at least 71% of the total These are followed by lime, cement and fabricated construction materials, accounting for 15%, 6% and 5%, respectively The demand for imports has escalated since government launched its reconstruction programme in 1987 (consumer goods 44%, capital goods 32%, and raw materials 24%) With trade liberalisation, the country has been able to import a wider range of products from a wider range of countries

Like other sectors, the industrial sector experienced great setbacks prior to 1986, due to neglect, poor management, and shortage of inputs Since 1986, the sector has shown significant improvement and an annual average growth rate of almost 12% This improvement has been attributed to enhanced utilisation of idle capacity due to liberalisation However, marked decline has been evident in the textile industry A number of industries are associated with pollution and degradation of the environment

Mining dates from as far back as 1907 and has contributed a great deal to the economy, with notable contributions from copper, phosphates and lime, and recently gold Nevertheless despite large deposits of different minerals, exploitation has been limited Mining suffered a dramatic 95 8% decline during the 1979-1985 period due to the political and economic chaos Since 1986, however, there has been a gradual recovery from a rate of -17 1% in 1987 to a record 165 6% in 1990 and again rising from -4 8% in 1994 to 25 2% in 1995 The slow growth registered in the early 1990s is partly attributed to persistent low metal prices on the world market and stiff competition from countries such as those of the former Soviet Union which flooded the world market with metal Prospects for future exploitation of minerals in Uganda are promising, and an increasing number of minerals will be exploited However, there is little linkage between the manufacturing sector and the mineral resource base This is attributed to low capacity utilisation in both mining and manufacturing

Traditionally tourism has been the third largest foreign exchange earner after coffee and cotton Since 1986, this industry has recovered swiftly, registering a 53% annual growth rate At this rate, the number of tourist arrivals is likely to increase to over 800,600 by the year 2000, up from the level of 193,000 in 1995 (projection for 1996 is slightly over a total of 288,380 tourists) Tourism contributes about 2% to the GDP Due to its improved image, Uganda presently ranks as the 20th most popular destination for tourists in Africa The potential for fast recovery in the tourism industry seems high with a strategy for quality tourism, supported by liberalisation of foreign exchange regimes and a deliberate marketing strategy Two factors that will benefit from tourism are environmental quality and protection of wildlife

and their habitats The Integrated Tourism Master Plan is one of the strategies set to enhance sustainable development of this industry It is a spatial strategy which defines tourism management zones

Overall, the areas of concern regarding trade and industry are i) diversification of the export base into the Non-traditional agricultural exports (NTAEs) in order to increase export earnings, ii) the need to improve terms of trade to enable exporters to compete on level terms in international markets, iii) the need to improve tourism image and national competitiveness since the country's image continues to be over-shadowed by the legacy of Idi Amin, iv) industrial pollution and waste management, and, v) low capacity utilisation

ENERGY AND CLIMATE CHANGE

Energy

The energy sector plays a critical role in the development of the economy The major sources of energy in Uganda are biomass, petroleum products and electricity, accounting for 96 5%, 1 5% and 2% of available energy sources, respectively A negligible percentage is represented by other renewable (non-conventional) sources of energy Total energy consumption in Uganda is estimated at about 5 million tonnes of oil equivalent (*toe*), of which about 90% is from biomass Based on a population estimate of 19 26 million in 1995 (MFEP, 1995), Uganda's *per capita* total energy consumption of 0 26 *toe* is one of the lowest in the world, and her consumption of electricity and petroleum is one of the lowest in sub-Saharan Africa (SSA) For instance despite the country's vast hydro-power potential, less than 10% of it is exploited The main challenges, therefore, are to develop hydro-electric potential, while simultaneously increasing the biomass resource base, and the efficiency of use of existing resources

The energy sector was neglected during the instability of the 1970s and 1980s This had a negative impact on commercial energy supplies, depressed efficiency in energy production and use, restricted the choice of energy sources, and resulted in a high import bill for petroleum products The institutional framework for energy resource management was also poor Today government aims at improving the quality and quantity of energy supplies, while promoting efficiency and conservation of energy resources

Key issues concerning the energy sector are i) insufficient capacity to meet energy needs, ii) high systems loss, iii) land degradation and pollution, iv) inadequate financial resources for the development of alternative sources of energy and technologies, and v) low efficiency in the use of petroleum products and fuelwood

Climate change

The earth is experiencing climatic change, and this is likely to have a major impact on health, socio-economic development and the environment Climate change in Uganda revolves around four issues climate variability, global warming, acidification, and ozone layer depletion Climate variability can be devastating In 1994 drought, due to climate variability, affected 16 of the 39 districts in the country Ozone depletion refers to destruction of the ozone layer by substances originating from anthropogenic sources Conversion of forested lands and grasslands to cropland releases carbon dioxide (CO_2) and greenhouse gases through decomposition of plant material and bush burning Change in vegetation affects land surface albedo, altering radiation balance and micro-climates, and especially increasing

atmospheric temperature
The areas of concern pertaining to Climate Change in Uganda are i) climate variability which has resulted in increased incidences of drought and unreliable rainfall regimes, ii) global warming and ozone layer depletion in relation to inefficient utilisation of fuels, increased use of ozone-depleting substances, devegetation and draining of wetlands, and bush burning

LEGAL, POLICY, INSTITUTIONAL FRAMEWORK, ENVIRONMENTAL EDUCATION, INFORMATION AND AWARENESS

Legal, policy and institutional framework

With independence in 1962, Uganda adopted wholesale the colonial policies and laws governing environmental resources Most laws were geared towards specific resource uses and the inter-relationship between them was not strong Too much reliance on command and regulation and little use of economic instruments resulted in poor compliance As a result government has adopted a participatory approach and ensured wide consultation nationally and to some extent internationally in the development of recent laws Notable examples are National Environment Statute, 1995, the Water Statute, 1995, and the Wildlife Statute 1996

Under the Constitution, the state has a mandatory duty to promote sustainable development and pubic awareness in a balanced manner for the present and future generations, and every Ugandan has a right to a clean and healthy environment The National Environment Statute is one important outcome of the extensive consultations carried out under the NEAP process It creates avenues for comprehensive and holistic amendment to sectorial laws on environmental matters Provision is also made in the Statute for other tools of environmental management including environmental impact assessment (EIA), environmental audits and environmental standards The National Environment Statute and people's growing awareness of the environment are creating new challenges for capacity-building The Statute also enabled the legal establishment of the National Environment Management Authority (NEMA) in 1995 NEMA is the apex body in environmental management coordinating, monitoring and supervising all activities in the field of the environment It established horizontal linkages with other agencies and vertical linkages with local governments Other new environmental policies include the National Environment Management Policy, 1994, the National Policy for the Conservation and Management of Wetland Resources, 1995 the Water Policy, 1995, and the Uganda Wildlife Policy, 1995

Uganda is party to regional conventions and agreements such as the Lake Victoria Fisheries Convention of 1994, which aims at regulating and enhancing fisheries on Lake Victoria, the Kagera Basin Agreement, 1977, which aims at ensuring equitable entitlement of each riparian state to the use of the River Nile waters, the Lusaka Agreement, 1996, directed at illegal trade in wild fauna and flora, and the East African Cooperation, which stresses the need for sustainable environmental management in the region Uganda is also signatory to several international conventions and treaties

The issues regarding the legal framework relating to environmental matters are i) policy gaps and deficiencies, ii) translation/implementation of various legal provisions into various development activities, inadequate awareness about environmental legislation, and iii) lack of guidelines

Environmental education and awareness

Environmental education is still a new phenomenon in Uganda It can be referred to as process of recognising values and classifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relatedness among human beings, their culture, and the biophysical surroundings This can be achieved through formal, informal and non-formal means The national initiatives which address the issue of environmental education include provisions made in the Government White Paper on Education, the National Environment Policy, 1994, and the National Environment Statute, 1995 One of the features of the White Paper on Education is that the curricula should be designed in such a way to include development of awareness and concern for the protection of the environment in formal, informal and non-formal educational arrangements Overall, there is need to develop an environmentally-responsive curriculum for all the three arrangements

The issues pertaining to environmental education are i) lack of environmental awareness, ii) lack of trained/specialised teaching staff, iii) inadequate financial and logistical support to the educational sector, iv) absence of or weak extension services relating to environmental issues, and v) ignorance about the value of indigenous knowledge

ENVIRONMENTAL INFORMATION

Despite strong environmental and supportive policies and legislation, environmental data collection, processing and information management have not been adequately addressed Systematic and formal management of environmental information is a new development in the country Also important are environmental information network and exchange mechanisms Besides NEMA (particularly its Information and Monitoring Division), other institutions manage environmental information Data have been collected at the national, district and community levels as a result of their activities These activities, however, remain sectorial and provide basic data rather than information in the holistic and integrated form required for environmental management

Nevertheless, it is encouraging that Uganda has produced three categories of environmental information assessments and reports, country case studies, and survey data and maps These include the National State of the Environment Report 1994, District Environment Profiles, and District State of Environment Reports Case studies include the Country Study on the Conservation of Biodiversity in Uganda Uganda has gained experience in the production of such reports but faces constraints, including lack of facilities for environmental information management, low level of inter-sectorial coordination, unclear laws and regulations regarding confidential or private information and access to it, and data quality and consistency

The issues relating to environmental information management are i) insufficient institutional input in regarding cross-sectorial participation and collaboration in ensuring effective management of the natural resources, ii) insufficient meta-database development due to inability of sectorial institutions to provide comprehensive environmental information for a wide range of data users, iii) lack of practical and cohesive approach among institutions due to absence of data dissemination guidelines, iv) poor capacity building in institutions in terms of skills and financial resources due to lack of a development plan and investment, to ensure sound environmental information management, and v) inadequate baseline and trend data due to incompatibility of data sets, in that a greater proportion of data sets cannot be combined to give meaningful information

ACRONYMS

ADB	African Development Bank
AEATRI	Agricultural Engineering and Appropriate Technology Research Institute
AFRENA	Agro-Forestry Research Network for Africa
CARE-DTC	Carry American Relief Everywhere - Conservation Through Development
CA	Constituent Assembly
CAST	Conservation and Sustainable Tourism
EC	European Community
EPAU	Export Policy and Analysis Unit
EPADU	Export Policy Analysis and Development Unit
FAO	Food and Agriculture Organisation of the United Nations
FORI	Forestry Research Institute
FRI	Fisheries Research Institute
GDP	Gross Domestic Product
ICDP	Integrated Conservation and Development Projects
ICRAF	International Centre for Research in Agro-Forestry
ILO	International Labour Organisation of the United Nations
IUCN	World Conservation Union
KARI	Kawanda Agricultural Research Institute
LIRI	Livestock Health Research Institute
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MFED	Ministry of Finance and Economic Development
MFEP	Ministry of Finance and Economic Planning
MNR	Ministry of Natural Resources
MTWA	Ministry of Tourism, Wildlife and Antiquities
NAARI	Namulonge Agricultural and Animal Research Institute
NARO	National Agricultural Research Organisation
NEAP	National Environment Action Plan
NEMA	National Environment Management Authority
NGO	Non-Governmental Organisation
NORAD	Norwegian Agency for International Development
NTAE	Non-Traditional Agricultural Export
NWSC	National Water and Sewerage Corporation
PAMSU	Protected Areas Management Support Utilisation
SAARI	Serere Agricultural and Animal Production Research Institute
SOER	State of the Environment Report
SSA	Sub-Saharan Africa
UFD	Uganda Forest Department
UNDP	United Nations Development Programme
UNCED	United Nations Conference on Environment and Development
UNEPI	Uganda National Expanded Programme for Immunisation
UNHCR	United Nations High Commission for Refugees
UNIDO	United Nations Industrial Development Organisation
USAID	United States Agency for International Development
UWA	Uganda Wildlife Authority
WHO	World Health Organisation of the United Nations
WWF	World Wildlife Fund for Nature

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CHAPTER ONE

1 0 STATE OF ENVIRONMENT REPORTING IN UGANDA

1 1 Introduction

In 1992 Uganda participated in the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro Uganda supported the provisions of Agenda 21 and other declarations and statements of principle Agenda 21, in part, calls for the periodic preparation of national state of environment reports Chapter 17, Article 278(1) of the Constitution of Uganda 1995, states that *Parliament shall by law provide for measures intended to protect and preserve the environment from abuse and degradation and to manage the environment for sustainable development* More specifically, The National Environment Statute 1995 Section 7(1) states that one of the functions of the National Environment Management Authority is to *prepare and disseminate a (national) state of the environment report once in every two years* The National Environment Statute, 1995, section 15(2), also requires districts to prepare a district state of environment report every year This national state of the environment report is the second one Apart from reflecting changes in environmental parameters, the 1996 State of the Environment Report differs from the first one in terms of organisation and content In terms of organisation, the 1996 State of Environment Report uses a issue-pressure-state-response framework[1] as opposed to sector approach used in the first one According to this framework, human beings exert pressure on the environment, such pressures induce changes to the state or condition of the environment, to which society responds with policies and programmes to prevent, mitigate or repair environmental damage With respect to content, this report includes new sections on climate change, minority ethnic groups, and the water hyacinth problem While these areas were briefly mentioned in the previous report, they receive more detailed treatment in this one

1 2 Uganda's Natural Resources

2 1 Location and Size

Uganda is located in the eastern region of Africa, situated between latitudes 1^0 30' south and 4^0 North and longitudes 29^0 30' East and 35^0 East The country is bordered by the Republic of Kenya in the east, Tanzania and Rwanda in the south, the Democratic Republic of Congo (former Zaire) in the west and Sudan in the north Uganda covers an area of about 241,500 sq km of which about 15 3% is open water, 3 0% permanent wetlands and 9 4% seasonal wetlands The perimeter of Uganda is about 16,630km

1 2 2 Physiography

The natural resources of Uganda include the air, water, land, climate, plants and animals These resources, if well managed, are capable of replenishing themselves and sustaining socio-economic development Uganda is a country of considerable physiographic interest comprising plateaus, highlands, mountains, rolling hills, flat lands, rivers, lakes and wetlands

Plateaus

Most of Uganda forms part of an interior high plateau of the African continent The area is characterised by flat-topped hills in the central, western and parts of eastern Uganda These flat-topped hills rise to an average height of about 1300m above sea level (m a s l) In the central and eastern regions, they are separated by broad, uniform valley slopes which descend into extensive papyrus wetlands, in the west, the valleys are narrower In the southwest of the country the plateaus reach great heights with hill summit levels above 2000m such as in Kabale, Rukungiri, Ntungamo and Kisoro districts These plateaus are deeply incised, particularly within the rift-ward drainage, and their elevations are only rivalled by the high upward ones of Nebbi District in the northwest and Kotido district in the northeast The rise from the central part to the western part of Uganda represents a long and continued deformation of the plateau by warping It is parallel in the east and north east though not generally to the same extent

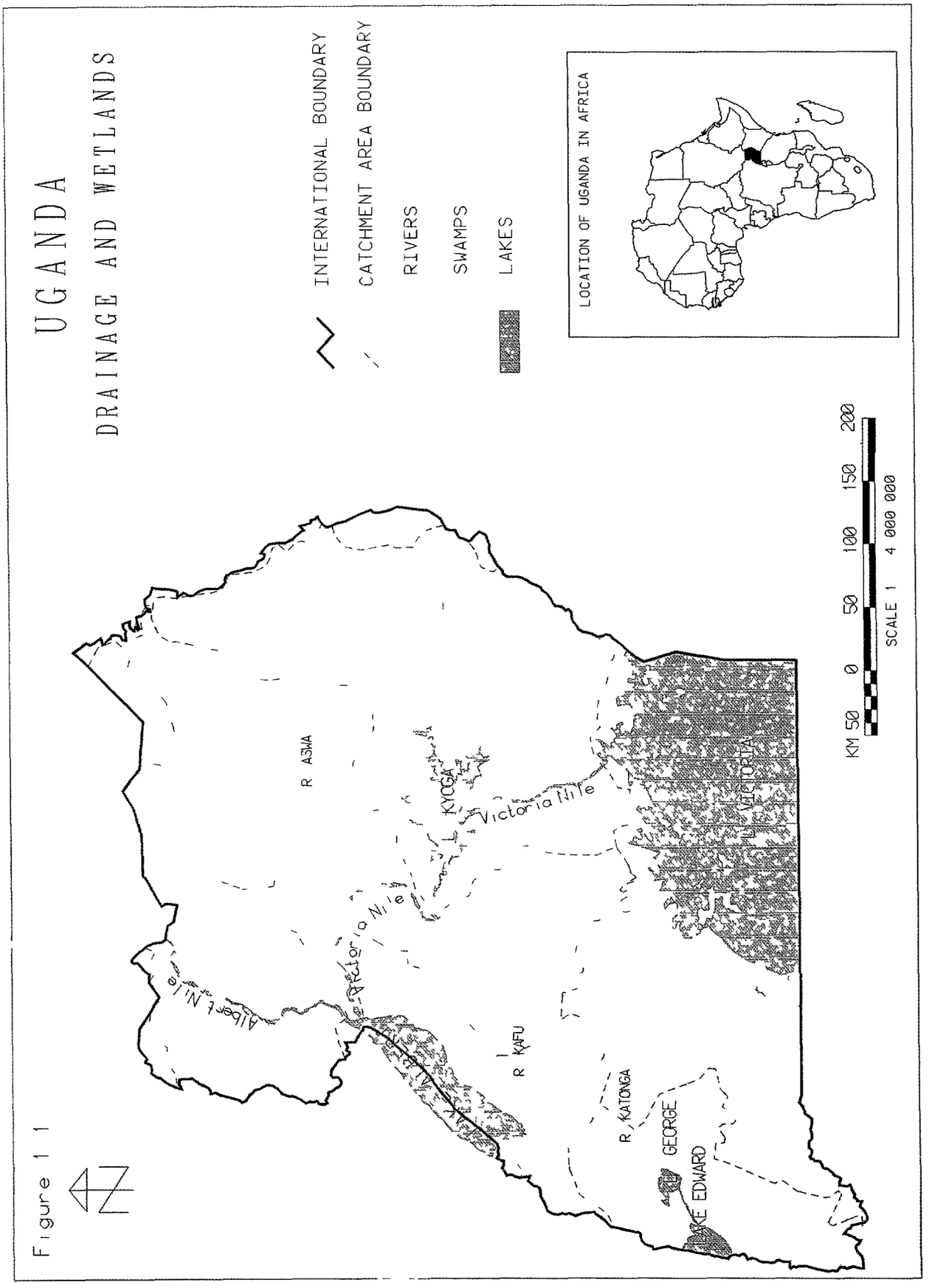
Mountains

The rise of the plateau level to the east and west of the country is emphasised by the impressive mountainous topography found along the borders To the west lies the Mufumbira Volcanoes at about 4120m a s l The Rwenzori Mountains with a peak of about 5100m a s l are located in the northern most part of the western rift To the east, the approach of the Kenyan border is marked in the south by the volcanic Mount Elgon rising to about 4320m a s l, and the stump of Tororo Rock To the north is the complex of volcanic mountains in Moroto and Kotido districts, which include Kadam at about 3070m a s l, Napak at about 2548m a s l, Moroto at about 3040m a s l, and Morongole at about 2700m a s l In the western part of the country, there is high relief contrast characterised by a height difference of 4500 metres, from the summit of Mt Stanley in the Rwenzoris (about 5,100m a s l) to Nimule at the northwest border with Sudan (about 600m a s l) There exists permanent ice and snow on the Rwenzoris, with a total of 37 small glaciers and ice fields covering a little under 64sq km These glaciers and ice fields are reported to have significantly decreased in number and size in the last 50 years While the Rwenzoris consist of a host block elevated between faults, the other Ugandan mountains are volcanic in origin Those at the eastern border of the country are older and extinct and have been deeply scoured by erosion as evidenced by Moroto and Kadam mountains Others are almost completely destroyed such as Tororo and Napak On the other hand, the young volcanoes of the west in Kisoro district consist of young conical hills and are associated with the Virunga Mountains across the border in the Democratic Republic of Congo which are known to be either active or dormant

Rivers

Most of the waters in the southern part of Uganda drain into Lake Victoria, they which then escape through the Owen Falls Dam into Victoria Nile and through Lake Kyoga to Lake Albert, the Albert Nile, the White Nile in Sudan, and down to the Mediterranean sea through Egypt (**Figure 1 1**) The drainage pattern represents past geological readjustments Uganda was once drained by a sub-parallel series of major rivers which had their headwaters somewhere in the region of the present eastern watershed of Lake Victoria and which flowed westwards to join the present River Congo Due to the influence of warping, many of the perennial streams of the plateaus of Uganda exhibit impeded flow characteristics and are commonly clogged with wetlands In northeastern Uganda,
many of the rivers are seasonal, with some carrying water for only a few hours after a heavy rain storm

Figure 1 1 Major Rivers, Lakes and Wetlands of Uganda



Lakes

Uganda's lakes cover nearly one-fifth of its area and are varied and significant They vary in size, shape, depth and age Key variables of the major lakes are shown in **Table 1 1** Lake Victoria is the second largest freshwater lake in the world It has an intricate submerged northern coastline and an elevated western plain of sandbar and lagoon These features provide Lake Victoria with strong scenic contrasts compared to the regular faulted basin lakes of the rift valley such as Lakes Albert and Edward The smaller lakes of Bunyonyi in Kabale District and Lakes Mutanda and Murehe in Kisoro District resulted from volcanic damming of drainage systems by lava The huge lakes of the rift valley were the result of water filling the deepest rift troughs, while the crater lakes of the western rift valley and those in the Rwenzoris resulted from gaseous explosions and glacial erosion, respectively

Table 1 1 Major lakes of Uganda

Lakes	Total Area (Sq Km)	Area in Uganda (Sq Km)	Height above Sea level (m)	Depth (m)
Victoria	68457	28655	1134	82
Albert (Mobutu)	5335	2913	621	51
Edward	2203	645	913	117
Kyoga and Kwania	2047	2047	1033	7
Salisbury (Bisnia)	308	308	1047	
George	246	246	914	3

Source *UNEP (1988) Strategic Resource Planning in Uganda Water Resources Vol 4*

1 2 3 Geology and Soils

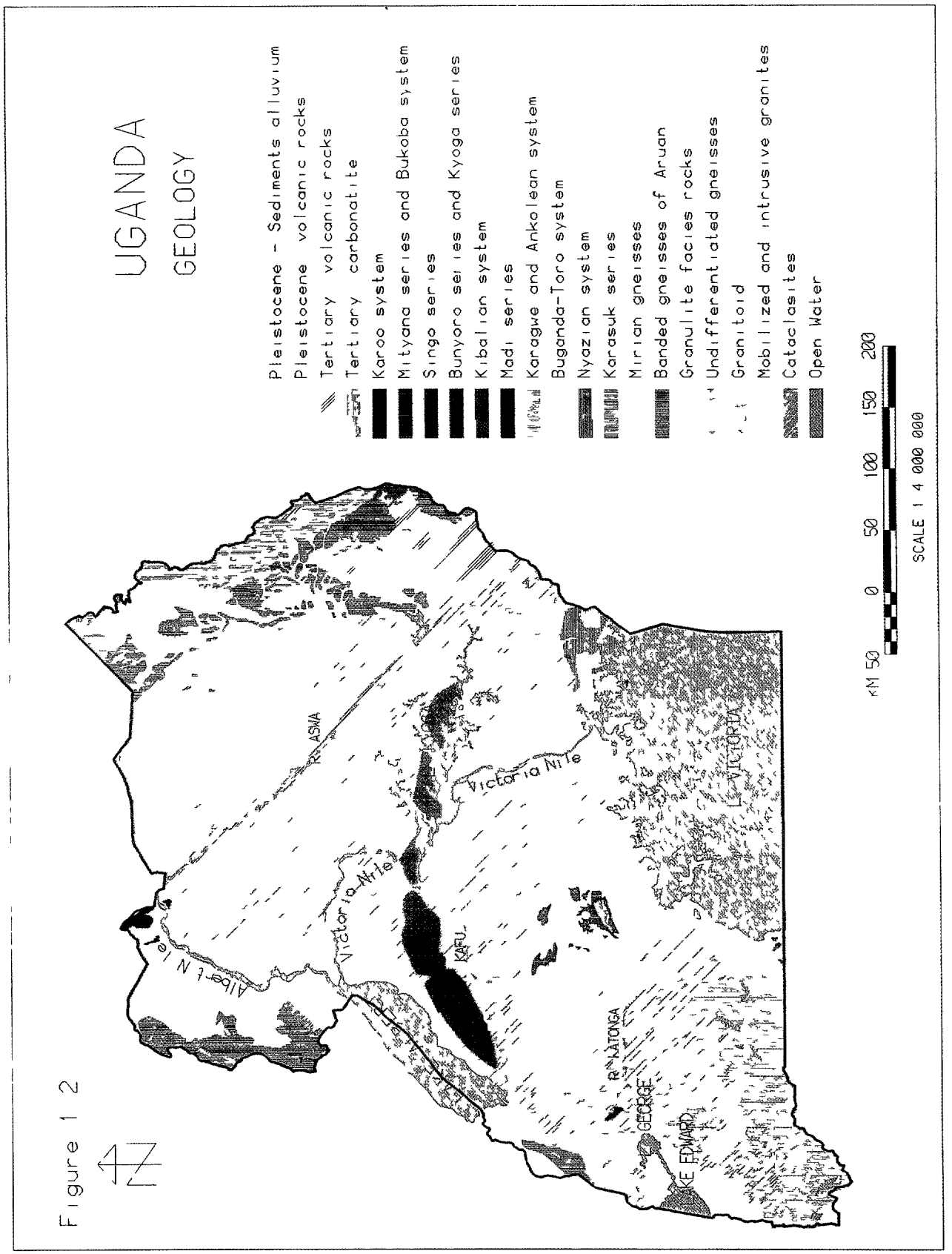
Geology

The predominant rocks found in Uganda were formed between 3000 and 6000 million years ago (pre-Cambrian era) and hence are old indeed In some western and eastern parts of the country, there are major developments of younger rocks, which are either sediments or volcanic in origin ranging from 135 million years ago (Cretaceous period) to the present day There is thus a gap of some 460 million years in the geological history of Uganda (Atlas of Uganda 1962) (**Figure 1 2** illustrates the geology of Uganda)

Soils

The type and character of the soils of Uganda are defined by a number of parametres such as the nature of the parent rock, age of the form and climate, especially the amount of moisture Soils may be defined according to the different dominant characteristics In Uganda soils are often classified according to the FAO system Ferralitic soils are the most dominant in Uganda (FAO ferralsols) They are very old and in their last stages of development with little mineral reserves left Their productivity, therefore depends on the delicate balance of nutrient recycling propagated by dense vegetation cover with deep rooting systems The other varieties of soil, include ferruginous soils which are richer in

Figure 1 2 **Geology of Uganda**



mineral reserves, and the volcanic soils, most of which are very productive Alluvial soils occur in many places, associated with present or past drainage systems **Figure 1 3** shows the different groups of soils in Uganda In terms of productivity (essentially for agriculture), Uganda s soils can be divided into six categories as detailed below

(a) Soils of very high to high productivity

These are mainly found in areas associated with volcanic activity but they also occur in some areas associated with pre-Cambrian rock and recent alluvials Rainfall amounts range from 1000mm to 1375mm with relatively mild dry seasons The relief is characterised by rolling hills with summits at 1200 to 1500m a s l and slopes of 5 to 16% These areas have rain forest and elephant grass as typical vegetation cover Soils of very high productivity are normally capable of supporting crops for 30 years or more with no apparent drop in their productivity These soils are suitable for annual and perennial crops, including cocoa, (with the exception of tea) and mechanical means of cultivation can be utilised Their nutrient status indicates a high content of humus in the top soil and high exchangeable bases, their top soil pH is 6 0 or below Crop yields can be increased with the application of better farming techniques, improved pest and disease control methods and use of appropriate farm machinery Sheet and gully erosion can be controlled by contour ploughing and bunding In comparison, soils of high productivity generally depend on the mode of treatment of the soil Where sheet erosion is evident, particularly in densely-populated areas, the sub-soil has been removed exposing the underlying rock to the surface Thus, with more intensive farming, these soils will require fertilizer applications to which they are likely to give considerable returns owing to their favourable physical conditions The nutrient status is moderate to good, depending on the previous cultivation history, length of cropping period, and the amount of accelerated erosion in the past The areas of very high to high soil productivity are scattered and occupy about 8% of the land area of Uganda Examples are Sipi Bugusege on Mount Elgon slopes, Panyimur in Nebbi district, large parts of Buganda region and Kabarole district, particularly around Fort Portal

(b) Soils of moderate productivity

These occur mainly in eastern and western Uganda except where there are sandy or sandy-loam soils derived from recent alluvial deposition These soils are usually red clay-loams Approximately 14% of the land area of Uganda has soils of medium productivity, comprising of a rather wide range of sub-types Examples of places where these are found include Bennet in Kapchorwa, Namalu in Moroto, Kabale Mabira in Mukono, Bushenyi, Ibanda, Bwamba, Lwampanga and parts of Mbale (Bubutu) Annual rainfall amounts range from 1000 to 1250mm, the relief is rolling to undulating hills, 1140 to 1380m a s l , with slopes 3 to 16% The vegetation cover generally ranges from elephant grass to forest re-growth to fire-controlled grass fallow These soils are capable of supporting a variety of crops after a long and undisturbed fallow Their physical conditions are generally inferior in comparison to high productivity soils The success in exploiting these soils will depend on strict soil conservation measures and may require construction of terraces Frequent mulching would reduce rain-splash erosion and loss of organic matter Nutrient status is moderate to low, being entirely controlled by contribution of vegetation to the soil organic matter The soils are frequently very acidic with a pH of 5 or less Low pH is an indication of an advanced stage of leaching and a low percentage of base saturation

(c) Soils of fair productivity

These soils occupy the largest land area of Uganda, accounting for at least 43% The relief is generally rolling to undulating hills with summits of 1140 to 1260 m a s l , and slopes in the range of 3 to 12% Annual rainfall ranges from 1000 to 1250mm, vegetation cover is characterised by medium grass savanna with unstable elephant grass fallow These soils are widespread in the central plateau of Uganda, for example, in Mubende, Kamuli, Jinja, Soroti, West Lira and Apac, as well as in Buruli county, Luwero district, and the Pajule series in east-central Gulu In western Uganda, the distribution is rather complex with various parent rocks giving rise to this category of soils, for example, around Rwenzori At middle altitudes of the mountains are clayey loams with high humus content Clay loams also occur in Masindi and Hoima districts Alluvial soils are also sometimes of fair productivity, such as in the Pager Valley of the major tributary of the Aswa River in southern Gulu district Other localities where soils of fair productivity are found include Isingiro (sandy loam), Lukaya (yellow loam), Ssese Islands (red sandy loam), Yumbe (sandy), Mbarara (sandy loam), Nyabushozi (sandy loam), Hoima, Pager and Ora These soils support both perennial and annual crops including cotton and tobacco, but are unfavourable for tree crops and plantains A long fallow period is required to maintain the present productivity of these soils The fallow period, however, can be shortened by the application of fertilizers, provided the soils are not in advanced stages of erosion The nature and intensity of erosion is similar to that of soils of moderate productivity The unfavourable soil properties restrict mechanical cultivation compared to the soils of moderate productivity mentioned above The nutrient status is low, but the top soils are less acidic with pH values of about 6 0

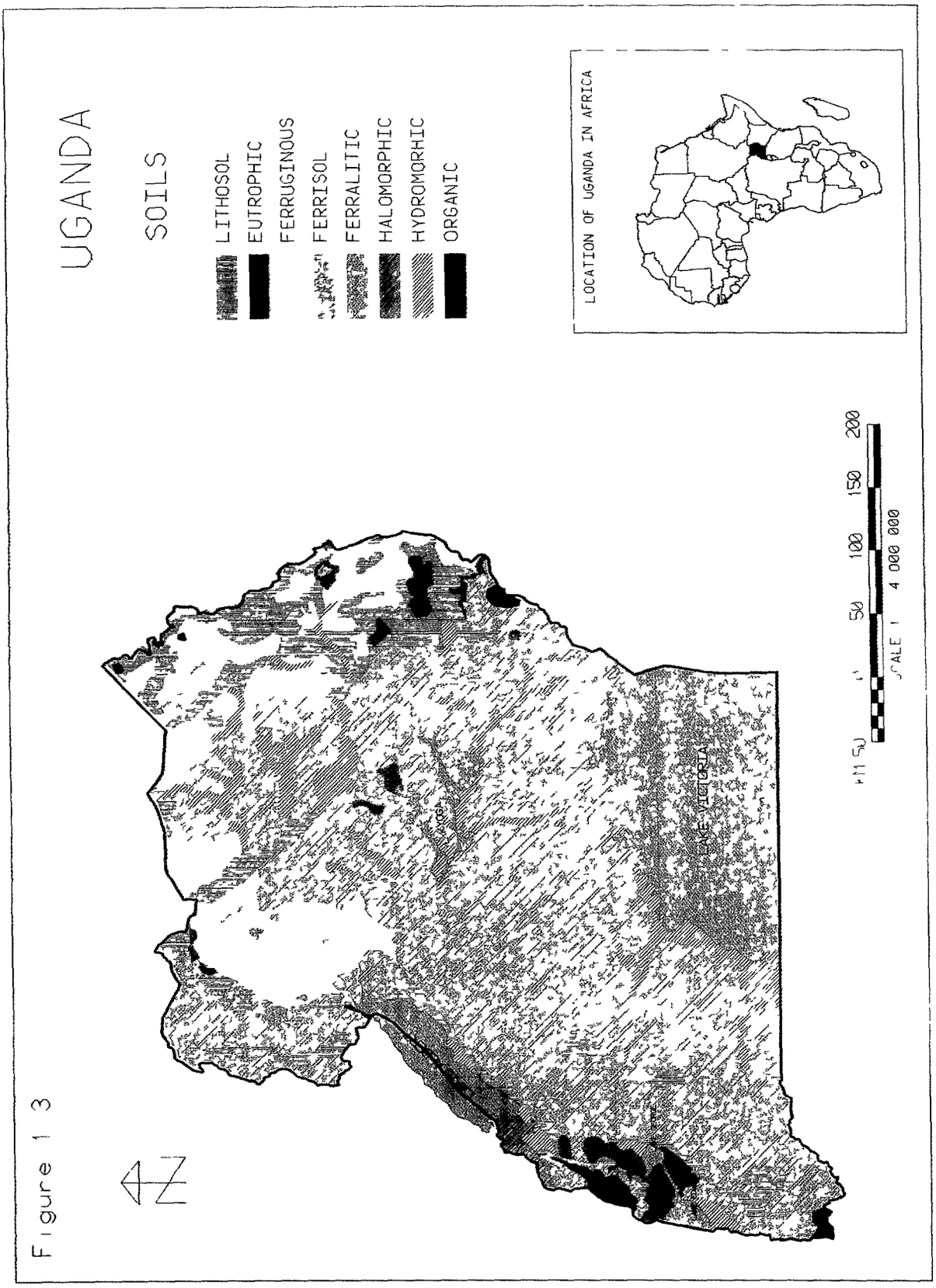
(d) Soils of low productivity

Theses occupy about 30% of the Ugandan land surface Although 40 soil types can be identified from the 1 250,000 map of soils of Uganda, there are others that are too small in area to be mapped at the present scale The relief is gently rolling to undulating hills with summits at 1080 to 1260 m a s l , annual rainfall averages 1000mm or less The vegetation cover is short-grass savanna with fire-tolerant species of shrubs and trees These low productivity soils are found scattered in association with other dominant soils Their main locations are in northern Uganda and in the western rift valley lowlands However, they occur elsewhere in special circumstances They can also be found at Kadam (peat loam), Tororo (stony loam), Aswa (rocky and coarse), Kazo (stony loam), Kidepo and Ishasha (sandy loam) Productivity of these soils is moderate for annual crops but low for perennial crops, however, semi-perennial crops like cassava and pigeon peas thrive well on them Rain-splash erosion often occurs even under natural conditions after heavy rains due to sparse grass cover and usually becomes more pronounced upon cultivation Sheet erosion is often more severe in the loamy soil types than in the sandy ones They are suitable for light mechanical cultivation only (ox-ploughing) The nutrient status reveals a low level of organic matter in the top soil, due to the sparse grass cover and low base-exchange capacities

(e) Soils of negligible productivity

These are generally characterised by flat valley bottoms Annual rainfall averages 1125mm, the vegetation types are mainly swamp communities, papyrus, *Miscanthidium* or swamp forest and are associated with alluvial conditions They vary from sandy conditions on lake terraces to plastic clays, and all are classified as hydromorphic soils These soils support only a small amount of cultivation and some

Figure 1 3 Soils of Uganda



grazing The main occurrence of the soils is along river courses, with organic matter usually raw peat or humus, giving rise to very acidic soil surfaces Soils of negligible productivity occupy about 3% of the land area of Uganda Examples include Mubende (red/yellow loams), Rubare (Podsol, sandy loam), Kifu (grey sandy) and Sango Bay (grey and brown sands)

(f) Soils of nil productivity

These occur as skeletal soils or as exposures of hard rocks which do not yield soil They also occur as areas of peat, or highly humus conditions and as organic soils at very high altitudes (over 3000m a s l) Of recent, some peat soils have been found to possess reasonably high productivity potential for a selected number of crops when reclaimed and drained These soils are estimated to cover a maximum of 2% of the surface area of Uganda and are associated with flat valley bottoms and flood plains Rainfall totals range from 1000 to 1250mm per annum In general, in this category are soils which would require draining and those which need to be irrigated to make them productive Areas associated with swamps provide good grazing/pasture during certain times of the year Rain-splash erosion may become severe if the land is left bare in the rainy season Waterlogged soils have high organic matter but often it is raw humus or peat They have acidic surface horizons with a pH of often less than 5 0, which indicates an advanced stage of leaching, although sometimes the only nutrient which is in abundance is phosphorous On the other hand, the soils which may require irrigation support extensive grazing The nutrient status, however, shows very low organic matter, and the soils tend to be less acidic There are also soils which are permanently non-productive, and these are usually associated with flat or rounded summits, steep slopes and occasionally more gentle pediments Slopes are in the range of 0-3%, 5-8% and 16-30%, respectively It has been observed that even grazing is liable to cause sheet erosion and loss of humose top soil as a result of bushfires that leave the ground surfaces bare Construction of earth terraces or grass bunds would control erosion of the soils Wherever possible tree plantations would act as windbreakers and also provide fuelwood and building materials Although some gently sloping sites have accumulated humus, the nutrient status is generally very low The vegetation cover is short grass with shrubs or thicket

1 2 4 Climate

General Climatic features

In most parts of Uganda, the wet and dry seasons are fairly well marked The rainy seasons in most cases begin shortly after the hottest time of the year and are associated with a short time lag in relation to the movement of the sun north and south of the Equator The wet and dry seasons are also related to the main air currents, both on the surface and in the upper atmosphere On the surface, these currents are generally known as the southeast and northeast Monsoons which tend to follow the movement of the sun The western districts of Uganda, however, receive rain from a westerly airstream originating from the Democratic Republic of Congo Generally, the number of rainy days in an area bears direct relationship with the amount of rainfall received which is in turn linked to the amount of water vapour and available crop water **Figure 1 4** shows mean annual rainfall distribution for Uganda Mean monthly values of water vapour in Uganda show that generally a minimum value occurs in January with a second minimum in July, except for northern Uganda where there is only the first minimum Similarly, the first maximum values of water vapour occur in April or May, with a secondary maximum occurring usually in October or November particularly in areas characterised by two rainy seasons
The difference between the maximum and minimum vapour pressure varies from less than 2 millibars

(mbs) at Entebbe to more than 6 mbs at Moroto The mean temperatures over the whole of Uganda show great variation In the mountainous districts of western Uganda and around Mt Elgon, variations in temperatures are experienced along the altitudinal gradient For areas in proximity to large water bodies such as Lake Victoria, temperatures are modified by maritime conditions Variation in mean annual and monthly evaporation rates is much smaller than corresponding variations in rainfall (10-20% in the south and 20-40% in northern Uganda) The movement of the Inter-Tropical Convergence Zone (ITCZ) is to a great extent responsible for the variations in meterological factors that determine evaporation The presence of the ITCZ has in most instances the effect of reducing evaporation While in the southern half of the country about 80% of the differences in evaporation at a given place are due to variation in solar radiation, in the northern half differences in altitude, run-off, wind, humidity and temperatures also play a significant role

Climate Zones

Using rainfall received in a given area as the main dependent variable, Uganda has five major climatic zones These zones are relatively minor from a continental perspective and do not have sharply-defined boundaries In addition, the five zones described below are defined more in terms of similarities of rainfall distribution rather than by volume

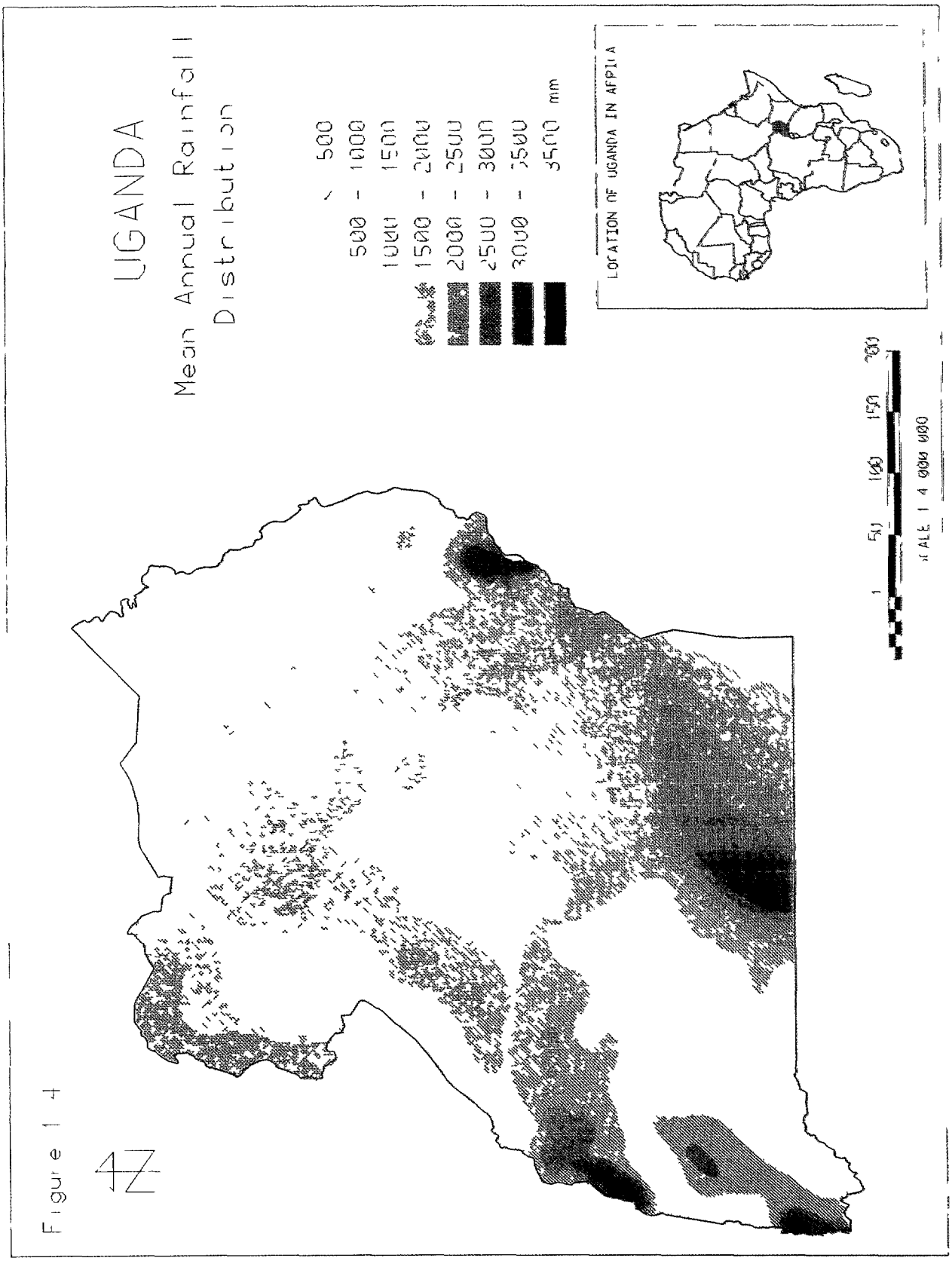
Zone I Lake Victoria Zone

This zone extends 48-64km from the lake shore and displays comparatively small variations of temperature, humidity and wind throughout the year Zone I has a high rate of evaporation estimated at 3-5 mm per day There is a relative dry season between December and March, and another in June and July Both periods, however, are frequently interrupted by thunderstorms leading to a regime with rainfall well distributed throughout the year, with peaks in March-April-May and October-November On the lake shores, rainfall varies from 1250mm per annum (p a) south of the Equator to over 1500mm p a to the north The annual rainfall is heaviest over the open lake with a marked gradient of about 30mm per kilometre inland The rainfall maxima are associated with the onset of the southeast and northeast Monsoons

Zone II Karamoja

The Karamoja Zone is characterised by an intense hot and dry season lasting from November to March During this season the scrub vegetation is subjected to extensive fires which produce a lot of smoke and haze that often rises up to about 3000m a s l There is a single rainy season beginning in April and ending around August with a marked minimum in June and peaks in May and July December and January are the driest months Average annual rainfall is generally in the range of 100 to 625mm During the northeast Monsoons, this zone is swept by a wind which traverses Somalia, the Abyssinian Massif and the Kenya highlands, losing most of its moisture The passage of the ITCZ northwards and the onset of the southeast Monsoons in April and May account for the earlier peak of rainfall The hills in this zone play a significant part in rainfall development and distribution during the southeast monsoons Large cumulus and cumulo-nimbus clouds build-up on hills early in the day leading to relatively heavy rainfall as the clouds move in a north-westerly direction under the influence of wind drift Thus small areas of heavier rainfall, notably at Mt Moroto (about 890mm p a), break the even pattern which shows a decrease in the north-easterly direction

Figure 1 4 Mean Annual Rainfall of Uganda



Zone III Western Uganda

Zone III is a relatively narrow zone along the western boundary of Uganda It embraces the high ground of West Nile, the escarpment on the eastern side of Lake Albert, Kabarole, Bundibugyo, Kasese, the high ground of the southwest and the rift valley lakes It also includes a chain of large tropical forests (Zoka, Budongo, Bugoma, Itwara, Kibale, Kalinzu and Maramagambo) The rift valley part of this zone is hot and dry, with mean annual rainfall of the order of 875-1000mm falling in 80 to 100 days In contrast, mean annual rainfall on the higher plateau of the zone rises to over 1250mm and occurs in 100 to 150 days On the mountains and escarpments surrounding the rift valley, the mean annual rainfall increases rapidly with altitude In the higher altitude extreme southern parts of Zone III (Bushenyi, Rukungiri and Kabale districts), mean annual rainfall exceeds 1875mm, while barely 10 to 30km away in the rift valley, the corresponding rainfall is less than 875mm On the slopes of the Rwenzoris, the mean annual rainfall reaches up to 2000mm at an altitude of about 4600m a s l In the districts of Kabarole, Hoima, Kibale, Masindi, Nebbi, Arua, and Moyo, rainfall is predominantly accompanied by thunderstorms and severe hailstorms

Zone IV Acholi-Kyoga

The Acholi-Kyoga zone embraces a great part of northern and eastern Uganda A large proportion of the area is represented by Lake Kyoga together with extensive papyrus wetlands Rainfall in Zone IV averages about 1250mm and occurs in 140 to 170 days of the year The wet season extends from April to October, with peaks in April, May and August A minimum (but not a true dry season) occurs in June and July Rainfall is mainly convectional, characterised by afternoon and evening occurrences The April-May peak and the September-October rainfall are due to the passage of the Equatorial trough Although the Acholi-Kyoga is classified as a single zone, there are indications that if sufficiently detailed analysis were carried out, the existence of smaller climatic divisions may be revealed Compared to the Lake Victoria in Zone I, both Lake Kyoga and Victoria Nile in Zone IV do not produce significant climatic variations in their immediate vicinity

Zone V Ankole-Southern Uganda

The Ankole-Southern Uganda zone includes parts of Busoga, most of the east and Mukono, Mpigi, Mubende and Masaka districts The rainfall, which is mainly convectional and an afternoon and evening occurrence, averages about 1125mm p a and falls in 90 to 130 days A much drier zone with mean annual totals below 875mm covers an area extending to the northeast from eastern Mbarara and Ntungamo districts to near Lake Wamala Two rainfall peaks associated with the Equatorial trough are evident, one during April-May and the other in September to November Two dry seasons also occur, with a pronounced one in June-July and a less severe and often interrupted one between December and February The explanation for the interruption is probably to be found in the air mass trajectory during these months During the southeast Monsoons, Zone V experiences less rainfall than the Acholi-Kyoga area although the two zones are not altogether dissimilar since the air mass that moves over them would have already deposited much of its moisture over the western parts of Lake Victoria

1 2 5 Vegetation

The vegetation classifications and descriptions still used in Uganda are based on the concepts of Langdale-Brown and Osmaston (1967)

High Altitude Moorland and Heath which consists of moist and dry montane forests, and montane bamboo forest The moist montane forests form a dense canopy that varies in height from about 10 25 to 18m There are actually two sub-types of this forest (*Pygeum and Hagenia - Rapanea) Pygeum* is the more luxuriant and occurs at lower altitudes (1800 to 2400m a s l) An irregular belt of the montane bamboo forest separates the moist montane forests from high montane heath (2700m a s l or above) The canopies of the dry montane forests hardly exceed 18m in height These forests have fewer epiphytes and less under-storey than the moist type

Medium Altitude Forests occur at an altitudinal range of 600 to 1900m a s l Two forest types are recognised within this category the moist evergreen forest and their semi-deciduous forest These have closed canopies at a height of around 30-50m and abundant lianas Grasses are generally absent, the few that exist are broad-leaved and fire sensitive These forest types can be found scattered in many parts of Uganda Mabira, Sango Bay, Kibale Forest National Park, Kalinzu and Budongo

Forest/Savanna Mosaic vegetation is found in many parts of Uganda and is dominated by elephant grass (*Pennisetum purpureum*) with isolated forest and savanna tree remnants These are either evidence of previous forest cover or the influence of clearing for cultivation The forest/savanna mosaic covers most of Masindi and Hoima districts and parts of central and southwestern Uganda

Moist Thicket represents a dense growth of evergreen or mixed evergreen and deciduous shrubs and small trees with interlocking crowns 4 to 18m high There is a noticeable absence or scarcity of grasses Examples of this vegetation type are the areas around Moyo, Kyegegwa in Fort Portal, and the islands of Sigulu, Lolvi and Sagitu in Lake Victoria

Woodland differs from a forest in that woody species form the upper layer under which is a more or less continuous grass cover Four sub-types of woodland are represented in Uganda Usually the height of the canopy of a woodland is anywhere from 9 to 15m Examples of woodland are found in Murchison Falls National Park and along the shores of Lake Kyoga

Wooded Savanna in Uganda represents six different vegetation communities distinguishable on the basis of floristic composition, ranging from scattered shrubs in open grassland to almost woodland vegetation The vegetation communities referred to as wooded savanna always have open canopy and well-developed grass cover Through the effects of annual bushfires, the grasses exert a considerable influence on the woody content of the wooded savanna These vegetation communities, to various degrees, can be found in most parts of Uganda

Grass Savanna, more popularly known as grasslands, forms a continuous grass cover ranging from less than half a metre (*Loudetia, Eragrostis*) to two metres (*Hyparrhenia*) Trees and shrubs are generally absent The grass savanna vegetation type covers extensive parts of Uganda

Steppe is a vegetation type consisting of scattered tree and shrub formations over an open cover of grasses and herbaceous plants with much bare ground Large parts of Moroto and Kotido can be characterised as grass steppe

Bushland and Dry Thickets represent the driest vegetation types in Uganda These types have many species in common Unlike in bushlands, where they are found scattered, thorny deciduous species

form a continuous cover in the dry thickets

Swamps (Wetlands) can be divided into three groups based on seasonality One community consists of seasonal swamp grasslands dominated by *Echinochloa, Sorghastrum, Hyparrhenia* or *Themeda* Other swamps consist of permanent water-logged vegetation dominated by *Cyperus papyrus* or *Miscanthidium* Swamp forest is another distinguishable vegetation It is of lower stature than medium altitude forest and occurs under seasonally water-logged conditions

Cultivation Communities are areas cultivated so frequently that the vegetation seldom develops beyond the first herbaceous stages

CHAPTER TWO

2 0 ENVIRONMENT AND DEVELOPMENT

2 1 Sustainable Development Vision for Uganda

Uganda is primarily an agrarian country, with agriculture contributing over 50% of the Gross Domestic Product (GDP) Agricultural output is largely by peasant farmers who grow both cash and subsistence food crops on their land holdings (averaging about 1 7 ha per household)

Current government effort is towards modernisation, part of which involves transforming Ugandan society from an agrarian to an industrial one This is a major challenge In addition, the transition will bring both agrarian and industrial environmental problems

In this chapter, the broad linkage between environment and socio-economic development is traced in key macro-economic trends and indicators

In 1992, the international community Uganda inclusive, adopted Agenda 21 which proposes to address the pressing environmental problems of today and also aims at preparing the world for the challenges of the next century The commitment arose out of the realisation that humanity stands at a defining moment in history, with great disparities between nations, worsening poverty and social development indicators, and deterioration of the ecosystems on which we depend for our livelihood Through a three year consultative National Environment Action Plan (NEAP) process, Uganda set its vision on attaining sustainable socio-economic development which maintains or enhances environmental quality and resource productivity on a long-term basis and meets the needs of the present generations without compromising the ability of future generations to meet their own needs[1] This vision conforms with that of the World Commission on Environment which defined "sustainable development" as "development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs"

2 2 Basic Pre-requisites for Sustainable Development

To make the above vision reality, the country places great importance on the role of economic policies, international cooperation, financing, trade relations and investment in human capital It equally emphasises effective environmental management, public participation and a decision-making process that integrates environmental considerations The ultimate aim is to ensure complementarity between development and environment In this way, the interests of humanity will be upheld now and in the future In 1992, UNDP articulated the minimum requirements for sustainable development with which Uganda is in agreement They are given in **Box 2 1**

Uganda's economic objectives are to ensure growth, equity, efficiency and overall stability On the other hand, the ecological objectives include conserving ecological life-support systems and biodiversity, using renewable resources sustainably, minimising depletion of non-renewable resources in the absence of substitutes, and keeping within the carrying capacity of the support systems Last, but not least the social objectives put emphasis on empowerment, participation, human capital development, social cohesion and legal, policy and institutional development

Box 2 1

Minimum requirements for moving towards a sustainable development path

The reduction of poverty
A reduction in population growth
More equitable distribution of resources
Healthier, more educated and better trained people
Decentralised, more participatory government
More equitable, liberal trading systems within and among countries including increased production for local consumption
Better understanding of the diversity of ecosystems locally adapted solutions to environmental problems and better monitoring of the environmental impact of development activities

Source *Adapted from UNDP (1992)* *Human Development Report (1992)*

2 3 History of Uganda's Economy

To appreciate the current linkages between economic development and ecological sustainability on one hand, and economic development and human development on the other a brief historical review is necessary The environmental and human quality today reflects events and activities of the past three decades At the same time, an historical review helps to assess the adequacy and relevance of both current and planned interventions or responses in economic, environmental or social

The economy in the 1970s suffered internal and external shocks Internally, fiscal responsibility collapsed, leading to widespread misuse of funds and corruption The administrative system and efficiency in government and the parastatal sector declined The parastatal sector expanded during the early 1970s with the "Nakivubo pronouncements" in which the government sought a 60% participation in a number of private industrial, commercial and financial undertakings It became bloated with the abandoned and confiscated industries belonging mostly to the Asians who were expelled in 1972 This takeover was chaotic, with little concern for proper transfer of ownership, compensation, financial control and management To make the situation worse, many of the country's best entrepreneurs, managers, administrators and professionals left the country

On top of these domestic problems, the Ugandan economy was shaken by a series of external shocks during the mid 1970s The 1973 rise in price of petroleum products had an adverse impact on the balance of payments and increased production costs throughout the economy This was exacerbated by a world slump in coffee prices which reduced foreign exchange earnings Coffee was and still is Uganda's major foreign exchange earner These problems were compounded by the breakup of the East African Community in 1977, a factor that has a negative bearing on trade relations and access to formerly-shared infrastructure services like railways, posts and telecommunications It is only in the recent past that the East African countries have rekindled their cooperation with the 1996 agreement, which addresses some of these problems

The impacts of both internal and external shocks are visible in the key macro-economic indicators summarised in **Table 2 1** Gross Domestic Product (GDP) at 1966 prices stagnated from 1970 to 1978, implying falling per capita incomes, with particularly sharp falls recorded in the value added areas of the industrial and monetary agricultural sectors The only sector to record a steady growth was subsistence agriculture, both to provide individual food security and to supply the thriving and lucrative 'magendo" or informal markets The savings rate fell sharply (to less than 8% from 1971 to 1978) and

with limited external capital inflows, investment was also cut back Few development projects were started during this period, and little effort was made to replace obsolete plants and equipment Even more importantly, little attention was paid to the maintenance of existing infrastructure and productive assets Evidence of this is still widespread throughout the economy among others, worn-out and unreliable industrial machinery, deteriorating conditions on the road network and limited capacity of the urban water supply and sewerage facilities

High inflation rates eroded producer incentives, and with a steady deterioration in transport and marketing facilities, production of export crops initially stagnated and declined Central Government's revenue base was eroded The breakdown of law and order meant that laws and regulations pertaining to environmental management could not be enforced Encroachment in protected areas increased, as did poaching of wildlife Standards related to settlement, particularly in urban areas, could not be enforced, culminating in poor drainage, traffic congestion and construction in wetlands **Table 2 1** gives key macro-economic indicators for 1967-1985 and illustrates some of the negative trends discussed above

Table 2 1 Key macro economic indicators, 1967 - 1985

	1967	1970	1975	1980	1985
GDP (Billions of current Uganda Shillings)	6 62(1966)	9 46	22 5	126 67	1 915 9
GDP growth rate(Average annual growth %)	5 1	0 8	5 1	5 2	6 0
Savings rate(gross domestic savings % of GDP)	14 2	16 4	5 5	4 6	5 3
Investment rate(gross domestic investment % of GDP)	13 3	13 3	7 6	6 1	8 6
Value of exports (million US$)	182	246	264	345	394
Value of imports (million US$)	159	172	206	293	327

Source *World Bank tables 1987 1988 1989*

2 3 1 Economic Reforms to Stabilise the Economy

In 1986 the country set itself to creating "an independent, integrated and self-sustaining economy[2] To that end, it has pursued an economic reform programme since 1987 intended to achieve sustainable economic growth and stabilise the economy The principle aims have been to restore producer incentives through appropriate pricing policies and greater reliance on market mechanisms, improve capacity utilisation of industries, and to mobilise and allocate public sector resources effectively In addition, the programme aimed at bringing about financial stability and lower the rate of inflation, thereby reducing imbalances in external accounts, promoting economic growth and instilling financial discipline[3]

To date macro-economic stability has not only greatly improved, but has also led to increased investment rates and faster economic growth The government budget is funded not by printing of money but largely from fiscal savings (**Table 2 2**) The dependence on coffee exports has also fallen Revenue collection as a percent of GDP has increased The dynamics between economy-wide policies and the environment can be complex To the extent that economy-wide policies have restored macroeconomic stability, their impact is unambiguously beneficial for long-term environmental management

For example, macro-economic stability has led to increased government financing of natural resources management institutions reduced encroachment of protected areas is already evident Second, with reduction in the inflation rates, speculative investments have greatly declined and the public is taking a longer-term perspective on investment, instead of "mining" the environment for short-term gain

Table 2 2 Key macro-economic indicators, 1986-present

	Average1986 1987 1991 1992	Average1992 1993 1994 995
Growth in Total GDP (% per year)	5 2	8 0
Growth in Monetary GDP (% per year)	6 7	9 5
Growth in Industrial Production (% per year)	11 8	15 2
Shares in total GDP (%)		
Agriculture	53 0	49 0
Industry	5 7	7 1
Recurrent Revenue (as % of GDP)	6 2	20 3
Total expenditure (as % of GDP)	14 6	9 7
Domestic Financing (as % of GDP)	1 2	1 5
Average end period inflation (% per year)	107 6	5 7
Private investment (as % constant prices GDP)	6 6	9 0
Private Transfers to Uganda (US$ Million)	104 8	300 0
Non coffee exports (US$ Million)	31 9	81 6

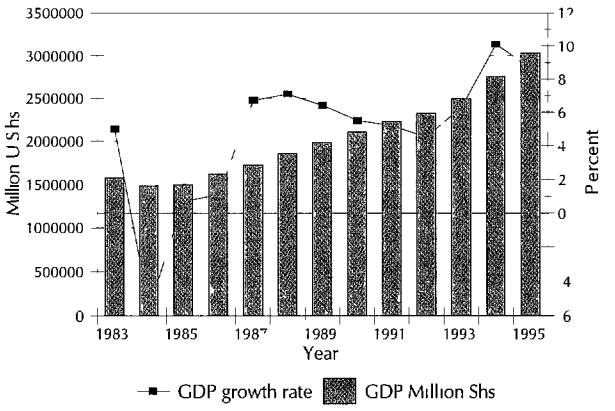
Source Ministry of Finance and Economic Planning (MFEP) [1996] Background to the Budget 1996 1997

2 4 UGANDA'S ECONOMY

2 4 1 Gross Domestic Product

The impacts and effects of economy-wide policies and environmental management are reflected in the trends and quality of macro-economic indicators GDP is one such indicator It measures the total output of goods and services produced by a country's residents It is calculated without deductions for depreciation of "man made" assets or depletion and degradation of natural resources **Figure 2 1** shows two major indicators the trends of the level of GDP and its growth rates since 1983 Since 1986, GDP at 1991 constant prices has risen from UShs 1,618,092 million to UShs 3,028,459 million in 1995 At the same time, the economy has registered impressive growth rates, with the highest of 10 6% being recorded in 1994-1995 All sectors of the economy have consistently improved since 1991 The growth in GDP is attributed to both a conducive macro-economic framework and increased output by individuals under a good system of governance For example, per capita GDP rose from UShs 105,435 in 1986, to UShs 120,849 in 1990 and UShs 144,731 in 1995 The improvement both in monetary values and growth rates of individual sectors is shown is **Table 2 3** Agriculture still dominates in monetary values, the construction sector has registered the highest growth rate of 23 5% in the last two to three years

Figure 2 1 GDP at constant (1991) market prices, 1983-1995 (U Shs million)

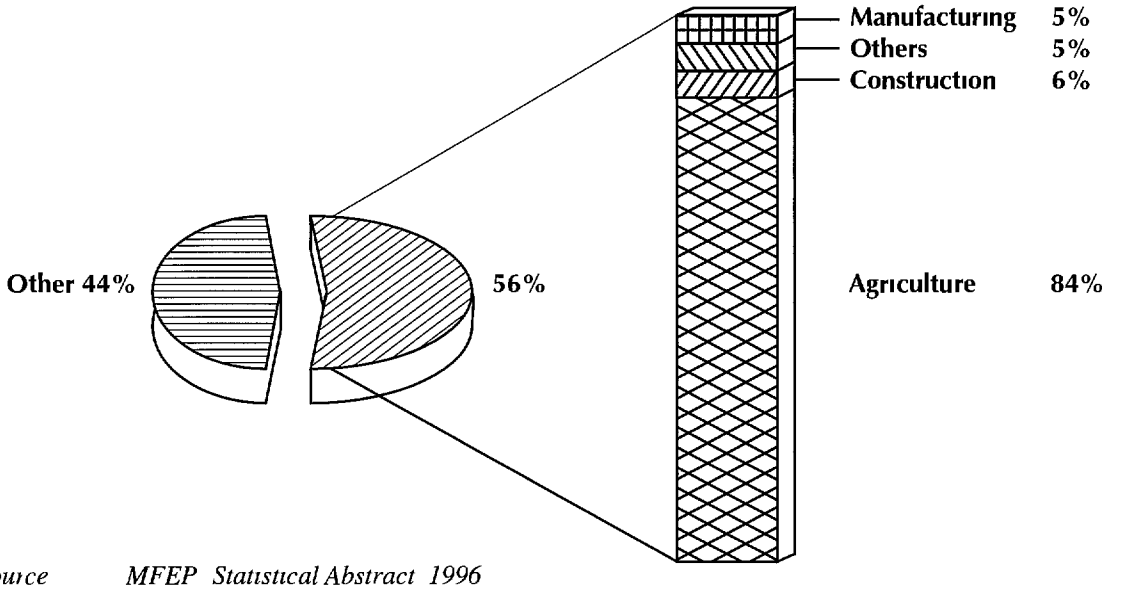


Source *(MFEP) Statistical Abstract 1996*

2 4 2 Natural Resource-based GDP

The importance of natural resources to Uganda's economy can be seen in its contribution to GDP All agriculture (cash and food crops, livestock, forestry and fishing) is based on using or harvesting natural resources Electricity and water, together with mining and quarrying, are predominantly resource-based sectors, as is housing About 50% of the construction and 30% of the manufacturing sectors are directly dependent on local resources Viewed from this perspective, the nature-based GDP as of 1995 was about 56% as shown in **Figure 2 2**

Figure 2 2 Composition of natural resource-based GDP 1995 at constant (1991) prices



Source *MFEP Statistical Abstract 1996*

Since independence, agriculture, industry and services have contributed shifting proportions to GDP as shown in **Figure 2 3** From 1965 to 1970 agriculture's contribution fell from 65% to 44%, as industry and services picked up This is a normal shift as a country develops However, this positive structural shift was reversed between 1970 and 1980 by 1980, agriculture's contribution to GDP had soared to

Table 2 3 GDP at factor cost at constant (1991) prices for the period 1991-1996 (Growth rates in percentages) (USh million)

Period	1991 to 1992	1992 to 1993	1993 to 1994	1994 to 1995	1995 to 1996
Agriculture	1,061 592 1 0%	116019 09	1 180 725 1 8%	1 250 419 5 9%	1 302,384 4 2%
O/W (out of which) Food crops	705 707 - 3 2%	792 566 12 3%	799 345 0 9%	860,880 7 7%	879 122 2 1%
Mining and Quarrying	6,782 10 4%	7488 1 10 4%	7 763 3 7%	8 471 9 1%	8 867 4 7%
Manufacturing	130 676 15 7%	139 787 7 0%	160 896 15 1%	188 143 16 9%	222 284 18 1%
Electricity	19 383 10 0%	2047 86	21 967 7 3%	24 461 11 4%	26 353 7 7%
Construction	122 169 1 3%	134 506 10 1%	149 690 11 3%	188 183 25 7%	232 396 23 5%
Commerce	268 819 6 6%	287 335 6 9%	314 218 9 4%	381 752 21 5%	429 913 12 6%
Transport and Communication	89 201 5 6%	94 644 7 2%	105 797 10 6%	120 232 13 6%	134,793 12 1%
Community services	331,832 9 3%	357 984 7 9%	380 718 6 4%	408 115 7 2%	431 534 5 7%
Owner-occupied dwellings	64 362 2 9%	66 765 3 7%	69 636 4 3%	74 441 6 9%	80 396 8 0%
Total Gross Domestic Product	2 094 816	2 270 177	2 391 410	2 644 217	2 868 922
Real GDP growth rates	3 1%	8 4%	5 3%	10 6%	8 5%

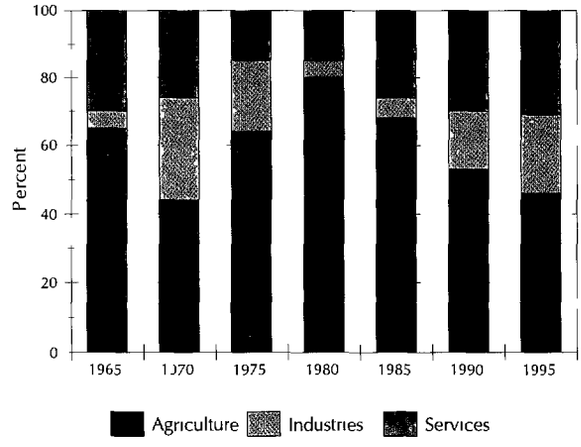
Source *Statistics Department Ministry of Finance and Economic Planning*

80%, while that of industry and services had greatly declined Only recently agriculture's contribution to GDP began to fall again This is good because it relieves labour from the natural resource base to industry and then to services Good macro-economic policies will have to be pursued further to sustain this positive trend It must also be noted that much of the growth in the industrial sector results from the rehabilitation of old industries as opposed to the growth of new ones

2 4 3 "Greening" the GDP

As has long been known, conventional measures of economic activity, such as GDP and national income, are limited indicators of social welfare Certainly, they do not accurately reflect environmental degradation and consumption of natural resources Estimating the costs of environmental damage in Uganda is in its infancy but studies elsewhere have revealed that GDP is lowered by 1 to 5% because of environmental degradation With much soil degradation, deforestation and some pollution, Uganda is undoubtedly also paying a very high cost, although this has not yet been measured Taking the above scenario, Uganda could be losing between UShs 277,000 million and UShs 1,388,000 million per annum It is gratifying, nonetheless that under the national environment management policy, government plans to start initiatives for "green" or environmental accounting This involves integrating environmental costs and benefits into economic planning and development at all levels of government in order to reflect the true costs and benefits of development

Figure 2 3 Trends in the contribution of agriculture, industry and services to GDP, 1965-1995



Source World Resources Institute World Tables 1996 1997

2 4 4 Gross National Product (GNP) per capita

GNP measures total domestic and foreign value added, claimed by residents It comprises GDP plus net factor incomes from abroad, which is the income residents receive from abroad for factor services (labour and capital), less similar payments made to non-residents who contribute to the domestic economy Thus GNP per capita shows the income available per person for use Ideally, the higher the GNP per capita, the better for every one person because the choice of goods and services is broadened Where GNP per capita is low and the majority are poor, there is limited choice Such a situation tends to exacerbate environmental problems

In 1966, Uganda's GNP per capita of US$ 160 was higher than that of Kenya (US$ 120), Tanzania (US$90) and Thailand (US$150) But Uganda's average annual growth rate of -2 4% between 1965 and 1990 was the lowest in all of SSA The need to invest in governance for poverty eradication, economic policy framework and productive sectors is therefore evident In 1991, GNP per capita was estimated at about US $170 and in 1996 at US $220 still substantially below that of Kenya and only about 5% that of Thailand

2 4 5 Annual Inflation

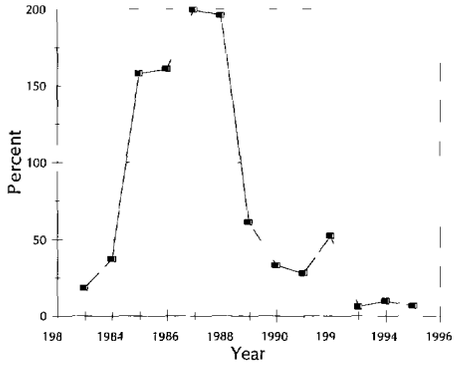
Persistent high inflation undermines confidence in a country's currency and causes speculation It also encourages use of resources in high-yielding short-term activities and curtails investment in activities whose benefits are realised after a long period Most environmental investments like land improvement, technology adoption, and conservation fall in the latter category and are at a disadvantage during high inflationary times Controlling inflation has been one of government's preoccupations Benefits have already been realised inflation has systematically been reduced from a high of 200% in 1987 to 5% in 1996 (**Figure 2 4**)

2 4 6 Savings and Investment

Increasing savings is extremely important for the growth process In 1986 gross domestic savings stood at 5 5% of GDP Since then, domestic savings have fallen to between -1 2% and 1 1 % A slight improvement was observed in 1994, but, by and large, domestic savings have been low, forcing Uganda to rely on foreign assistance to finance domestic investment

After 1986, investment recovered rapidly through 1989-1990, driven by the rehabilitation of infrastructure and productive capacity, but investment as a share of GDP (at 1991 market prices) stagnated and then declined between 1991-1992 and 1993-1994 (**Figure 2 5**) Investment averaged around 20% of GDP in all of Africa in 1987-1994, the average in Uganda was around 15% Investment in structures has increased, but the share in equipment and machinery has fallen precipitously since 1987 In short, Uganda has experienced a period of growth with only modest investment possibly because the economy started far below the previous peak Since 1995, however, a substantial increase in investment in structures as well as equipment and machinery is starting to be realised

Figure 2 4 Annual Rate of Inflation 1983-1995



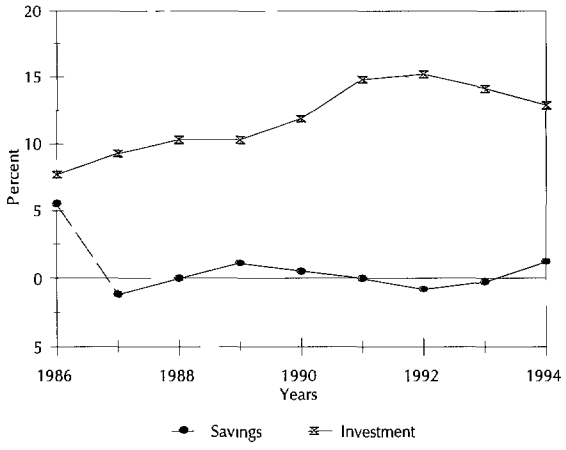
Source *MFEP Statistical Abstract 1996*

2 4 7 Balance of Payments Position

The balance of payments position had worsened from 1990 (US$ -85 8 million) to 1991 (US$ -107 5 million) to 1992 (US$ -122 5 million) Since a positive balance of payments cushions against external and internal shocks, the above trend was not conducive to sustained economic development

However, there has been consistent improvement since 1993 with an overall surplus of US $ 8 6 million in 1993, US$ 106 2 million in 1994 and US$ 141 4 million in 1995 (**Figure 2 6**) This performance

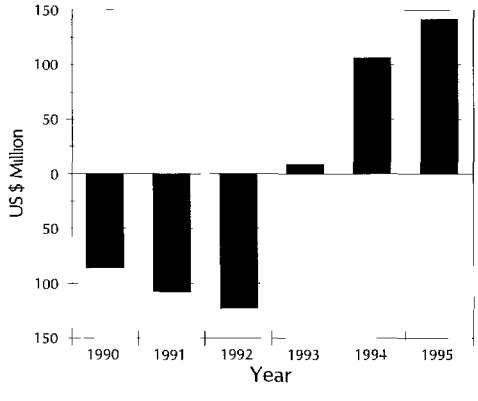
Figure 2 5 Savings and investment (as % of GDP at market prices)



Source *World Bank (1996) Uganda The challenge of the growth and poverty reduction A country study*

has enabled Bank of Uganda to strengthen its foreign reserves to the equivalent of just over 4 months of imports of goods and services By April 1996, the foreign exchange reserves of Bank of Uganda had reached US$ 606 5 million, an increase of US$ 91 5 million over the end of June 1995 This improvement comes both from increased inflows of foreign exchange (mainly for investment) and from good non-coffee export performance Such increases in reserves help the country to manage its foreign debt However, the trade balance must improve from its recent negative balances if the balance of payment position is to even increase from the present level By remaining highly indebted, while at the same time failing to improve its balance of payments account, Uganda narrows its options for funding general economic development and environmental management in particular

Figure 2 6 Balance of payments trends 1990 - 1995



Source *Ministry of Finance and Economic Planning Statistics Department 1996*

2 4 8 Public Finance

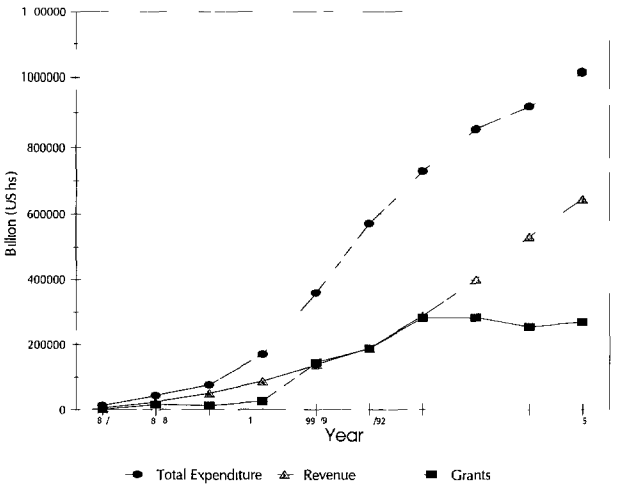
The government has been preoccupied with both balancing the budget (spending within the revenue generating capacity) and raising sufficient revenue to finance expenditure The first major step towards raising revenue was the establishment of Uganda Revenue Authority (URA) in 1991 to collect

revenue on behalf of government since then revenue collection has improved The second was to broaden the export base As far back as 1985 export taxes, particularly on coffee accounted for 67% of the revenue, a factor that was a disincentive to the sector In 1995, export taxes as percentage of revenue collection had dropped to only 3 5% Overall, revenue collection has risen from merely USh 11 4 billion in 1986-1987, to USh 358 2 billion in 1990-1991, and USh 1,013 5 billion in 1995-1996 This is reflected in **Figure 2 7** **Figure 2 7** also illustrates that

(i) The total funds available to pay for public expenditures have risen tremendously in recent years, with greater changes being witnessed following the establishment of URA This demonstrates that good institutional reform is conducive to macro-economic management

(ii) With increase in tax revenue collections, the proportion of grants to total funds available has started to fall, particularly over the last two financial years, showing a positive step to augmenting the policy of building a self-financing economy The tax revenue as a percentage of GDP has now reached almost 12%, from a mere 6% in 1986 This, however, still lags behind the estimated SSA level of 18% **Figure 2 7** also shows the deficit between expenditure and total revenue gap, which needs to be closed or reduced Public expenditure in Uganda is about 18% of GDP, which is also below the SSA average of 28%

Figure 2 7 Government expenditure, revenues and grants, 1986 - 1996



Source *MFEP Statistical Abstract 1996*

It is important to reduce the dependence of Uganda's public sector budgets on external finance such financing may not be permanently available, donor resources and preferences change over time Also, donor requirements may limit the flexibility of public expenditure and cause additional costs or delays Aid creates dependency that adversely affects private behaviour and public choice and may result in less than optimal economic performance and growth The government is thus still challenged to increase contributions from domestic taxation to finance public spending

Despite the progress made todate, a number of factors still account for low revenue effort in Uganda First, the transition from reliance on subsistence and informal economic activity, to which the economy retreated during the long period of civil strife, has been relatively slow Second income levels are low and direct taxation of the large agricultural sector is limited At the same time, industrial and service

sectors are small and hence formal employment is low Third, revenue leakages are substantial because of exemptions, smuggling, corruption and weak information and accounting systems Fourth, Uganda has a poor tax paying culture, which will take time and education to change As a result, taxes on international trade (particularly imports) still contribute well over 50% of total revenue When the revenue is still low, there is little by way of investment that is ploughed back to the various competing sectors, including those charged with environmental management and conservation

2 4 9 International Debt and External Assistance

As noted in **Section 2 4 8**, the failure to earn enough foreign exchange and mobilise sufficient local revenue compels Uganda to finance most of its expenditure by borrowing However, the country also currently benefits from substantial inflows of external aid from donors partly due to the tremendous goodwill it enjoys

Today, the total debt stock is estimated at US$ 3 2 billion **Figure 2 8 (a)** shows that debt stock has consistently risen, now constituting 60% of GDP and 475% of the value of goods and services Further, in 1996, the total debt service due was US$ 164 3 million Debt service as a percentage of exports of goods and services is 24% There is one conclusion Uganda still has a heavy debt burden The long -term solution will lie in increased production through increased savings and investment Debt relief, cancellation, and debt-for-nature swaps are growing in popularity as incentives to developing countries on environmental grounds Uganda is set to benefit from the Heavily Indebted Poor Countries Initiative, which was launched last year to provide relief to countries with a three year track record of good economic performance under a joint IMF/World Bank reform programme More than 50% of the debt is owed to the International Development Association (IDA) of the World Bank, bilateral debt totals almost 22% The International Monetary Fund (IMF) is owed about 10% of the debt (**Figure 2 8 (b)**)

In general terms, external assistance to Uganda has been declining since peaking at US$ 652 million in 1990 It fell to US$ 634 million in 1991, US$ 580 million in 1992, US$ 531 million in 1993, and US$ 566 million in 1994 Further, the proportion of grants to total external assistance has fallen from 55 3% in 1993 to 35 1% in 1994[5] Much of the assistance has gone to support economic management measures, about 30% has supported natural resource and environment-related activities (**Figure 2 8 (c)**)

2 4 10 Encouragement of Direct Private Investment

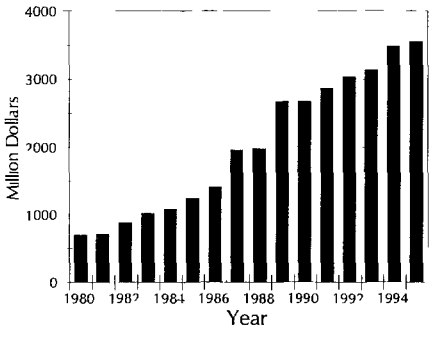
With growing debt stock, government undertook to encourage direct private investment as one of its development strategies It established the Uganda Investment Authority in 1991 as a one-stop centre to licence investments and provide policy guidelines The resulting advantage is that the private sector is now funding sectors for which government previously borrowed money By the end of 1995, more than 1700 projects, valued at US $2 5 billion and offering employment to over 107,500 people had been registered The distribution of this investment among the sectors of the economy is shown in **Figure 2 9**

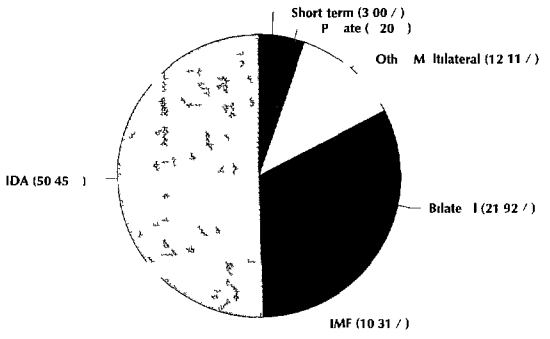
2 4 11 Monetary Indicators

A strong and vibrant financial sector is vital for sustainable development There are two main linkages between the financial sector and macro-economic policy, both of which bear on the use of the natural resource base First, some problems like unattractive interest rates and weak liquidity contribute to

Figure 2 8 International Debt trends and its allocation among creditors or donors, 1980 - 1996

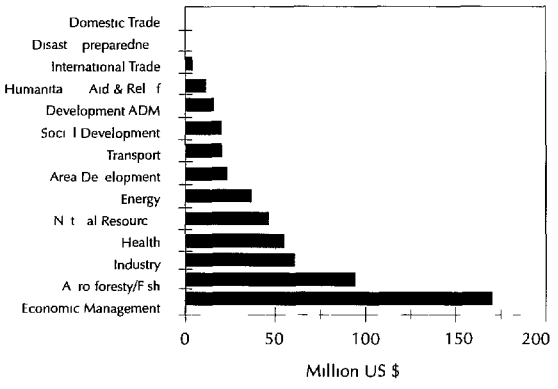
(a) International Debt Trends 1980-1995 (b) Allocation of Debt among Debtors (1996)





Source *World Bank (1996) Trends in Developing Economies*

(c) Distribution of External Assistance by Sector 1994 ('000 US $)



Source UNDP Development Cooperation Uganda 1993 1994 Report

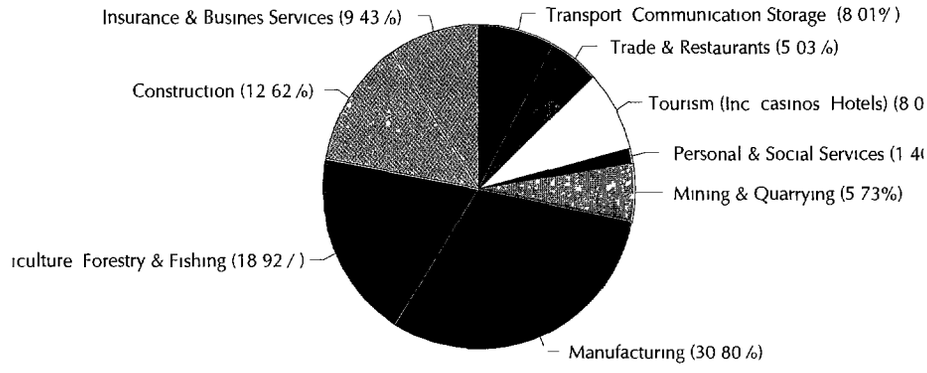
macro-economic instability Second, the ability of financial markets and institutions to mobilise and allocate resources efficiently depends heavily on the existence of a stable macro-economic environment As indicated earlier, Uganda's internal savings have remained low There are two reasons why

First, the interest rates on savings deposits are lower than the average rate of inflation, rendering real interest rates negative Depositors have no incentive to hold savings accounts Second, the low ratio of financial savings to GDP is due to the lack of capacity and the necessary infrastructure by commercial banks to mobilise rural savings The situation is aggravated by the fact that there is a wide margin between the savings and lending interest rates (the latter being much higher than the former)

Thus the small holders who constitute the biggest proportion of the productive enterprises are disadvantaged in accessing capital for investing in land, new technologies and conservation practice Realising this, the government is taking steps such as restructuring the largest commercial bank, UCB,

and vigorously implementing the Financial Institutions Statute The second largest commercial bank, the Co-operative Bank Limited, has opened up its capitalisation to strengthen itself Once the restructuring has been completed and with improvement in infrastructure, the cost of financial intermediation is expected to fall, subsequently leading to a reduction in interest rates Overall, the commercial banking system is in a precarious state More than 15 of the commercial banks made losses in 1994 and had a large negative core capital of over UShs 100 billion

Figure 2 9 Uganda Investment Authority licenced projects July 1991-December 1995



Source *Uganda Investment Authority (UIA) Computer Service Division*

2 4 12 The Human Development Index [HDI] for Uganda

Economic development should also be reflected in the social indicators of the country Since 1990, the Human Development Report has presented the human development index (HDI) to capture as many aspects of human development as possible in one simple composite index As a composite the HDI consists of three basic indicators life expectancy educational attainment, which represents knowledge and capacity to improve training and job potential, and real GDP (in purchasing power parity), which represents money needed to sustain a decent standard of living The HDI value for each country indicates how far it must still go to attain certain defined goals (highest levels set for each indicator in a given country) such as an average life expectancy of 85 years, access to education for all, and a decent standard of living The HDI's maximum value is 1, thus the difference between the country's value and 1 shows the shortfall in HDI Presently, Uganda's HDI stands at only 0 326, implying a shortfall of 0 674[6] Uganda takes the 155th position among 174 countries for which HDI was calculated in 1996

Even though Uganda's economy has been growing at an impressive average rate of 6% since 1986, the link between that economic growth and human development is still weak, and improvement should not be expected to be automatic If the links remain weak, they may become mutually stifling as the absence of one undermines the other **Table 2 4** indicates Uganda's relative position worldwide with respect to the HDI measure The level of human development in Uganda is clearly very low by standards of even the least developed countries and sub-Sahara Africa (SSA) The situation is even more alarming when compared with that of industrialised countries

Table 2 4 Uganda HDI rating at global level 1993

	HDI 1993	Gap to be covered in full provision for human development (1 00-HDI)
Uganda	0 326	0 674
All developing countries	0 563	0 437
Least developed countries	0 331	0 669
Sub-Saharan Africa	0 379	0 621
Industrialised countries	0 909	0 091
World	0 746	0 254

Source *UNDP (Uganda) (1996), Uganda Human Development Report*

Table 2 5 Regional human development index - Uganda (1992)

Region	Indexed life expectancy	Indexed educational attainment	Index adjusted income	Total	HDI	Rank
Central	0 40	0 570	0 23	1 210	0 403	1
Western	0 40	0 463	0 11	0 973	0 324	2
Eastern	0 40	0 457	0 11	0 967	0 322	3
Northern	0 31	0 410		0 820	0 273	4
Uganda	0 39	0 483	0 14	1 013	0 338	-

Source *UNDP (Uganda) (1996) Uganda Human Development Report*

To understand regional disparity in human development, locally-desegregated regional HDIs were computed[7] These are shown in **Table 2 5** They reveal a systematic pattern of imbalance with the central region consistently scoring highest in all indices, followed by western, eastern and northern in that order

Of the three basic human development indicators the income index is the lowest, implying that poverty is a serious impediment to human development in Uganda Poverty is followed by life expectancy, implying poor and unhealthy conditions of living The HIV/AIDS epidemic is one of the factors explaining low life expectancy in Uganda Although Uganda's educational level is still in the low HDI category, it is relatively better compared to life expectancy and poverty

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CHAPTER THREE

3 0 LAND RESOURCES AND TERRESTRIAL ECOSYSTEMS

3 1 LAND RESOURCES

3 1 1 Land Use/Land Cover in Uganda

Land may be defined as a complex system comprising its topography, spatial dimensions, soils, minerals, water and *Biota* (including plants, animals and micro-organisms in all their diversity) Uganda's land area is estimated at 236,000 sq km comprising cultivated areas, arable but uncultivated areas rangelands, mountains and built environments (roads and urban areas) as shown in **Figure 3 1**

Land and its components are organised in terrestrial ecosystems which provide a variety of functions and services Uganda's land and the processes which take place on it are also an important component of the global biogeochemical cycles While the country's land resources hold much potential for agricultural development, they can be easily degraded if put under uncontrolled agricultural production Inappropriate and uncontrolled land uses are a major cause of degradation and depletion of land resources

Uganda s present land use pattern disregards actual potentials, carrying capacities and other limitations of land resources Without appropriate care and attention to these resources, there is a real danger that the country's environment will suffer irreversible damage Where rehabilitation is possible, the costs are likely to be prohibitive

3 1 2 Key Issues Facing Land Resources in Uganda

There are a number of issues confronting the land resources of Uganda They include the following -

fragility of ecosystems,
tenure arrangements, and,
land use planning

Ecosystems Fragility

Overall for Uganda, the most fragile ecosystems are the highlands and drylands

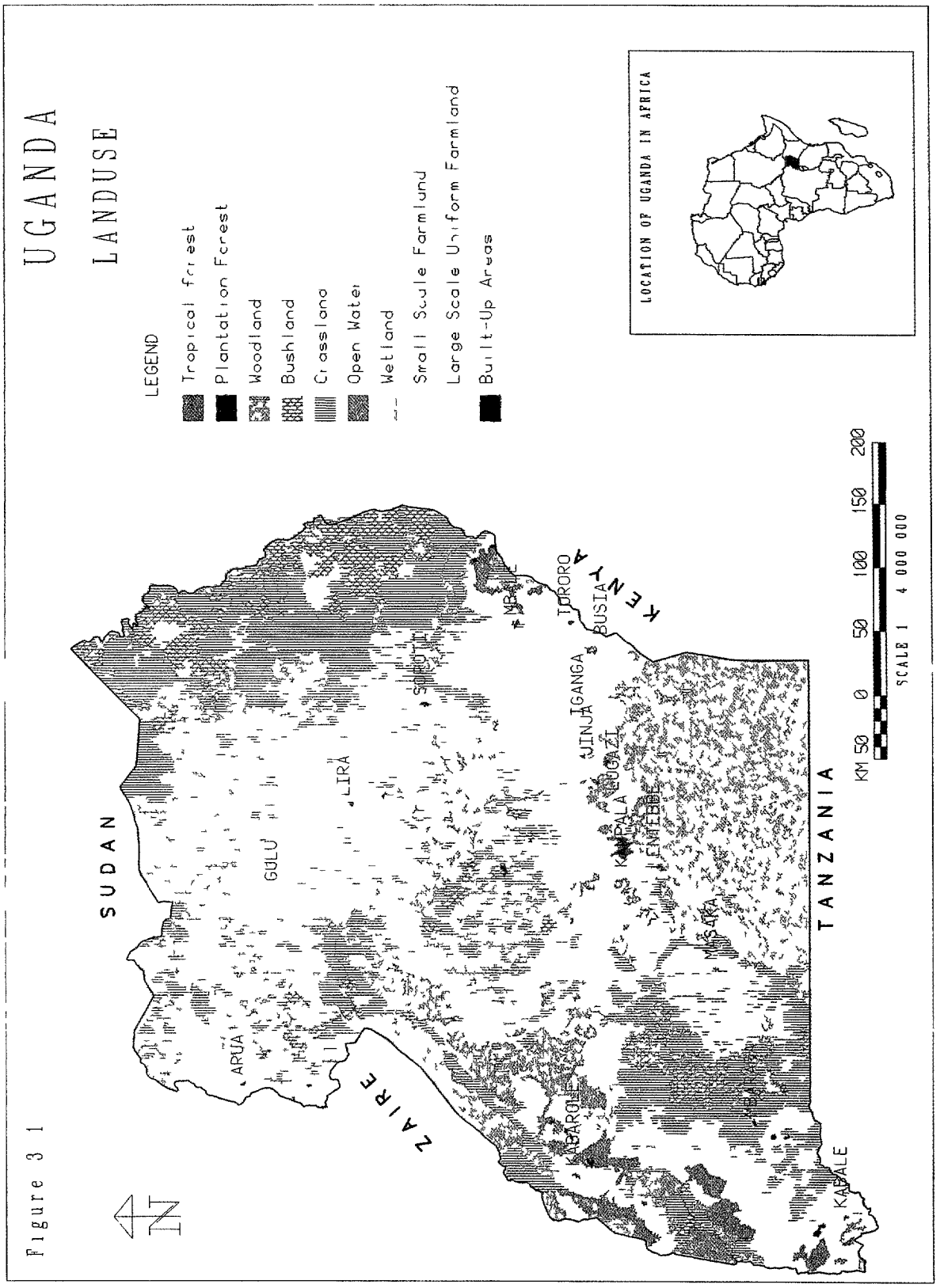
(1) **Highlands**

Uganda's highlands occupy about 7% of the country's total land area and are divided into south-western, eastern, western and north-eastern highlands They are a good example of tropical highlands and are indeed a unique environment Due to good climate, adequate rainfall and relatively high productivity, these highlands are relatively heavily populated except for the north-eastern area (**Table 3 1**) The population in the highland areas, as false where in Uganda, consists mainly of peasants dependent on indigenous agriculture

There is serious degradation of Uganda's highlands as a result of population pressure People have been forced to reclaim steeper slopes with the resulting negative consequences of soil erosion, mass

Map

Figure 3 1 Land use/Land cover, 1996



wasting and land fragmentation, although there is little quantitative information on their extent and degree of severity

In response to erosion problems in the highland areas, a number of measures have been initiated, including

- soil erosion control projects and studies (Rockfeller Foundation support and individual academic research),

- highlands of Uganda have become centres for conservation and development activities primarily centred around the welfare of local communities neighbouring particularly the fragile ecosystems The ideas have been developed locally but funded by donors (such as WWF, Rwenzori Mountains Conservation and Development Project, CARE-DTC activities around Mgahinga and Bwindi National Parks, IUCN-Mount Elgon Conservation and Development Project) These projects teach and create public awareness on conservation measures, including funds, terraces, contours and cover crops To further reduce pressure on the ecosystems, communities are encouraged to pursue income-generating activities such as bee-keeping and eco-tourism,

- a Mountain Resource Centre has been set up at Makerere University's Geography Department to undertake research, document information and create awareness of the high mountains of Uganda, and,

- environment committees in districts are to identify hilly and mountainous areas prone to degradation and initiate restoration and afforestation of hill-tops, hill-sides and other exposed mountainous areas The committees are also to issue guidelines on the sustainable utilisation of highland ecosystems

(ii) Drylands

In 16 out of the 39 districts of Uganda, large areas are categorised as dryland ecosystems These unique ecosystems pose great challenges for the management of Uganda's environment
The predominant pre-occupation in dryland areas is livestock production Although human population is sparse in these areas, the cultural attitudes of the people, coupled with survival coping considerations, have resulted in overstocking Thus, drylands' carrying capacities are frequently exceeded, leading to overgrazing and erosion Desertification in some dryland areas is already pronounced, including Karamoja, Buruli county in Luwero district, and Kakuto country in Rakai district

The Cattle Grazing Act 1964 attempts to control soil erosion by regulating the number of animals which can be grazed on a given area Under the Act, the Veterinary Officer responsible for the area is empowered to make an order prescribing the maximum allowable number of cattle The Act is a good piece of legislation but it is not adequately enforced as evidenced by the increasing degradation of drylands The drylands also support some crop production partly because of government policy promoting non-traditional agricultural export crops Large areas have been opened up in the drylands for the growing of simsim, maize and sorghum, far in excess of normal consumption requirements The fragility of the drylands ecosystem calls into question the sustainability of these agronomic practices without significant inputs of agrochemicals

Table 3 1 Population densities of districts in Uganda's highland areas.

Highland Area	District/Uganda	Population density per Km2 (1991) (excluding Protected Areas)
South western	Kisoro Kabale Rukungiri	301 246 279
Western	Bushenyi Kasese Bundibugyo Kabarole Nebbi	207 232 294 92 114
Eastern	Mbale	319
North eastern	Kotido Moroto	15 12
	Uganda	85

Source *The Population and Housing Census Report, 1991*

Land Tenure Systems

Land tenure refers to the manner in which land is owned, occupied, used and disposed of within a community A properly defined and managed land tenure system is essential to ensure balanced and sustainable development Until 1975, there were four types of land tenure systems in Uganda customary, *mailo*, freehold and leasehold

(i) Customary Tenure

The customary land tenure is the most dominant in Uganda This is the system whereby land is owned and disposed of in accordance with customary regulations Specific rules of customary tenure vary according to ethnic groups and regions Often customary tenure is superimposed on other systems like *mailo* and freehold This tenure system also exists on its own as communal land ownership One advantage of this tenurial system is that people have lived with it for a long time and therefore understand it One disadvantage is that it does not encourage record keeping, often making it difficult to resolve land use conflicts Environmentally, the main disadvantage is that it generates little personal interest in the status of land resources ("the tragedy of the commons"), leading to mismanagement and degradation Previously, when human populations were low, the environment could absorb the impacts of human activities It now appears, however, that the assimilative capacity of Uganda's environment under customary tenure is exceeded in several areas of the country

(ii) Mailo Tenure

Mailo tenure was introduced as a result of the 1900 Buganda Agreement Under this agreement, land was divided between the *Kabaka* (King) of Buganda, other notables and the Protectorate Government The basic unit of sub-division was a square mile (hence the name *mailo*) Originally, there were two categories of ownership under the *mailo* system (*private and official mailo*) Official *mailo* land was transformed into public land in 1967 Under this system, land is held in perpetuity and a certificate of title is issued The principal advantage of this system is that it provides security of tenure, thus allowing long-term investments including those related to conservation Absentee landlordism and lack of access by regulatory agencies are disadvantages that limit sound environmental management Absentee landlordism encourages squatters on *mailo* land These squatters have no incentives for the sustainable management of a land resource they do not own To the extent that *mailo* land is private, resource management regulatory agencies have limited authority over what happens on it For instance, much of the deforestation occurring in the districts of Buganda is on *mailo* land There are no clear mechanisms which allow the Uganda Forest Department to regulate the private forests on these lands

(iii) Freehold Tenure

In the freehold tenure system, ownership is also in perpertuity, and a certificate of title is issued The system was originally established to address limited and quite specific requirements or requests, say by religious organisations Freehold tenure was also granted as a result of the Toro Agreement of 1900, Ankole Agreement of 1901 and Bunyoro Agreement of 1933 The Crown Lands Ordinance of 1903 gave the British colonial authorities power to alienate land in freehold This system is mainly found in parts of eastern and western Uganda Apart from parcels of land under the freehold system being smaller, it has a lot of similarities with *mailo* tenure and shares the same environmental management problems In addition, due to heavier population pressures in parts of Uganda where freehold land tenures exist, land fragmentation is a common occurrence Land fragmentation has contributed to significant environmental degradation, although concrete data is lacking

(iv) Leasehold Tenure

Leasehold tenure is system whereby land is held based on an agreement between the lessor and the lessee There are two types of leasehold tenure arrangements, namely, private leases given to individual landlords and official or statutory leases given to individuals and/or corporate groups under public act terms The advantage of the leasehold system is that the lessor can attach conditions to the leases and has the right to revoke ownership in case of abuse The main disadvantages are that leases are costly and cumbersome to obtain, and hither to, the leases awarded have not addressed environmental concerns

The 1975 Land Reform Decree sought to improve upon tenurial arrangements for land The Decree substantially changed the legal basis of land tenure in Uganda by declaring all land in Uganda as public land administered by the Uganda Land Commission Freehold and *mailo* lands were converted into leases of 99 and 199 years for individual and public/religious bodies, respectively The provision which required consent of the customary tenant before grant of freehold (or lease) on public land was abolished

Prior to the 1995 Constitution of the Republic of Uganda, it was realised that the provisions of the Land Reform Decree 1975 had not been fully implemented due to among others, lack of budgetary provisions and personnel, and resistance by land owners under the previous system Consequently, both land owners and administrators continued to behave as if they were in the pre-Decree period It was recognised, therefore, that the country had reached a stage where it had to prescribe the type of and tenure that would benefit the country most in terms of environmental sustainability, agricultural productivity, and equitable resource sharing As a result of the previous land tenure arrangements land non-compliance with the Land Reform Decree 1975, it was observed that in Uganda there was

- lack of a clear land policy and national physical development plan,
- land fragmentation and exclusion of women from land (property) inheritance,
- open access to resources under communal land use,
- land degradation due to unsustainable methods of resource use, and,
- demographic pressure leading to encroachment into gazetted areas

Therefore the 1995 Constitution sought to introduce a better land tenure system for Uganda After prolonged debate by the Constituent Assembly (CA), it was resolved that the four tenure systems that existed before the Land Reform Decree 1975 be recognised On the coming into force of the 1995 Constitution, the following recommendations were made, that

- all Ugandan citizens owning land under customary tenure may acquire certificates of ownership in a manner prescribed by Government,

- land under customary tenure may be converted into freehold ownership by registration,

- any lease which was granted to a Ugandan citizen out of public land may be converted into freehold in accordance with law made by Parliament, and,

- lawful or *bona fide* occupants of *Mailo* land, freehold or leasehold land shall enjoy security of occupancy of the land

Government intends to introduce a new land bill in parliament The new bill aims to streamline the tenure system in accordance with the provisions of Chapter 15 of the Constitution

Land Use Planning

When the population of Uganda was small relative to land resources, activities were carried out without due concern to land use planning Such unplanned and uncoordinated uses, such as agriculture, urban development, rural settlements and road networks development, damaged the environment but the damage went largely unnoticed However, at present rates of growth, the population is set to double every 28 years Furthermore, the demands of urbanisation, although starting from a relatively low base (about 11% of total population resides in urban areas), are also putting pressure on the country's land resources, as is modernisation with the related increase in the affluence of the population According to the National Environment Action Plan (NEAP), 1995, at present Uganda does not have a comprehensive national land use policy Consequently, inappropriate land use activities are contributing to serious environmental degradation The NEAP suggests two objectives for remedial action

- to provide a coordinated, national approach to sustainable land use planning, and,
- to prepare national and local land use plans to help guide land use decisions in an environmentally-sound, sustainable and socially-acceptable manner

The NEAP recommends the following strategies to achieve the above stated objectives

- Review existing land legislation as part of the planning process
- Develop a comprehensive national land use policy and an enhanced land use planning system based on appropriate technology, such as Geographic Information Systems (GIS)
- Develop technically-appropriate, socially-acceptable and environmentally-sound rural and urban land use plans, capability classification, and guidelines for sustainable resource use
- Utilise the land use plans and the national land use policy and legislation to enable districts develop district-level land use guidelines and bye-laws, and employ a combination of enforcement and incentive measures to facilitate and ensure compliance at all levels
- Provide for continuous monitoring of land use at national and district levels

3 2 AGRICULTURAL RESOURCES (CROPS)

3.2 1 Crop Production

Uganda's economy is primarily agrarian and supports close to 90% of the country's population, which is rural The crop sub-sector is the main component of agriculture, with food crops alone contributing 67-75% of agricultural output, export crops account for over 70% of total earnings The country is endowed with a variety of soils, rainfall and altitude which allow for the production of a correspondingly large diversity of crops

- **Food Crops**

As a result of favourable climatic conditions, Uganda has continued to experience a marked increase in food production **Table 3 2** shows the level of production by area planted for selected years between 1970 and 1995 Food crop production was projected to increase by 3% during 1996

- **Traditional Cash Crops**

Uganda's traditional cash crops include coffee, cotton, tobacco, sugar (raw) and cocoa Cash crop production increased by 15 8% during the 1995-1996 fiscal year, the fastest increase ever recorded Liberalisation of the coffee sub-sector improved prices paid to farmers with export shares of the market remaining fairly constant during the 1995-1996 fiscal year In 1995 coffee exports amounted to about 168,800 tonnes The coffee sub-sector has experienced an influx of operators both for internal marketing and export In 1993-1994, the market share held by private exporters was 72%, followed by the Coffee Marketing Board Limited (CMBL) with 16% and Union Exporters (UNEX) with 12% During 1994-1995, the private exporters increased their market share to 80% while CMBL and UNEX took 10% each (similar figures were recorded for 1995-1996)

Table 3 2 Trends in area cultivated for food crops ('000 ha) for selected years

Year	Plantains	Cereals	Root crops	Pulses	Oil seeds	Total Food crops
1970	909	1 193	983	414	306	3 805
1980	1 173	732	557	329	164	2 946
1990	1 388	1 055	857	630	347	4 277
1991	1 430	1 099	849	643	364	4 385
1992	1 459	1 139	841	673	386	4 498
1993	1 488	1 220	869	694	402	4 673
1994	1 500	1 295	837	722	415	4 769
1995 (estimates)	1 511	1 290	875	750	428	4 854
1996 (projections)	1 519	1 321	910	779	439	4 968

Source *(a)* *World Bank 1993 Uganda Agricultural Sector Memorandum, Vol III, Statistical Annex Washington D C for the 1970 and 1980 statistics*

(b) *MFEP (1996) Statistical Abstract for Background to the Budget, 1996 - 1997*

World coffee prices rose between 1994 and 1995 increasing coffee earnings by more than 15% The 1995 export crop fetched US$ 384 12million compared to US$ 343 39million from 194,309 tonnes sold in 1994 Better surveillance during export certification has helped to improve coffee quality in the recent past

Tea production decreased by 5 7% from about 13,460 tonnes in 1994 to 12,690 tonnes in 1995, basically due to shortage and high cost of labour The quantity exported declined by 2 6% in the 1994 - 1995 period, and the value of exports went down by 26 3%[1]

The cotton industry is now fully liberalised, government policy has focused on transfer of ginneries to creditworthy proprietors to improve management Cotton production has not increased significantly, the reasons include the relatively higher margins realised from traditional food crops compared to cotton, slow restocking of cattle (for animal traction) in Teso region, unfavourable climate (erratic rains) in cotton-producing areas, and poor pest and disease control Areas planted decreased by 57% between 1985 and 1990 Available information indicates that 160,000 hectares were under cotton in 1985, compared to only 69,000 hectares in 1990 Export volume has, however, increased in recent years, from 3841 tonnes in 1994 to 5580 tonnes in 1995 This was influenced by relatively high domestic and international prices Pricing policies where good quality cotton fetches better prices have improved the marketing of the crop

There was a small increase in tobacco production during 1995-1996 Export volume, however, decreased from about 4080 tonnes in 1994 to 3520 tonnes, resulting in a decrease in value of 8% **Table 3 3** shows trends in area cultivated for traditional cash crops together with estimated yields

Table 3 3 Trends in areas planted ('000s ha) and yield (tonnes/ha) for Uganda's traditional cash crops

	Coffee	a Cotton	b Tobacco	c Tea	Sugar(raw)	Tobacco
(1)	**Area Planted**					
1978	223 0	667 5	4 1	20 9	31 3	14 4
1979	224 0	417 0	3 7	20 9	37 5	14 5
1980	224 0	312 4	3 3	20 9	31 0	14 5
1981	224 0	121 3	0 6	20 9	31 0	14 5
1982	224 0	150 3	1 1	20 9	31 0	14 5
1983	224 0	169 6	3 8	20 9	31 0	14 5
1984	224 0	199 4	3 2	20 9	31 0	14 5
1985	224 5	160 0	2 9	20 9	31 0	14 5
1986	224 7	180 0	1 4	20 9	31 0	14 5
1987	224 7	140 0	2 1	20 9	31 0	14 5
1988	224 7	98 9	2 7	20 9	31 0	14 5
1989	237 6	106 0	3 8	20 9	31 0	10 0
1990	240 0	69 0		20 9		10 0
(2)	**Yield**					
1978	0 54	93	0 34	2 61	256	14
1979	0 46	56	0 22	0 43	139	14
1980	0 60	60	0 12	0 36	139	7
1981	0 444	104	0 17	0 41	123	7
1982	0 74	104	0 55	0 62	106	7
1983	0 70	181	0 42	0 74	100	14
1984	0 62	188	0 63	1 24	77	29
1985	0 69	192	0 55	1 39	26	14
1986	0 64	152	0 64	0 79	0	7
1987	0 71	127	0 62	0 86	0	7
1988	0 70	156	0 96	0 84	200	14
1989	0 79	139	1 00	1 10	0	50
1990	0 79	263				100

Note on yield a - for cotton (kg seed), b - tobacco (flue/fired), c - tea (green leaf)

Source *World Bank Report (1993) Uganda Agricultural Sector Memorandum Volume III, Statical Annex*

3 2 2 Non-Traditional Agricultural Export Crops

Non-traditional agricultural export (NTAE) crops refer to those crops previously grown principally for home consumption The NTAE crops, that are gaining popularity among farmers include maize, beans and other legumes, bananas, groundnuts, and simsim Other new non-traditional and high value export crops are soya beans, pepper, vanilla, fruits and cut flowers The contribution of NTAE crops to the total export earnings of Uganda is shown in **Table 3 4** Promotion of NTAE crops is likely to have some impact on the environment as highlighted below

(i) Maize and Beans

Uganda has a significant comparative advantage for supplying the East and Central African regional market with maize and beans The most prominent maize growing districts are Kapchorwa, Iganga and Kamuli Bean production is concentrated mainly in Kabale and Mukono districts (IDEA/ANEPP,1994) Unfortunately little or no extension services are provided by the government and the private sector, resulting in low yields due to poor farming practices The average yield of maize is about 1 2 tonnes/ ha, well below the potential yield of 4 tonnes/ha, while bean yield is about 0 75 tonnes/ha It is anticipated that by 1998 maize yields will increase by 33%, and the focus will be the export markets in Kenya and Rwanda

One of the limiting factors to increasing the area under maize is the availability of family labour The increase in maize area is most likely to occur through substitution of other crops or bringing recent fallow land back into cultivation There is no evidence that forests or long-term fallow are likely to be cleared for maize or bean production, except in the special case of resettlement programmes Given the shortage of family labour and the cost of shrub clearance, it appears more than likely that maize will simply replace other less profitable crops In addition, farmers are less inclined to clear followed or new land simply to maintain the areas of the low-value food crops displaced by maize Although there is land scarcity in some areas, beans can be inter-cropped with other farm crops without significant displacement of traditional subsistence crops Neither maize or beans are likely to perform well on newly-reclaimed wetland soils, and the returns from these low-value crops would not justify the expense of reclamation The significance of the impact of maize and beans will depend on the type of natural ecosystem that will be put under the crop The loss of primary forest would be more significant than the reclamation of an area under short-term fallow It is inevitable that the increased production of maize and beans will be accompanied by the erosion of crop genetic resources through, for example, the introduction of improved maize and bean varieties into the farming systems It is thought that specific interventions should be instituted in order to curb the loss of crop genetic resources

Predictions by Meltzer *et al* (1994) indicate that maize yield in Uganda will increase from the current average of 1 2-1 5 t/ha using simple technologies to 2 8 t/ha with predicted improved technology In this respect, use of agro-chemicals is envisaged, giving estimates of 300kg of fertilizers and 2 litres of herbicides per hectare as the required rates to realise the high yield This trend, however, runs counter to the Integrated Pest Management (IPM) approach advocated by government Ideally, production increase will be through simple but proper production techniques which include proper crop husbandry/ agronomic practices, use of improved crop varieties, and minimising post-harvest losses If the latter practices are adopted, output per unit area would be enhanced, while at the same time reducing the

tendency for acreage expansion, which is often wasteful with accompanying negative impacts on the environment

Any increase in agro-chemical use is likely to be associated with seed dressing to reduce post-harvest losses and application of phosphatic fertilizers to improve production Dressed seed does constitute a hazard to health In contrast, while increased use of phosphatic fertilizers is likely to have a positive impact on soil and poses little environmental threat, phosphates, unlike nitrates, are less readily leached into water supplies However, if phosphates do leach into water resources, they will cause eutrophication

Unless cultivation methods are improved, the increase in maize production is likely to be unsustainable, and under pressure to generate income, farmers may resort to expanding the area under maize at the expense of other crops or environmentally-sensitive areas The key to reducing the pressure to expand the agricultural area is to secure increased crop production through greater yields per unit area There is considerable scope to improve the yields of both maize and beans, but sustainable increases can only be obtained through conservation of the valuable soil resource

(ii) Spices and Essential Oils

Currently only chillies, vanilla and pyrethrum are grown in any significant quantities for export In each case, extension advice is provided to the farmers by the processors/exporters Chillies are widely grown but harvesting is labour intensive and hence they tend to be grown where the opportunity cost to labour is low, such as in Mukono and Mpigi districts The Kibaale Forest Resettlement Scheme has potential for viable promotion of chillies Pesticides and fertilizers are rarely used in the production of these crops

Vanilla production is concentrated in Mukono district All vanilla is grown under shade, often in banana or coffee plantations, although better results are obtained when native nitrogen-fixing trees are used for shade It is envisaged that most of the expansion in vanilla will be centred in Mukono district

Pyrethrum has been reintroduced in Kabale district, mostly using subsistence farmers as outgrowers It is grown on the hill-tops and hill-sides above 2000m a s l These areas are extremely prone to soil erosion The private sector extension therefore places great emphasis on encouraging growers to adopt good soil management techniques
One of the occupational hazards associated with vanilla is poisoning (vanillism, as explained by Purseglove *et al,* 1981) Poisoning affects people who handle vanilla and occurs in two phases on-farm during planting and harvesting, and during later stages of curing, especially the conditioning operations The latex juices cause inflammation of the skin Although poisoning is not yet a serious problem in Mukono, it should be monitored Vanilla appears to be the best NTAE crop in that it does not involve the use of chemicals that affect the environment

The processing of essential oil crops may consume large quantities of energy and involve the use of volatile solvents such as hexane The use of even moderate amounts of steam and organic solvents present a risk of explosions, fires and solvent-related dermatological and respiratory diseases

The introduction of spices and essential oil crops hitherto not grown in Uganda increases diversity within agro-ecological systems Provided only agricultural land is brought under cultivation for the production of these crops, the promotion of spices and essential oil crops will have a positive impact on bio-diversity

Since pyrethrum is planted on the hill-tops and ridges in already cleared agricultural lands, it does not pose a threat to protected areas (the case of Kabale) On the other hand, because pyrethrum grows on the upper areas of the landscape, where streams originate, some of such catchments might be degraded It should be noted, however, that pyrethrum is not the initial cause of degradation of these catchments In addition, pyrethrum is not suited to valley sides or valley bottoms and therefore must be grown largely on steep slopes, a fragile easily eroded environment where pyrethrum provides poor vegetation cover Finally, much time is often devoted to pyrethrum at the expense of other crops, thus reducing labour available for food crop production This may have long-term negative implications for food security

(iii) Cut Flowers

Although the growing and collection of flowers has a long history in Uganda, flower-growing activities on a commercial basis are a new phenomenon in Uganda's farming systems The promotion of floriculture is largely attributed to Government and USAID The market, especially in Europe, offers good opportunity for increased incomes in the hands of the growers Cut flower growing started in Uganda in 1992, after careful assessment of the potential/feasibility of this agricultural investment by the Export Policy Analysis and Development Unit (EPADU) This activity is continuing to expand, initially started by specialised firms growing the crop in greenhouses Gradually out-growers have joined the business Mukono and Mpigi districts are the key areas where the crop is grown, most notably within a 45km radius of Kampala This is near the key infrastructure, such as Entebbe Airport The current production has replaced low-value crops or is occurring on land reclaimed from fallow No wetland has yet been reclaimed for production of flowers

Cut flower production is associated with very intensive use of agro-chemicals and is currently considered the leading user of these chemicals (fungicides, pesticides, and fertilizers) in terms of quantity per unit under the crop Thus, there is bound to be increased chemical loading of the environment, especially in soils and water The main health and safety concern arises from the high risk of exposure to agro-chemicals, especially the pesticides Thus, much as Uganda is in need of the good economic returns associated with floriculture, measures must be put in place to ensure that these benefits are realised without harming the environment There is likely to be a corresponding increase in incidence of pests and diseases, which may result in increased application of agro-chemicals to counteract the problem It is possible that the pests and diseases may acquire tolerance or resistance to these chemicals if application regimes and rates are not adhered to This will in turn call for application of completely new chemicals, probably more toxic and hence more dangerous to the environment Reduction of the use of agro-chemicals in the floricultural industry could be achieved through promotion of seeded annual flowers which require less use of chemicals (although the market value for annuals is lower than that for perennial roses) and Integrated Pest Management (IPM), which involves a combination of agro-chemicals, biological control and other methods

Cut flower growing is, not likely to encourage extension of farms into virgin land, since farmers currently prefer locating floricultural farms on land already opened up for other farming purposes

(iv) Vegetables

The main concern in the expansion of vegetable growing is the category of farmers who are new entrants to this activity Those already growing vegetables do so on already cultivated land, but the new export-oriented entrants tend to clear forested areas The promotion of vegetable growing is associated with the significant soil erosion and local reduction in bio-diversity caused by forest clearance This is an adverse environmental impact, especially when reduction in bio-diversity includes the improper use of pesticides, which eliminate non-target or even beneficial insects Since government extension services are limited, small farmers after receive misleading advice from exporters who are often not trained agronomists

3 2 3 Issues in Agriculture

The overall agricultural sector policy objectives of Uganda are to increase agricultural productivity to ensure food security and self-sufficiency in raw materials for the agro-processing industry as well as surplus for export, increase incomes and reduce poverty through increased sales of agricultural surplus, and, diversify the country's exports through the promotion of non-traditional agricultural export crops Already the growing of flowers, oil crops, spices, vegetables, mulberry trees (silkworm) and fruits is gaining ground Thirty-one of Uganda's thirty-nine districts are already growing mulberry trees, actual silk production is on trial in 24 districts

It is important to be aware of the associated environmental impacts of plans to increase national output Agricultural activities, unless carefully planned and controlled, have negative environmental impacts The key issues considered in this report include the following

- soil degradation land tenure
- farming systems
- agro-chemical usage
- technology
- food security

• Soil Degradation

Degradation of soil in cultivated areas has been mentioned under the various sub-sections of **Section 3 2**, but its importance warrants separate treatment The main cause of soil deterioration and declining productivity include increasing population, inappropriate farming practices, and changing land use, resulting in over-cultivation and absence of fallow periods There is evidence of declining soil productivity, especially in fragile ecosystems However, information on the extent of land/soil degradation is sketchy and fragmented There is limited use of improved farming techniques and inputs to ensure soil conservation This is particularly obvious in the intensive banana, coffee and annual food crop montane farming systems in the south and southwest of Uganda, and the medium altitude coffee-growing areas of Mount Elgon

Land fragmentation and a multiplicity of land ownership arrangements further hinder adoption of improved soil conservation techniques which minimise soil degradation and possibly even restore soil productivity

Table 3 4 Domestic exports by percentage principle products, 1990 - 1995

Commodity	1990	1991	1992	1993	1994	1995
Traditional export crops						
Coffee	80 3	64 2	65	53 1	53 1	69 3
Cotton	3 3	6 4	5 6	2 7	2 7	1 8
Tea	2	3 7	5 3	5 5	5 5	1 6
Tobacco	1 7	2 5	2 9	3 5	3 5	1 3
Sub total	**87 3**	**76 8**	**78 8**	**64 8**	**64 8**	**74**
Non traditional exports						
Maize	1 9	2 3	2 7	11 6	11 6	3 5
Beans and other legumes	2 4	2 3	1 9	6 3	6 3	2
Fish and fish products	0 8	2 9	4 4	4 4	4 4	3 2
Cattle hides	2 3	1 8	2 3	2 6	2 6	0 1
Sesame seeds	3	5 7	4 4	1 4	1 4	1
Soya beans		0 3		1	1	0 2
Soap				0 6	0 6	0 5
Electric current	0 7	0 5	1	0 4	0 4	0 4
Cocoa beans	0 3	0 2	0 2	0 4	0 4	0 1
Goat and sheep skins	1 2	0 5	0 5	0 3	0 3	0
Hoes and hand tools	0 1	0 2	0 3	0 2	0 2	0 4
Pepper		0 1	0 1	0 2	0 2	0
Vanilla		0 1		0 2	0 2	0
Live animals	0 1			0 1	0 1	0
Fruits				0 1	0 1	0
Groundnuts		0 1	0	0 1	0 1	0 1
Bananas		0 1	0 1	0 1	0 1	
P				0 1	0 1	0
Ginger		0 1	0 1	0 1	0 1	0
Gold		5 3	0	0	0	4 2
Other products (1)	1 6	1 3	3 2	5	5	10 1
Sub total	**12 7**	**23 2**	**21 2**	**35 2**	**35 2**	**26**
Total All Exports	**100**	**100**	**100**	**100**	**100**	**100**

Note (1) - Includes some re-exports, and therefore over-states the true level

Source *MFEP Statistical Department Statistical Abstract, 1996*

Ferrisols and eutrophic soils are the most productive and are found all over the country Ferruginous soils are scattered throughout the country, but are concentrated in Tororo and Gulu districts Ferruginous soils are less productive and require careful usage to preserve their poorly developed top-soils The lighter soils unlike heavy soils are more susceptible to leaching **Box 3 1** gives an insight into soil degradation and possible restoration of soil productivity Several initiatives are underway or are proposed or considered feasible for addressing the problem of soil degradation, including

- Zoning the country to facilitate utilising soil for the use to which it is best suited based on comparative advantage this in essence involves a Soil Policy for Uganda

- Rational management of the soils to prevent degradation, for instance, by initiating farm demonstrations at regional level Already there is a plan to complete a National Soil and Water Conservation Manual for extension use

- Rehabilitate or reclaim degraded areas the Soils and Soil Fertility Management Programme will focus on new information and technologies for proper utilisation and sustainable management of the soil and related environmental resources Attention will be paid to management and recycling of crop residues, soil fertility management in selected cropping systems, verification and up-dating of interim fertilizer recommendations for selected crops, and establishment of a National Soils Difference Data Base

- Integrate soil improvement techniques to increase unit yield in arable land

- Community participation and bye-laws to curb use of uncontrolled fires and poor farming methods that lead to soil erosion

- Strengthen extension services, research institutions, in collaboration with NEMA and the Ministry of Natural Resources

Box 3 1
Costs of Soil Degradation and Restoration

It is not possible to estimate the costs of making agriculture sustainable Costs of preventing erosion and degradation are relatively small compared to restoration and will vary with farming systems methods used and topography For instance expenditure of US$50 to US$150 per hectare (sometimes less) for such measures as farm forestry and contouring with grass or other vegetative barriers are typical US$200 to US$500 may be needed per hectare for structural measures like terracing levelling and earth banks on ungraded land In contrast rehabilitation may cost from $500 to several thousand dollars per hectare

Not all agricultural land will need additional investment in preventive measures but enough is known about measures for preventing soil erosion and degradation for a significant programme to be mounted For example 0 2 to 0 3 % of GDP in the 1990s including the costs borne by the farmers themselves would probably be sufficient to extend the coverage of improved soil management practices Allowing for the need to compliment agricultural programmes with reforestation projects in some watersheds may raise investment costs by a further unit cost varying between US$500 and US$1500 per hectare The main limits would be the capacity of the institutions to implement the programmes and the circumstances such as tenurial arrangements crop prices and education that affect the farmers' responses

Given the increasing complexity of the rural environmental problems and the need to raise agricultural yields, more money is needed for agricultural research particularly on the effects of agricultural practices on soil losses and fertility To help put agricultural practices on sustainable footing the extension message will be broadened from the present emphasis on production technologies to include soil conservation the management of pasture/rangelands, integrated pest management and more generally issues of resource custody

Source *World Development Report (1992) Development And The Environment World Development Indicators Published for the World Bank Oxford University Press*

- **Land Tenure**

Section **3 1 2** described the various land tenure systems in Uganda This section discusses the environmental implications of crop production under each tenurial arrangement
Uganda's land management is dominated by customary and *mailo* land tenure systems, which do not confer freehold rights and which engender the fragmentation of holdings as a result of inheritance These systems of land tenure tend to discourage investment in the land soils are being degraded as population pressure on the land increases and yields are generally low

The customary system has two main types of property holdings specific single permanent holdings and communal with non-permanent individual holdings Specific permanent holdings are predominant in southern, eastern and east-central Uganda The head of each household (usually a man) decides on the use and transferability of the land This tends to lead to land fragmentation The communal type of customary land tenure is found in northern and eastern Uganda, southern rangelands of the districts of Mbarara, Mubende, Kiboga, Luwero Mukono, Kamuli, and the Lake Albert flats of Semliki and Bugungu

Traditional pastoralism is mostly restricted to communally-held land In areas where arable agriculture dominates over animal grazing as is the case in northern Uganda, specific parcels of land are set aside for communal grazing, other parcels are allotted to families for homesteads and crop farming Such holdings are retained only for as long as they are in use Male elders effect the allocation, and the women and the youth are excluded from the process of determining land utilisation despite being the main users of the land

The advantage of customary land tenure system is that it is well established and understood Also, the majority of the population affected is not subject to annual payments of ground rent The main disadvantage, however, is that the land cannot be used as collateral security for credit facilities This constraining technical and economic improvements Land conflicts are difficult to resolve because of lack of written records, and the main users (women and the youth) have limited opportunity to influence land utilisation decisions The lack of adequate security of tenure discourages investment and commitment to care for the land, resulting in over-exploitation, land degradation and eventual abandonment

Mailo land tenure system is confined to Buganda and parts of Bunyoro The system is based on square mile sub-divisions and offers the advantages of a land title system which minimises land conflicts and encourages investment in the land It could also avail the landlords the opportunity to oversee proper land management practices by tenants over large blocks of land In practice and reality, however, the system has encouraged the proliferation of absentee landlords whose interest is focused on rental income to the detriment of appropriate land management The actual users of the land, the tenants, do not have sufficient security to encourage investment and much of the *mailo* land in Mubende, Kibale and Kiboga is idle or under-utilised Since the holdings are fixed, transfers through inheritance have led to land fragmentation in areas of high population density, such as in Mpigi, Masaka and Mukono

The leasehold system offers the advantage of enabling the government to specify how a given landholding could be developed and to attach specific user or environmental conditions to the lease

In Uganda, however, environmental conditions have rarely been attached to leases It has also been suggested that the leasehold system has tended to contribute to urban decay and corruption

Freehold land tenure is not widespread in Uganda, being mostly restricted to Ankole Toro, Bugisu and parts of Buganda Freehold land tenure offers a number of advantages, it provides maximum security of tenure and therefore encourages interest in the land It is also the best asset to offer as collateral security for credit facilities and therefore facilitates investment in land improvement The main disadvantages are that transfer of sub-divided holdings have led to excessive fragmentation and extensive soil degradation in areas where population densities are high, for example, in the districts of Rukungiri and Kabale

- **Farming systems and their impact**

Figure 3 2 shows a map of the farming systems practised in Uganda, based on considerations of climate and soils, as requirements for crops This classification is not exhaustive and to some extent was determined by colonial arrangements of supply zones for the various cash crops rather than purely agronomic requirements The existence of wild coffee in isolated forests such as Zoka, in the north of the country, suggests coffee could grow there Yet, most parts of northern Uganda were zoned for cotton and tobacco

Uganda is currently divided into five major farming systems Intensive banana - coffee, Western banana - coffee - cattle Kigezi afro-montane, Northern and Eastern cereal -cotton - cattle, and, the West Nile cereal - cassava - tobacco The key environmental impacts of crop production under the five farming systems are presented below

(i) Intensive Banana-Coffee system

This system is found on the northern shores of Lake Victoria, in south Mukono, south-east Mubende, south Luwero, on the Ssese Islands, around Kampala and Entebbe, most of Jinja, Iganga and Mpigi, south of Kamuli, and east of Masaka and Rakai districts The relief is characterised by flat-topped hills long gentle slopes and extensive papyrus swamps The soils are mostly *ferralitic/ferrasols* and include some of the most fertile friable clays

The main crops are bananas and robusta coffee, usually inter-cropped with maize cassava, sweet potatoes, beans and a variety of vegetables Animal production may form an important part of the farming system, comprising poultry, dairy cattle and pigs Although the production of perennial crops and the adoption of inter-cropping are usually beneficial, soil degradation has occurred because of continuous use of small plots in absence of restorative measures to minimise degradation of the land, especially in the mailo land tenure system

(ii) Western Banana-Coffee-Cattle

This system is practised in Bushenyi, Kabale, Rukungiri and parts of Mbarara The relief is hilly, with steep slopes in some areas The dominant soils are highly-weathered *ferralitic* soils and mostly sandy loams, with some sandy clay loams

The landholdings are highly fragmented due to high population density and the existence of the customary land tenure system Deforestation has reached alarming levels, and together with the steep slopes and generally poor farming practices, has led to considerable soil erosion The adjacent water bodies are often laden with large amounts of sediments (silt)

(iii) Kigezi Afro-Montane

This system comprises the land above 1800m above sea level in Kabale and Kisoro districts and on the northern slopes of the Muhavura Mountains The soils are mostly *ferralitic/ferrasols*

The most important crops are sweet potatoes, Irish potatoes, field peas, maize, wheat and vegetables Inter-cropping and anti-erosion funds along contours are common practices Animals are herded and grazing occurs on marginal hill-sides, valley bottoms, roadsides and interseasonal follows Woodlots composed of eucalyptus have been established around homesteads

The sustainability of this system is being undermined or threatened by the rapid decline in soil fertility caused by repeated cultivation in absence of restorative measures High population density has led to reduction of farm size and increased land fragmentation Contour funds are also being destroyed in an attempt to increase the size of arable land and to use the built-up fertility of the bunds, which are in effect long-fallow lands This has caused increased soil erosion, landslides and serious siltation of rivers and lakes

(iv) Northern and Eastern Cereal-Cotton-Cattle

This system is dominant in Apac, Gulu, Kumi, Tororo, Soroti and parts of Mbale The soils are *ferralitic* and consist of deeply weathered and leached loamy sands These soils are generally low in fertility and are vulnerable to erosion especially during heavy rain, particularly the steep slopes

The main crops are millet and cotton, while others include maize, sorghum, simsim, pigeon peas, cowpeas, groundnuts, sweet potatoes and cassava Ox-ploughing is practised where soils are light Cattle are herded and grazed on communal rangelands

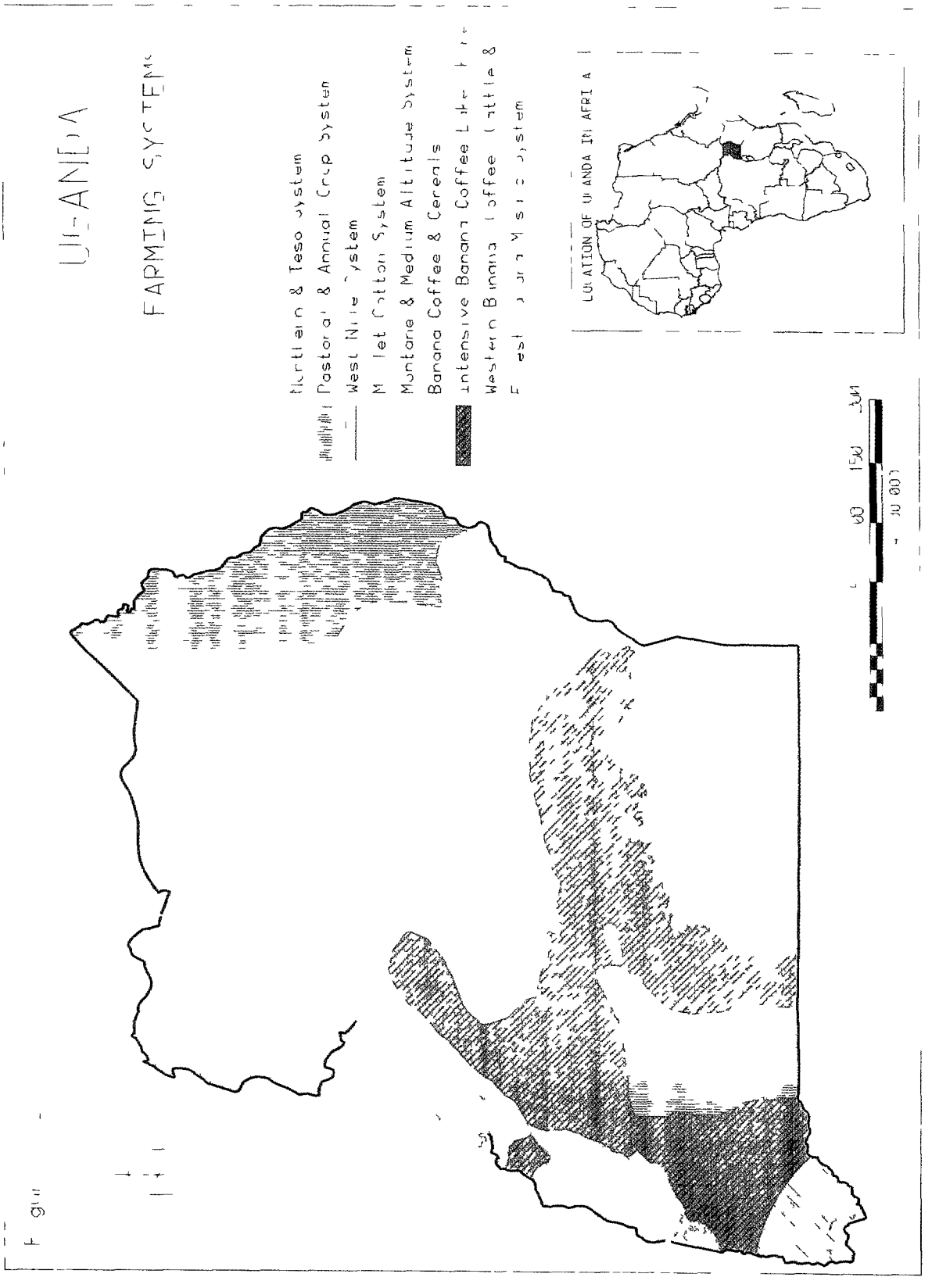
Soil erosion by wind and water is a serious problem, particularly in densely-populated areas such as Tororo and Kumi districts Many rivers have been silted as a result of rill and sheet erosion Erosion has further been aggravated by the abandonment of the Teso system (which required farmers to plough along contours and leave grass bunds 3m wide to stop soil erosion) and by over-grazing during the dry season In addition, fallow periods have become very short or have been abandoned altogether

(v) West Nile Cereal-Cassava-Tobacco

This system occurs in the western part of Arua district Intensive, mixed and double cropping is commonly practised The major crops are cassava, millet, sorghum, groundnuts, cowpeas, maize and tobacco The herd sizes commonly grazed on communal land are smaller than in the Northern and Eastern-Cotton-Cattle system

Poor cultivation methods coupled with lack of following, without corrective/restorative measures, have led to decline in soil fertility and increased soil erosion The presence of tobacco has resulted in

Figure 3 2 Farming Systems in Uganda map



extensive depletion of natural vegetation to provide large quantities of fuelwood needed for the flue-curing process (10 to 40 tonnes of dry wood is needed per tonne of tobacco)

Crop Production Technology

Overall, Uganda's crop production technology utilises low level inputs with resulting low output and yield Several factors acting in tandem seem to perpetuate the low input-low output scenario, including high levels of poverty, lack of land ownership rights, lack of education and awareness, low investment in land and crop improvements, low levels of purchased inputs (seeds, fertilizers, pesticides and herbicides), reliance on manual cultivation methods, and reliance on family labour

Uganda's population has been growing at a rate of over 2 5% per annum during the last 10-15 years Each year there are more mouths to feed The growing population pressure and the need to produce saleable crop surpluses in line with the "Agricultural Modernisation Strategy for Alleviation of Poverty" mean there is urgent need to increase output In August 1996, core problems that affect the agricultural sector (such as poor infrastructure, inadequate marketing system and low levels of investment) were identified and addressed in the agricultural modernisation strategy and the medium-term Agricultural Sector Plan for 1997 to 2001 Increased agricultural output can come from increases in areas under cultivation and intensification of management on existing farms through application of agro-chemicals, plant breeding, improved extension services, post-harvest loss reduction and adaptable soil conservation techniques

(i) Increases in Areas Cultivated

Table 3 5 shows the distribution of arable land in selected districts grouped by population density The data show that expansion in areas under cultivation will become increasingly difficult in the heavily-populated districts (density of 125 persons/km^2 and above), such as Jinja, Kasese, Mbale, Mukono, Rukungiri, Tororo and Pallisa According to the 1991 figures, arable land availability in these areas was 0 21 to 0 49 hectares (ha) per capita compared to the national average of 1 02 ha Those districts with low to medium population density (up to 124 person sq km) have some room for expansion of cultivated area Expansion of areas under cultivation is likely to lead to deforestation in the low to medium density districts On the other hand, in the densely-populated districts, it is likely to occur on marginal lands and ecologically-sensitive areas with concomitant loss of bio-diversity and land degradation

(ii) Increased Agro-chemical Usage

Instead of, or perhaps in addition to, increasing areas under cultivation, crop output levels can be enhanced by the application of agro-chemicals The introduction of agro-chemicals such as fertilizers, pesticides and herbicides in hitherto low input agriculture poses major environmental problems Unless farmers are adequately educated in the proper handling of fertilizers, exposure to them poses a threat to human health Second, nutrients will also find their way into the underground watertable and contaminate supplies meant for human consumption Third, through erosion of top-soil, nutrients are also able to find their way into open water bodies and contribute to eutrophication

Pesticides are used for pre and post-harvest crop protection **Box 3 2** attempts to explain the demand for pesticides in Uganda Hazards posed by the pesticides commonly used in Uganda are presented in

Table 3 5 Distribution of arable land and arable land per capita for selected districts

District	Land area (sq km)	Arable land (sq km)	Marginal land (sq km)	Arable land per capita (ha/capita)
High density (125 + /km2)				
Jinja	677	619	58	0 21
Kasese	2724	1478	1246	0 43
Mbale	2504	2022	482	0 28
Mukono	4594	4061	533	0 49
Rukungiri	2584	1391	1193	0 35
Tororo + Pallisa	3900	3887	13	0 42
Medium density (50 124 per km2)				
Apac	5887	5774	113	1 27
Arua	7595	6816	779	1 07
Bundibugyo	2097	394	1703	0 34
Luwero	8539	7986	553	1 77
Mbarara	10587	9477	1110	1 19
Soroti	8526	8407	119	1 95
Low density (0 49 per km2)				
Gulu	11560	11321	239	3 34
Kitgum	16136	13536	2600	3 79
Kotido	13206	10352	2854	5 28
Masindi	8458	5369	3089	2 06
Moroto	14113	7540	6573	4 32
Moyo	4668	4313	355	2 45
Uganda				
1991	197096	167596	29500	1 02
Projections ***				
1995				0 7
2005				0 5
2015				0 4

Note

* - Includes Protected Areas

** - Includes pasture land

*** - Statistical Department, MFEP (1996) - Statistical Abstract (Population projections)

Source *The 1991 Population and Housing Census*

Table 3 6 Table 3 7 shows an assessment of the overall likely increase in pesticide use Like fertilizers, unless properly handled, there is a real risk of exposing farmers to toxic pesticides Similarly, some of the harmful pesticides may find their way into supplies of drinking water Additionally, others are non-target specific, and their application could cause loss of bio-diversity in the surrounding areas

At the moment, Uganda does not use extensive amounts of herbicides since most weeding is carried out by family labour However, in plantations such as the tea and sugarcane estates, herbicides are used to control weeds The environmental impacts of herbicide and pesticide application are generally similar

Table 3 6 The hazards of pesticides commonly used in Uganda

Use pattern	Pesticides	Main hazard
Seed dressings food storage for maize dry beans groundnuts	Organochlorine insecticides mercury	Carcinogenicity Bioaccumulation Hazard to wildlife other chronic effects Acute toxicity (lindane mercury)
Cotton other crops	Organochlorine insecticidesDDT dieldrin	Same as above
Maize dry beans groundnuts vegetables flowers cotton coffee	Some organophosphate and carbamate pesticides	Acute toxicity Toxic to non target species
Maize dry beans cotton vegetables flowers	Synthetic pyrethroid insecticides	Toxic to non target species
Cattle dipping	Organophosphate insecticides	Acute toxicity
Vegetables flowers coffee	Some fungicides	Oncogenicity and/or toxic to non target species
Maize (estate only)	Triazine herbicides	Can leach to ground water Can cause tumor growth or birth defects
General use	Paraquat herbicide	Irreversible lung damage or fatal if swallowed skin irritation
Tea maize	Some other herbicides	Various adverse health effects
Flowers	Soil sterilants	Acute toxicity and/or chronic health effects hazardous to non target species Can leach to ground water
Maize coffee sesame	Storage pesticides fumigants	Acute toxicity and/or hazardous to non target organisms

Source Martin Melter, et al (1994) Environmental and Economic Implications of Agricultural Trade and Promotion Policies in Uganda Pests and Pesticide Management EPAT Project

(iii) Measures for alleviating low input-low output levels

- Liberalisation and privatisation of the inputs supply system

- Improving efficiency of land, labour and capital utilisation, and markets - particularly through rural finance

- The new research institute - Agricultural Engineering and Appropriate Technology Research Institute (AEATRI)-will develop and maintain the research functions at Namalere Agricultural Mechanisation Centre

- Continued promotion of integrated pest management and reduction of post-harvest losses

- Promotion of other high value farming enterprises and the need for farmers to shift from low value to high value farming enterprises

- The Research Institutes under the mandate of National Agricultural Research Organisation (NARO) to define themes and assess research results for increased flow of improved technologies to producers

Table 3 7 Projected trends in use of pesticides for crops

Crops	Potential to expand area cultivated (a)	Incentive to intensify production (b)	Overall likely increase in current pesticide use (c)	Comments
Coffee	Medium	Low medium	Low	Price of coffee
Tea	Low	Low	Low	Price low
Cotton	Medium	Low	Low medium	
Maize	Medium	Low medium	Low medium	Exports driven by disasters
Sesame	Medium	Low	Negligible	Few pesticides used
Beans	Low medium	Low	Negligible	Few pesticides used
Groundnuts	Medium	Medium	Low medium	Oil crop exports are low
Fruits	Low	Low	Negligible	Market difficulties
Essential oils	Low medium	Low	Low	Very competitive market
Vegetables	Low	Low medium	Low	
Horticulture	Low	Low medium	Low	Lack and cost of freight

Note a - Includes switching of area currently cultivated from one crop to another
b - Intensification of production is defined as increasing yields, utilising agro-chemical inputs
c - Overall change is defined as the potential to change or increase in the volume of pesticides used compared with current usage pattern

Source *Martin Meltzer et al (1994) Environmental and Economic Implications of Agricultural Trade and Promotion Policies in Uganda Pests and pesticide management EPAT Project*

Table 3 8 Yield of selected commodities at farm level and research stations (tonnes/ha)

Crop	Farmer (a)	Research Station (b)	(a) as percent of (b)
Beans	1 0	3 0	33
Maize	1 8	9 0	23
Finger millet	1 6	5 0	32
Cassava	9 0	50 0	18
Sweet potatoes	4 0	30 0	13
Irish potatoes	7 0	35 0	20
Matooke	5 9	35 0	17

Source *EPAU, MFEP Food Security and Exports, Technical Report September 1995*

Agro-chemicals and Plant Breeding

The National Agricultural Research Organisation (NARO) has active crop breeding programmes at its various research institutes The purpose of these breeding programmes is to increase yield and enhance resistance to pests, diseases and drought Agrochemical-neutral plant breeding successes would appear to offer the most environmentally benign means of increasing crop output It would appear that even if high-yielding crop varieties were to be produced, for there to be significant increases in out put, there must be a concerted effort to disseminate the results of research work **Table 3 8** shows that although high yields are obtained at research stations for a variety of crops, farmers are only able to realise 13-33% of this potential

Box 3 2
Economic and other Factors Affecting the Demand for Pesticides among Cotton Farmers

Khauka (1992) found the following variables to be important in explaining the variations in demand for pesticides among cotton farmers in Iganga District

a) previous season's crop output
b) distance to site of input purchase,
c) availability of credit to farmers,
d) nature of distribution system and
e) size of cotton field to be sprayed

In contrast the following variables were not significant in explaining demand for pesticides

f) levels of farmer s education,
g) a farmers's total crop acreage owned,
h) experience in cotton farming,
i) nature of available extension services
j) farmers income level and
k) prices of the input

It may seem surprising that the price of the input was not a significant factor, but Khauka's study was based on cross-sectional data Thus the relationship over time between price of input was not studied Moreover, variables a, c and e have a direct impact on the amount of cash available and that needed to purchase pesticides

Farmers perception of the problems that pests cause can also affect the demand for pesticides Studies elsewhere have demonstrated that farmers' subjective perceptions of pest damage affect demand for pesticides significantly (Adesina, Johnson, and Heinrichs 1994) The relative lack of data concerning the economics of pesticide use and the damage that pests cause suggests that farmers perceptions concerning the need to use pesticides is erroneous Thus there is an urgent need for research into and extension of economic thresholds for many crops and pests

Source *Martin Melter et al (1994) Environmental and Economic Implications of Agricultural Trade and Promotion Policies in Uganda Pest and Pesticide Management Winrock International Environment Alliance EPAT Project*

- ### Food Security

Where shortage of food or famine prevail, food insecurity can lead to serious environmental degradation **Table 3 9** shows that Uganda faired much better in food production than the rest of sub-Saharan Africa in the last decade **Table 3 10** shows indices for agricultural production, food production and

per capita food production for Uganda over the period 1980 - 1992 Other than in the Karamoja region and areas experiencing civil unrest, Uganda has been endowed with a variety of food combinations This means that in theory there is good potential for a balanced diet within many areas and for substitution between crops Uganda's ecological diversity should also provide the opportunity for movement of foods between regions

Earlier studies, however, show that as a result of lower growth rate in food production, the *per capita* availability of food declined from 1060 grams per day in 1968 -1969 to 580 grams per day in 1985-86, a fall of 46% The availability of cereals declined from 389 to 154 gm/day during the 1986-1990 period On the other hand, the *per capita* availability of starchy foods increased gradually from 501 gm/day in 1965-1966 to 661 gm/day in 1975-1976 and then to 426 gm/day in 1985-1986

Table 3 9 Trends in agricultural production in Uganda compared to the rest of Africa, 1982-1994

Totals and Per Capita	Uganda	Africa
Index of agricutural production		
(1979 1981 = 100)		
Total 1982 84	116	102
1992 94	154	135
Per Capita 1982 84	106	94
1992 94	101	94
Index of food production		
(1979 81 = 100)		
Total 1982 84	115	102
1992 94	155	138
Per Capita 1982 84	106	94
1992 94	102	95
Average production of cereals		
(000 metric tonnes)		
1992 94	1887	94708
% change since 1982 84	65	41
Average yields of cereals		
Kg/hectare 1992 94	1549	1160
% change smce 1982 84	17	10
Average yields of roots and tubers		
Kg/hectare 1992 94	6289	7607
% change since 1982 84	2	17
Crop land		
Total hectares 1983	6300	177907
Hectares per capita 1983	0 44	0 34
Total hectares 1993	6 77	187887
Hectares per capita 1993	0 34	0 27

Source World Resources (1996-1997) A Guide to The Global Environment Data Table 10 1238p

Table 3 10 Agricultural and food production index and food production per capita index for Uganda (average 1986 - 1988 = 100)

Year	Agricultural Production Index	Food Production Index	Food production Per Capita Index
1980	82	81	99
1984	95	94	103
1985	96	96	102
1986	95	95	99
1987	100	100	100
1988	105	105	102
1989	114	113	106
1990	116	118	108
1991	120	121	106
1992	124	124	106

Source *World Bank (1995) African Development Indicators, 1994 - 1995*

Although it appears that Uganda is self-sufficient in food, the country does experience considerable nutrient deficiencies For instance, while cereals and high energy-protein foods (millet, sorghum and maize) constituted 44% of the total food supplies in the 1960s, the share dropped to 27% by 1990 On the other hand, the share of starchy foods went up from 56% to 73% over the same period plantains 30-35%, cassava 18-26%, and sweet potatoes 8-12% Although malnutrition in Uganda is considered moderate, there is perhaps need to increase the production of cereals, pulses and oil seeds rather than promoting the production of low calorie starchy foods

Districts with permanent food deficits include Kotido, Moroto, Moyo, Bundibugyo, Kabale and Luwero Food deficits are principally the result of poor soils, low rainfall and population pressure For instance, the annual *per capita* availability of beans, cassava, and sweet potatoes is below 5kg for the districts of Moroto, Kotido and Moyo, compared to 50 kg for Masindi, Gulu and Apac

Although districts such as Mpigi, Mubende, Masaka, Soroti, Kumi, Nebbi, Tororo, Kabarole and Bushenyi have high levels of food availability *per capita*, they are considered to have transitory deficits The main causes of these transitory deficits include drought, cattle rustling, pests, disease and over-dependence on one staple food which can be vulnerable to drought

Another important cause of food insecurity is pre- and post-harvest losses According to a survey carried out by Export Policy and Analysis Unit (EPAU) (1995), high crop losses are most evident in the northern region followed by the eastern region For example, about 30-40% of the maize crop is lost in Tororo, Soroti, Moroto and Kabarole, bean losses of as much as 30% occur in Soroti, Lira, Moroto and Rakai **Table 3 11** shows regional crop losses **Table 3 12** shows regional *per capita* food availability in Uganda in 1995 Overall, northern Uganda had the lowest level per capita of food availability at 101kg and western region the highest at 135kg

High levels of food insecurity affect the environment in various ways New and sometimes marginal

Table 3 11 Regional crop losses for selected crops (% of output)

Crop	Eastern	Northern	Western	Uganda
Beans	25	30	20	25
Maize	25	25	22	23
Millet	7	12	6	8
Cassava	25	35	20	25
Groundnuts	12	12	10	10

Source *EPAU,MFEP Food Security and Exports Technical Report, September,1995*

or ecologically-sensitive areas are opened up for cultivation to increase food production During periods of prolonged drought, the rural population is forced to harvest, often unsustainably, the natural resources of the area

Some of the measures being implemented, planned or considered feasible for reducing food insecurity in Uganda include the following

(i) Enhancement of Policy on Food Security based on improved farming techniques to ensure increased production, and, offering land users incentives to promote agro-forestry, aqua-culture, crop-livestock, soil and water conservation as a sustainable practice

(ii) The Agricultural Extension Programme (AEP) as a strategy for increasing food production The Unified Extension Programme (UEP) is already in place in 19 districts and more are to be incorporated during 1996-1997

(iii) The Cereal Programme continues to improve the performance of existing varieties, has developed drought resistant varieties and is developing and evaluating better varieties for the highland and mid-altitude ecologies, In addition, multi-locational testing and grain quality assessment of the rice varieties is on-going with the aim of establishing suitability to different locations/ecosystems

iv) Integration of Family Life Education (FLE) into Agricultural Extension Services, relating to linkage between population and health The project has been operating in 15 districts and the fourth phase is to start in 1997 for other districts

(v) Improve food monitoring and accuracy of data, for example, through the National Early Warning and Food Information System (NEWFIS), however, the system still requires development and improvement to serve the purpose it was intended for

vi) Demonstration of improved storage to reduce pre- and post-harvest losses

vii) Encouragement of commercialisation of agriculture can lead to food security directly by increasing yields and farm incomes and indirectly by empowering producers with the means to acquire (improved) technologies

viii) Price liberalisation policy

Table 3 12 National and regional per capita food supply (kg per head)

Category of crops	Eastern	Northern	Western	Central	Uganda
Pulses	27	39	19	15	25
Cereals	117	143	61	23	86
Roots	452	513	270	187	356
Oil seeds	15	29	5	3	13
Plantains	278	62	689	687	427
Milk	14	13	29	24	20
Pork/goat meat/mutton	7	8	7	7	7
Poultry	0 53	0 77	0 35	0 41	0 52
Average	113 8	101 0	135 0	115	116 8

Source *EPAU, MFEP Food Security and Exports - Technical Report, September 1995*

3 3 RANGELANDS AND LIVESTOCK RESOURCES

3 3 1 Production and Use of Rangelands

The term rangeland is often used to include areas of agricultural potential, comprising natural grassland, bushland or woodland The rangelands in Uganda form what is known as the "cattle-corridor", which stretches di- lly from the Uganda border with Tanzania, in the south, through the Lake Kyoga region, to Karamoja in the northeast **(Figure 3 3)**

The rangelands occupy an estimated 84,000 sq km (43%) of the total land area These areas experience erratic and low rainfall, and severe drought either annually or every few years Consequently, there is a characteristic seasonal movement of people and livestock between wet and dry season grazing areas There is evidence of continuous and insidious deterioration of the rangeland, especially along the cattle trails and around water points In recent years, however, government policy has emphasised sedenterisation of the pastoral/nomadic communities

The main rangelands within the cattle corridor areas are experiencing increasing individualisation of communal grazing land rights[1] That is, there are untitled parcels of land on customary tenure, which the rights to use have been individualised This practice is widespread in the districts of Mbarara and Ntungamo In the rangelands of Kasese district, it is causing tremendous tension between the Basongora (cattlekeepers) and the Bakonzo (cultivators), rendering the Basongora almost landless (Government of Uganda, 1993 13) Karamoja is also beginning to experience a trend towards individualisation of grazing land rights This is leading to a high incidence of rangeland resource use conflicts, displacement of indigenous pastoralists, and crises in rangeland management

Grasses are certainly the most important forage plants, and the variation in grass composition is great

However, the area of open grassland is limited It has been suggested that, of the three dozen grass species usually present in these rangelands, only about 10% provide the bulk of the forage preferred by cattle[2]

The overall range condition has never been accurately documented due to lack of a complete inventory of the rangelands resource Hence, development of rangelands depends on the mode of utilisation and management activities An inventory, especially if repeated periodically, provides some indication of condition (potential) and trend (strong, moderate or weak) in terms of sustainability of the rangelands

Livestock Production

The livestock sub-sector contributes about 9% of the total GDP At least 90% of the livestock in Uganda is owned by traditional herders, and the rest by commercial ranchers There has been a steady increase in livestock numbers during the 1985-1995 period, although the rate of increase in numbers was slightly higher in the 1985-1989 period than from 1990-1995 (**Table 3 13**) The Zebu account for about 30% of the cattle, the Sanga (Ankole) 50%, Nganda 18%, crossbreeds 13%, and, exotic breeds 2%

Table 3 13 Percent increase in livestock numbers 1985 - 1995 period

Type	1985 1989 (%)	1990 1995 (%)	Projected increase during 1996 (%)
Cattle	8	5 7	2
Sheep	21	18 5	NA
Goats	20 7	17 7	1 9
Pigs	28 7	15 8	NA
Poultry	24 2	15 2	2 1

NA - Not available

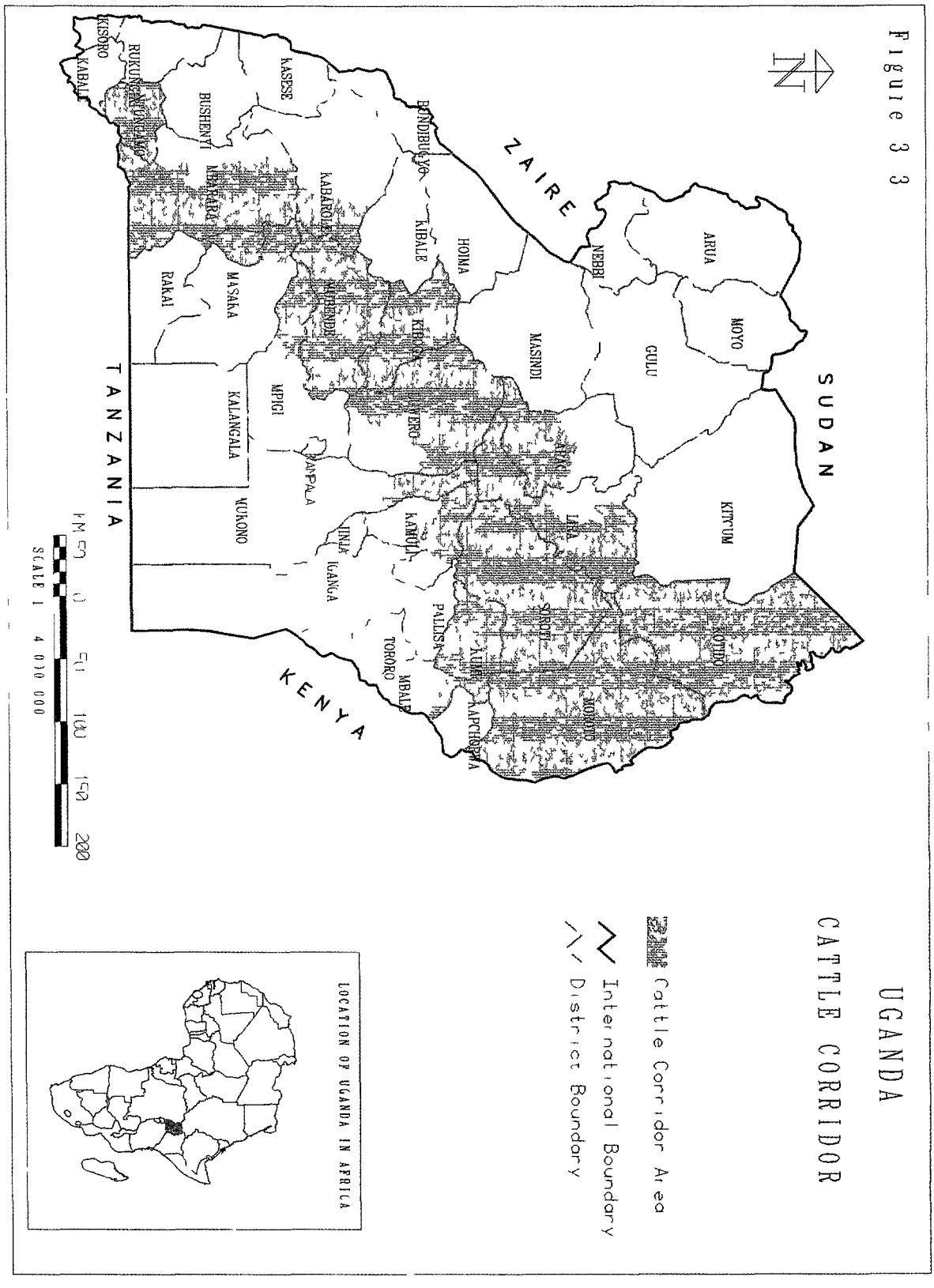
Source *Derived from Statistics Department, Ministry of Finance and Economic Planning Statistical Abstract, 1996*

The rate of increase in cattle numbers was affected by two factors There was an exodus of cattle to Rwanda in 1994-1995 after the Rwanda Patriotic Front Government came to power On the other hand, the projected increase is attributed to re-stocking of cattle areas where cattle rustling was experienced Milk production has followed the same trend of steady increase in output, due to better farm-gate prices and improved livestock management techniques and milk handling Milk output was projected to increase by about 3-5% during 1996

A ready market for chicken and eggs has led to a significant increase in their numbers, especially in urban centres There has been an improvement in procurement of day-old-chicks and management of poultry units, especially in controlling diseases such as fowl cholera and Newcastle disease Poultry feeds are a big problem as they compete with human needs The marketing of poultry products is still very poor and the prices very low

Figure 3 3 Rangelands of Uganda

Map



The sector also shows a steady increase in percentage growth rates (at constant 1991 prices), apart from a slight decline during the 1991-1992 period The percent growth rates for the livestock sector was 4 4% in 1986, compared to 4 1%, 8 0%, 1 9% and 2 4% in 1987, 1988, 1991 and 1995 respectively Hence, the average growth rate during 1986-1995 has been 2 8%

The actual growth rates for livestock products were 1 3% from 1981-1991 and 4 6% for 1986-1991 The projected growth rate for the 1992-2005 period is 4 6% Comparatively, the domestic export records show that during 1994, cattle hides, sheep and goat skins, constituted 2 36% of the total exports and 11 7% of total non-traditional exports **Table 3 14** shows livestock numbers and projections to the year 2000

Table 3 14 Livestock total and per capita, 1990 - 2000

Year	Cattle	Sheep	Goats	Pigs	Poultry
1990	4950	780	4710	1160	18 960
1991	5121	820	4950	1210	20 020
1992	5209	845	5070	1228	20 576
1993	5370	871	5227	1266	21 214
1994	5106	897	5383	1304	21 404
1995	5233	924	5545	1343	21 832
2000 (estimates)*	6143	1720	10 120	2434	29 524
Percent increase during 1995 2000 (estimates)	17 4	86	82 5	81 2	35 2
Per Capita (estimates) **					
1991	0 3	0 05	0 28	0 07	1 14
1995	0 27	0 05	0 29	0 07	0 1
2000	0 28	0 08	0 46	0 11	1 33

* MAAIF (1996) Background to The National Cattle Breeding Policy May 1996
* * Human population extracted from MFEP Statistical Abstract July 1996

Source *MFEP (1996) Statistical Department Statistical Abstract July 1996*

Uganda has a high potential for a profitable livestock industry, and plans for livestock development should be based on ecologically-sound management practices The development of this sub-sector may necessitate Uganda being divided into zones based on the climate and productivity of the land and human population[3] Zoning may be as follows

(i) High potential densely-populated areas

Mountainous areas like foothills of Mt Elgon Mt Rwenzori Rukungiri and Kabale, where there is little pasture expansion The alternative is through integration of livestock in to existing farming systems

(ii) **High potential areas with low population**

Under-utilised area in Masindi, Kabarole, Mubende and Hoima districts Despite the incidence of tse-tse fly, these zones are suitable for large scale dairy, crop farming and commercial ranching

(iii) **High potential areas with medium population**

Areas around Lake Victoria and West Nile Large tracts of under-utilised land exist, and the rest is moderately cultivated Expansion of livestock development could be realised by intensifying production systems

(iv) **Low potential densely populated areas**

Heavily cultivated areas of Tororo, Kumi and parts of Mbale districts Development of small ruminants and poultry would be a suitable alternative

(v) **Low potential areas with low population**

Karamoja region Nyabushozi in Mbarara district, and the northern part of Luwero district Development could include provision of several watering points to minimise over concentration of livestock at these points, reduction of stocking rates by promoting sale of excess animals, and, enhancing introduction of ruminants for efficient utilisation of the rangelands **Table 3 15** illustrates common indicators of cattle production systems in Uganda

Growth Prospects

Livestock depend almost entirely on natural grass-dominated pastures, and although there is scope for improved rangeland use in the more densely-settled areas, the greater long-term potential lies in the areas that are currently under-utilised **Table 3 16** shows areas potentially available for range use Control of epidemics of rinderpest and Contagious Bovine Pleuropneumonia (CBPP) would also reduce the present high mortality rates (e g , 25-30% for calves)

Annual domestic meat consumption is estimated at 55,000 tonnes which is equivalent to about 3kg per capita[4] Domestic demand is expected to increase in line with the growth of population and per capita income Access to foreign markets outside of the East African region will require the attainment of rigorous quality and health standards in the livestock industry, from production and processing to marketing

Presently Uganda is almost self-sufficient in meat, and exports of hides and skins have increased tremendously Although the current annual per capita availability of milk is about 22 litres, the effective demand for milk is almost satisfied

Table 3 15 Common Indicators of Livestock (Cattle) Production System in Uganda

Characteristic	Small farmer dairy		Commercial semi intensive		Dairy/Beef ranch	Large commercial	Subsistence	
	Peri/intra urban	Rural mixed	Peri/intra urban	Rural			Communal/ agro pastoral	Pastoral
Milking herd	2 milking cows (exotic/ grade)	2 5 milking cows (grade/local)	5 10 milking cows (exotic/grade	9 15 milking cows (exotic/grade/local)	9 15 milking cows (exotic/grade/ local)	20 25 milking cows (exotic/grade)	1 2 milking cows (local)	5 10 milking cows (local)
Priority of farmer	Sale of milk	Milk/meat production Soil fertility Draught	Sale of milk	Sale of milk	Milk/meat production	Sale of milk Sale of breeding stock	SubsistenceMilk /meat production Draught	SubsistenceMilk/meat production Livestock numbers
Farmers attitude	Cash income	Spreading of risk integration	Cash income	Cash income	Cash income Spreading risk	Cash income	Aversion of risk	Aversion of risk
Feed resources	Cultivated or purchased fodder concentrate mixtures	Enclosed grazing Improved pastures Crop residues	Enclosed grazing Improved pastures Cultivated fodder Concentrate mixture	Enclosed grazing Improved pastures Milling by products & concentrates occasional	Enclosed grazing	Enclosed grazing Improved pastures Cultivated fodder Concentrate mixtures	Communal grazing Crop residues	Communal grazing
Land available	0 0 5 ha	0 5 2 0 ha	0 0 5 ha	0 5 2 0 ha		5 0 10 0 ha	0 5 2 0 ha	Variable
Major inputs used	ConcentratesFodder CreditExtension services Training Vet curative & preventive services Hired labour Breeding (AI)services	Extension services Training Vet curative & preventive services Family labour	Concentrates CreditExtensionservices Training Vet curative & preventive services Hired labour Breeding (AI) services	Extension services Training Vet curative & preventive services Hired labour	Extension services Training Vet curative & preventive services Hired labour Credit	ConcentrateCredit Extension services Training Vet curative & preventive services Hired labour Breeding (AI) services	Vet services (mainly vaccinations) Family labour	Vet. services (mainly vaccination) Family or communal labour

Source *Ministry of Agriculture, Animal Industries and Fisheries (MAAIF) Background to the National Cattle Breeding Policy May 1996*

Table 3 16 Ecology of major ranching areas of Uganda

Location	Administrative District	Rainfall (mm) pattern	Soil Type	Vegetation Formation	Potential Range use (Ha) (000)
Northern	Gulu Kitgum Lira Apac	1000 1250 mmMono modal	Ferrosols weathered low mineral and CEC toxic levels of Mn & Al	Dry Combretum Butyrospermum TerminaliaGrass layer Hyparrhenia Setaria Andropogon Panicum, Brachiaria Sporobolus	1998
North west	Arua	1000 1200 mmMono modal	Vertisols Fine clay swell during wet season crack during dry season	Moist Butyrospermum Combretum Terminali aGrass layer Panicum Hyparrhenia Andropogon Cymbopogon Brachiaria Setaria Themeda Sporobolus	248
North east	Kotido Moroto East Soroti	500 1000 mmMono modal	Vertisols	Dry Acacia Combretum Terminali aGrass layer Hyparrhenia Themeda, Setaria Sporobolus	2095
Central	Luwero Singo Mubende Masindi	750 1250 mmBimodal	Ferrallitic and Ferrosols old weathered low mineral reserves	Moist Combretum TerminaliaGrass layer Hyparrhenia Andropogon Panicum Bracharia Loudetia Chloris Setaria	1190
South east	Tororo Kumi Iganga	1000 1250Bimodal	Ferrallitic soils	Moist Combretum ButyrospermumGrass layer Hyparrhenia Panicum	605
South west	Mbarara Masaka Kabarole West Mpigi	750 1250 mmBimodal	Lithosols young shallow susceptible to erosion	Dry Acacia CombretumGrass layer Cymbopogon Themeda Bracharia Panicum Chloris Loudetia	1402
Total					7538

Cec = Cation Exchage Capacity Mn = Magnesium Al = Aluminium

Source J S Mugerwa (1992) Management and Utilisation of Rangelands The Case of Uganda (Paper presented at the 2nd FAO Regional Workshop on Grazing Recources for East Africa)

3 3 2 Issues in Rangeland Management

The issues pertaining to rangeland use and their apparent declining productivity, and the slow development of the livestock sub-sector include the following

- Shrinking grazing land
- Inadequate water supply and water sources
- Lack of effort to determine the viability of wildlife ranching
- Insufficient market facilities

- **Shrinking Grazing Land**

Although rangelands in Uganda occupy a significant proportion (43%) of the total land area, many of them have deteriorated Raising the productivity of these degraded areas is a formidable problem, presenting almost intractable technical challenges The financial returns would be low Reclamation would also involve a notable change in the way of life of the pastoral people

In Karamoja there is a significant trend towards crop growing by virtue of necessity rather than choice, low returns are being realised from livestock The herders are traversing longer distances in search of pasture and water moving into neighbouring districts and across international borders This has resulted in cattle rustling and violent conflicts

The coping strategy of the pastoral community in Nyabushozi is quite unique It has selected a number of options, searched for pasture in neighbouring districts like Luwero and Rakai, reduced the number of livestock while improving their herd, especially for milk production, established ranches with improved pasture management, and, restructured ranches to settle the landless squatters, following the formation of Lake Mburo National Park (which was previously communally grazed)

The factors causing shrinkage of pasture in the rangelands include the following

(i) Pastoralists

Pastoralists tend to attach more importance to the number than the quality of their animals Often the fear of decimation by disease or drought leads to the maintenance of herds exceeding the subsistence minimum The resources to improve pasture management and livestock are lacking

(ii) Poor grazing methods

This has led to under-utilisation and over-grazing of pasture Over grazing successively reduces plant vigour and carrying capacity of the land, leading ultimately to a depleted ground cover, invasion of dense unpalatable and often thorny bush, and gully erosion

For instance, in the *Themeda and Hyparrhenia* grasslands in Uganda, there is a problem presented by *Cymbopogon afronardus* a tall tufted grass which is unpalatable to cattle, in some areas it dominates the land cover This constitutes a state in succession from grassland to bushland thicket Regular burning tends to prevent invasion by coarser species but because of bush clearing and over-grazing, the fires are no longer intense enough to control bushes and thickets

(iii) Encroachment by Cultivators

This is due to the increasing population and the proliferation of cultivation activities Areas which have been traditionally used for grazing have had settlements established on them This is evident in rangelands adjacent to medium to high population density areas in Ntungamo, Mbarara and Rakai districts

(iv) Climate Change

Rainfall distribution is becoming increasingly unreliable and uneven and has, affecting the levels of regeneration of palatable plant species Desert-like conditions are becoming more evident Prolonged drought or premature grazing can impair the productivity of the grassland for several seasons

(v) Other factors

Include the following

- establishment of National Parks, Game Reserves, and Forest Reserves
- fencing of commercial farms and ranches
- tse-tse fly infestation
- *Acacia* and bush encroachment
- siltation of water sources

Inadequate water supply and water sources

Water shortages occur frequently in the rangelands and cause extensive movement of livestock and herders in search for water and pasture The main causes are inadequate and unreliable rainfall and the low potential of shallow-wells and springs

This has resulted in insufficient flow of water into storage facilities such as dams and valley tanks Where adequate in-flow is experienced, storage capacity of dams and valley tanks is short-lived due to siltation caused by soil eroded from higher slopes

To alleviate this problem, MAAIF is according high priority to the improvement of water provision facilities in the drought-prone areas Emphasis will be on construction and rehabilitation of strategic reservoirs, community mobilisation and participation

Lack of effort to determine economic viability of wildlife ranching

International and national policies on wild game products are prohibitive Even where wildlife ranching could be possible, it becomes uneconomical for small-scale producers Particularly, problematic are hygiene and disposal requirements

Consequently, the existing policies relating to wildlife tend to focus on its protection or control as a type of agricultural pest (commonly referred to as vermin)

Some households in Karamoja have begun rearing ostrich alongside other livestock There appears to be sufficient evidence of initiative and progress to warrant maintaining wildlife ranching activities This should, however, be based on two aspects namely, the management and research levels alongside two options

(i) Which is best, for what products and under what conditions - wildlife or domestic animals or both in various combinations?
(ii) Can these animals complement each other in the prevailing production systems?

The viability of wildlife ranching in Uganda will be addressed in the Meat Master Plan Study to be undertaken by MAAIF

Insufficient market facilities and narrow supportive industry base

Factors which have caused slow growth of the livestock sub-sector include the following

(i) Low investment in market systems, structure development and trade
(ii) Inadequate stock to enable expansion of market and industries related to processing of livestock products

For instance, the diamatucally decreased number of cattle in Soroti, Kumi and parts of Lira districts could not have supported the Meat Packers Factory at Soroti Unfortunately, this factory has been non-functional for several years due to neglect

The hides and skins industry has a high potential for earning foreign exchange, with international prices steadily increasing since 1992-1993 However, this potential will be realised only if high investment can be attracted into producing semi-processed products rather than exporting raw materials

3 3 3 Factors Influencing the State of Rangelands

The prevailing factors that influence the state of rangelands in Uganda include the following

- **Low investment in the livestock sub-sector**

Inadequate funding and extension services have hampered implementation of livestock development plans, improvement of infrastructure including water provision (dams and valley tanks), and pasture improvement

Government policy, however, has tended to emphasise sedentarisation of pastoral communities through increased water development and social infrastructure Yet little investment has been put into promoting the human and social well-being of pastoral groups such as the Karamojong Hence, poverty prevails despite the large herds of livestock Milk production per unit area is low, although milk availability per capita tends to be high due to low population density

- **Low carrying capacity of the rangelands**

The stocking rate which permits maximum use of the range without causing deterioration is

known as its carrying capacity The carrying capacity of any rangeland is significantly influenced by soil fertility, rainfall pattern and composition, and quantity and quality of the vegetation Available data are not readily applicable for determining the rangeland carrying capacity in Uganda However, Uganda has great potential for livestock production

There is regional variation in the productivity of the range Despite the general trend of insidious deterioration of rangeland, there are little baseline data on range ecology Past surveys reveal that stocking rates in some communally-grazed areas have exceeded the optimum Earlier studies on the ecology of East African[7] rangelands showed a relationship between eco-climatic zones, livestock carrying capacity and maximum population density under subsistence pastoralism It has also been observed that, for pastoralists living under customary property rights such as the Karamojong, their wealth in terms of grazing land and cattle is gradually shrinking
To ensure that stocking rates conform to established capacities, two aspects of carrying capacity could be considered ecological carrying capacity which is determined by environmental factors and economic carrying capacity, which implies the stocking rate that offers maximum economic returns and also relates to the economic objectives of the livestock keepers

Devegetation and poor grazing methods

These facts have caused rapid top-soil loss This is aggravated further by water and wind erosion, rendering some areas unproductive and quite impossible to reclaim Currently rates of erosion are still unknown, although evidence can be deduced from the amount of deposited material in lowlands (plains) and in water bodies (silting)

Quality of local livestock breeds

Local livestock breeds are suited to the prevailing environment in Uganda, but their productivity is low The majority of farmers realise low returns from the livestock herds in terms of milk and beef output This in turn reduces the level of investment intended to improve livestock rearing in the impoverished communities, leading to inadequate pest and disease control

Inadequate supply of water

This has inevitably enhanced pastoralism In some parts of the country, such as Kazo and Nyabushozi in Mbarara district and Karamoja in the north-east, pastoralists move distances of 50km and above in search of water, often crossing into Tanzania and Kenya respectively This not only magnifies the problem of environmental degradation but also encourages the spread of cattle diseases

Poor pasture management and insufficient disease and pest control

Causes of pasture degradation include uncontrolled bush burning, over grazing, communal grazing and tsetse fly infestation There is already evidence of soil erosion in the ranching schemes of Mbarara, Masaka, Buruli and communal grazing areas of Kyaka Nakivale, Nyabushozi and Karurangira, and parts of Karamoja These degraded areas have been invaded by unpalatable plant species The presence of tsetse flies in potentially grazeable areas is forcing herders to concentrate on tsetse fly free areas There are still, for example, large tracts of land for potential grazing in Masindi, Hoima, Iganga,

Mubende and West Nile Uganda's climate is conducive to the spread of disease-causing agents This, coupled with poor nutritional status, seasonal congestion and transhumance of pastoralists during dry seasons contributes to very unfavourable animal health conditions with a very high incidence of disease attack

3 3 4 Strategies for Improved Rangeland Management

Several steps/measures have been undertaken to alleviate problems associated with deterioration of grazing land These include

Policy on privatisation of veterinary services

This affects animal health, bee-keeping, small ruminants, the beef industry and ranch reconstruction, and importation and distribution of veterinary inputs Arab Bank for Economic Development in Africa (BADEA) funding is developing small ruminant production to supplement cattle rearing

Restocking areas affected by civil strife

This is to redress the imbalance and exploit the vast underutilised range Restocking covers Kumi, Soroti, Pallisa, Apac, Lira, Gulu and Kitgum The Heifer Project International provides a model for re-stocking, focusing on poor households

Carry out livestock censuses regularly

The aim is to establish trends in production (numbers) in accordance with existing rangeland potential and sustainability Some pastures are being improved through extension services, though not in the rangelands The National Agricultural Extension Programme is yet to address rangelands improvement

The cattle breeding policy

This has been prepared by the National Cattle Breeding Project funded by DANIDA and requires concerted effort from both government and the private sector The policy focuses on matching genotypes with the available feed resources and the socio-economic environment

Livestock improvement

NARO aims to improve the local Zebu breed, goats and local chicken through cross-breeding and selection

Animal nutrition

There are two major activities to be promoted under this measure

- Forage development in at least 27 districts covering over 235 farms This pasture extension service produced about 2240 acres (about 895 ha) of pasture in 1995, where forage seed production was intensified, involving over 390 farmers

- Provision of water for livestock by establishing dams and valley tanks

Disease Control

The country is participating in the Pan African Rinderpest Campaign - for control of Contagious Bovine Pleuropneumonia (CBPP) and rinderpest This is in addition to the Livestock Services Project which deals with disease control to ensure a healthy national livestock herd

3 3 5 Sectoral Intervention Programmes

In addition to the responses/measures mentioned above, the following sectoral intervention programmes have been undertaken, are underway or have been proposed

(i) The Dairy Master Plan (1991)

Components of the Dairy Master Plan include the following

- Liberalisation of the Dairy Industry
- Review of Dairy Industry Act of 1967
- Establishment of Dairy Board and Dairy Development Plan

This plan addressed privatisation of the Uganda Dairy Corporation Currently it is 100% commercialised and its plant and collection centres will be privatised A number of privately owned dairy units have come up in western and central Uganda

(ii) Regional African Hides and Skins Leather Products Improvement Scheme

With support from UNIDO, a regional African hides and skin leather products improvement

scheme has been running a leather project in Rakai, Masaka, Mpigi and Jinja since 1994 This is encouraging the private sector to process hides and skins to add value for export

(iii) The Meat Master Plan Study

Plans are in place to execute this programme during 1996 Supported by African Development Bank, the main objective is to identify the necessary investment programmes intended to enhance and support future meat production and marketing in Uganda

(iv) The Animal Production Programme

This programme under NARO is directing research towards guidelines, information, and technologies on improved multi-species systems in rangelands, feed resource development and management Included also are surveys on production constraints and development potential for small ruminants

(v) **Proposed promotion of wildlife ranching**

This aims to promote wildlife ranching as a landuse option and to integrate park communities in planning modalities of conserving wildlife and use of park resources

(vi) **Livestock Health Research Institute** (LIRI)

This institute in Tororo is carrying out research on animal health and breeding and, in collaboration with Ministry of Health, on human trypanosomiasis

(vii) **The National Animal Genetic Resources Programme** (NAGRP)

This programme was launched in 1995 with the main objective of promoting and guiding sustainable utilisation of the indigenous animal genetic resources which have been previously neglected

3 4 FOREST RESOURCES

3 4 1 Forests in Uganda

Forest is a type of vegetation dominated by trees, many species of which are tall at maturity and have straight trunks The canopy is typically deep, being composed of several layers of foliage, and the herbaceous vegetation is generally open and lacks the tussock-forming grasses which are so characteristic of many types of savanna (Hamilton,A C 1984) In Uganda's context, forest has on occasions been taken to include woodland The major difference between forest and woodland is that in the latter, trees are characteristically shorter than in forest and the canopy is less dense Uganda's forests can be classified into the following broad categories tropical high forest (fully stocked or degraded/encroached) and plantations (broad-leaved, coniferous or woodlot)

Tropical High Forests

According to FAO estimates, forest and woodlands covered about 10,800,000 ha (or 45%) of Uganda's surface area in around 1890 Since then, the size of the forest estate has shrunk At the beginning of this century, Uganda's tropical high forests (THFs) covered 3,090,000 ha or 12 7% of the country Over the years, THFs have been gradually cleared Today the Uganda Forest Department (UFD) estimates that the THF estate has been reduced to about 730,000 ha, only 3% of Uganda's land area

Forests in Uganda occur as gazetted areas (forest reserves), other protected areas (national parks), and on private and ungazetted public lands (**Figure 3 4**) THFs occur largely in the eastern run of the western rift valley escarpment in western Uganda, a broad belt around the north-western shores of Lake Victoria, and on scattered mountains in the north and east of the country **Table 3 17** shows the extent of forests in protected areas in Uganda

Plantation

In addition to THFs and other types of natural vegetation, plantations make up 2 2 % of gazetted forests As a result of a policy shift necessitated by increased demand for industrial wood, posts,

poles and woodfuel, two types of plantations were established conifer (pine) and hardwood (dominated by eucalyptus) plantations (In the early 1900s, eucalyptus plantations were established around urban centres to drain swamps as an anti-malaria measure and not to provide wood) Todate, the main protected plantations stand at 14,000 ha of conifers (of which 2000 ha are now located in newly-gazetted national parks), eucalyptus plantations cover 18,600 ha In addition to plantations in forest reserves, there are plantations for tobacco, tea processing and private woodlots

Recently, the Uganda Forest Department (UFD), supported by the Norwegian Agency for International Development (NORAD), embarked upon the establishment of peri-urban plantations as sources of woodfuel and building poles and posts Initially UFD's peri-urban plantation activities were concentrated in six pilot areas, each in a selected district The predominant species planted are eucalyptus, but the Peri-Urban Forest Plantation Project is conducting species trials at each of the six sites Some of the new species may become more important than eucalyptus **Table 3 18** shows the peri-urban plantations as of April 1996

Agro-Forestry

The practice of integrating trees and crops or livestock on a given piece of land is not new in Uganda, but has long been carried out as part of subsistence farming However, formal agro-forestry activities started in 1987 in Uganda as a result of diagnosis and design exercises that were carried out in some highland areas The process of institutionalising agro-forestry started with it being both a mandate and subject group of the National Agricultural Research Organisation (NARO)

The main pressures leading to the focus on agro-forestry are the high rates of population increase with its consequent demand for farm and grazing land coupled with fuelwood and building poles scarcity in many parts of Uganda

The Agro-Forestry Research Network for Africa (AFRENA) was established in 1986 Its main objectives are to develop appropriate agroforestry technologies for land use systems and the national/regional capacity to plan, formulate and implement agro-forestry research The achievements in Uganda so far include

- identification of upper-storey trees for the production of poles and small timber They include *Grevillea robusta Casuarina cunninghamiana, Cedrella serrulata and Alnus accuminata* for areas above 1500 m above sea level and *Melia azedarach, Cassia siamea* and *Maesopsis eminii* for low altitude areas,

- trees with severe suppressive effects on crops have been identified such as eucalyptus, *Cordia abyssinica, Measopsis eminii* and *Albizia falcataria Casuarina* and *Markhamia* have mild suppressive effects,
- trees with positive effects have also been identified such as *Alnus accuminata*,

- trees/shrubs which are effective in stabilising bunds and controlling soil erosion and water run-off when planted along contours and hedgerows have been identified (for example *Calliandra calothyrsus)* These hedge-rows also provide fodder, fuel wood and stakes for climbing beans,

Table 3 17 Extent of protected forests in Uganda, 1996

Protection Category	Forest Type	Area (ha)
Forest reserves	THF/Montane	417 000
	Savanna woodlands	720 000
	Conifer plantations	12 000
	Eucalyptus plantations	18 600
National Parks	THF/Montane	321 000
	Conifer plantations	2000
Total		1 490 600

Source *Kamugisha and Sepp , 1996 Forest Department Report*

Table 3 18 Extent of peri-urban plantations (1996)

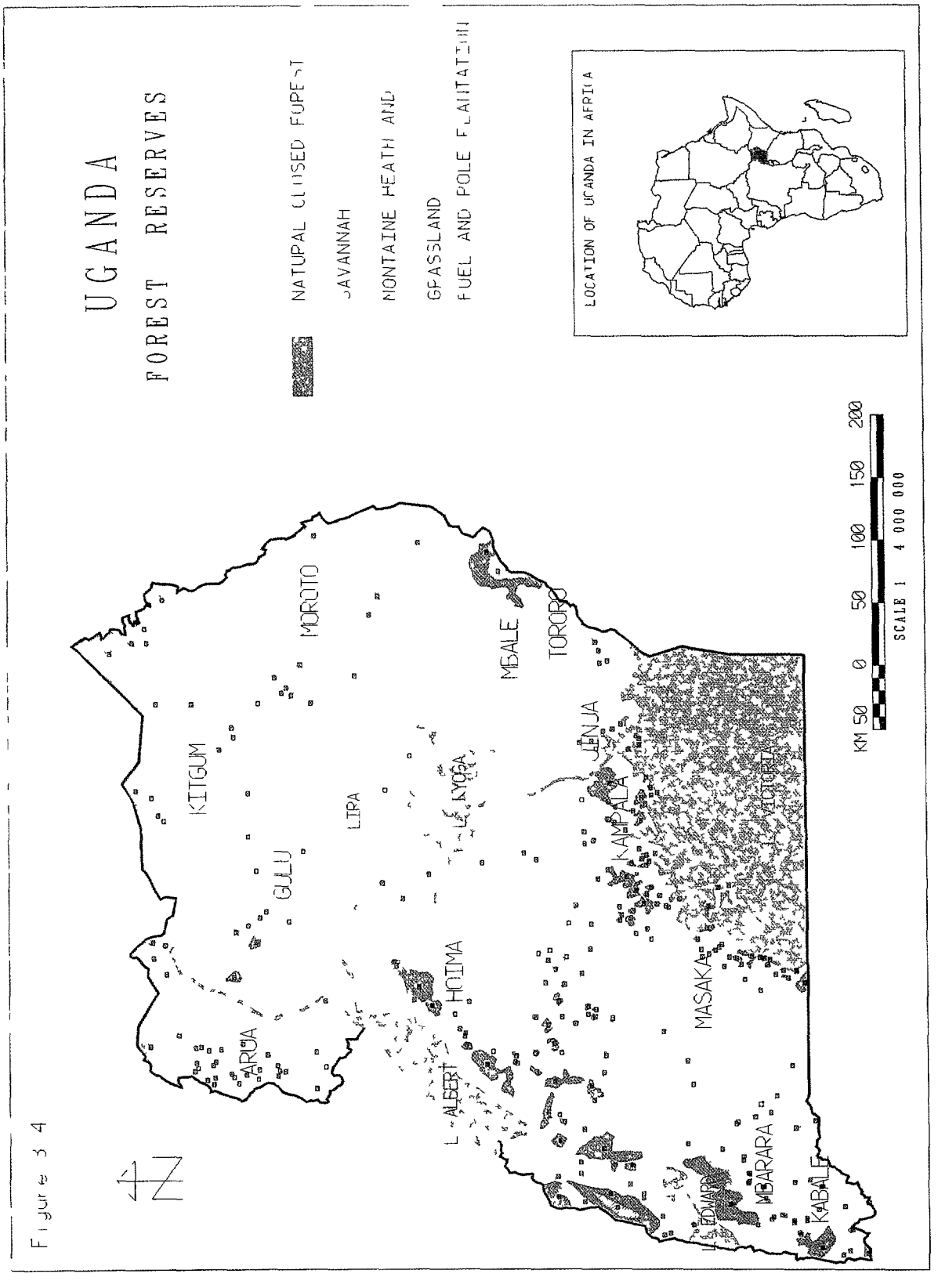
District	FD planting (ha)	Private Area Planted (ha)	No of farmers with woodlots
Arua	271 88	151 43	57
Mbarara	233 66	200 00	95
Mbale	312 80	119 60	46
Tororo	264 00	42 80	10
Kampala	297 00	246 00	70
Jinja	375 00	471 70	85
Total	1769 56	1232 03	363

Source *Byarugaba D N (1996) Forest Department Report*

- diagnostic and design surveys that are used to identify farmers' problems and prioritise research topics have been carried out in most land use systems in the highlands of Uganda,
- farmers have been motivated to make their own selections of agro-forestry tree species, establish their own nurseries and implement agro-forestry technologies on their farms, especially in Kabale district, and,
- both post-graduate and under graduate students from Makerere University have been supervised in agro-forestry research

There are plans to set up more experimental stations in addition to the five already existing at Kabanyolo, Namulonge, Bushenyi, Kacwekano and Kalengyere There are plans to develop Kifu as an experimen-

Figure 3 4 Forest Reserves of Uganda



tal station and to establish a tree nursery at Kifu in collaboration with ICRAF Multipurpose Tree (MPT) improvement programme In the near future, on-farm evaluation of specific agro-forestry technologies will be carried out in Mbale, Tororo, Iganga, Mukono and Nebbi

3 4 2 Forest Products

Uganda's forests produce a multitude of products roundwood (industrial logs poles,fence posts and firewood), processed wood products (sawn wood, chipboard, plywood, blockboard, charcoal) and other non-timber products (honey,medicines, bamboo shoots, gum arabic, fodder and cloth) There is great demand for these tangible forest products due to high population growth rate and increased affluence There is also a high demand for woodfuel The construction sector also generates a high demand Expenditure on construction increased from UShs 154,980 million to 432,095 million between 1986-1987 and 1995-1996 Contribution to GDP rose from 9 4% to 13 5%, respectively, during the same period According to the UFD (1996), similar growth rates are being experienced with regard to woodfuel used as an energy source for the production of building materials such as lime tiles and bricks and in sectors experiencing high growth rates like hotels and restaurants (12-22% per year since 1990), tea (nearly 100%, 1990-1995), and tobacco (97%, 1990-1994)

It is estimated that 20% of Uganda's population will be urban by the year 2006, this and higher household incomes will increase consumption of timber products There will also still be the urban poor who almost exclusively depend on charcoal for cooking **Table 3 19** provides estimates of forest product purchases for 1995-1996 with extrapolation to the year 2006

Economic Contribution of Wood Products

The non-monetary forest contribution is more important to the Ugandan economy than the monetary sector The monetary contribution, however, is much bigger than the non-monetary one **Table 3 20** shows the value of wood products consumed in Uganda in 1994 Government revenue collection from forestry is at present low, mainly due to poor collection methods and illegal

off-take and trade in forest products Furthermore, there is a moratorium on timber exports and issuance of new concessions in natural forest areas (Carvalho and Pickles, 1994) Otherwise, it is estimated that annual revenue collections could yield as much as US$ 20-30 million, providing ample justification for more attention to forestry (UFD, 1996)

Forest Services

Apart from previously mentioned wood and other non-timber products, forests provide various ecological functions, such as watershed protection, windbreaks, erosion control, climate amelioration and carbon sequestration For example, the forests of Mgahinga, Bwindi, the Rwenzoris, Elgon and Moroto are important watersheds Trees planted along farm boundaries act as windbreaks Forests offer ground cover that prevents exposure to forces of erosion There is evidence that forests at the micro-level affect the distribution of rainfall Finally, and probably most importantly from a global perspective, is the carbon sequestration function

Unfortunately, none of the functions and services that these forests perform enter into the conventional national accounting system Hence, the total contribution of forests to the national economy is routinely underestimated

Table 3 19 Estimates of the value of forest products with projections for 2006

Product	1995 1996 UShs Billion	Growth rate per annum	2006 UShs Billion
Charcoal 400 000 tonnes @ 120 000/= a tonne	48 0	7%	96 0
Firewood (Monetary) 3 6 Million tonnes @ 20 000/= per tonne	72 0	7%	144 0
Firewood (non monetary) 5 7 Million tonnes @ 5 000/= per tonne	45 0	2 5%	58 0
Subtotal Biomass for Energy	165 0	6 0%	298 0
Sawn timber 200 000 cubic metres @ 200 000/= per cubic metr	40 0	7 0%	80 0
Electricity Poles 8000 @ 80 000/- (retail) per pole	0 8	10 0%	2 0
Telephone poles 25 000 @ 40 000/= (retail) per pole	1 0	10 0%	2 6
Poles (Monetary) 500 000 cubic metres @ 50 000/= per pole	25 0	7 0%	50 0
Poles (non Monetary) 250 000 cubic metres @ 20 000/= per pole	5 0	5%	6 4
Other products (monetary) 100 per capita	20 0	5 0%	3 0
Other products (non monetary) 210 per capita	40 0	2 5%	5 0
Total	296 8	6%	574 0
MONETARY	206 8		407 6
NON MONETARY	90		116 4

Notes - ' Other products" denote all minor products like medicines, bamboo shoots and other edibles, shea butter oil, honey gum arabic fodder tourist trade in curios, matches, plywood, weaving materials etc

- Figur 1 growth rates are rounded off

Source *The Environmentally Sustainable Development (ESD) study of Woody Biomass Derived Energy and the National Biomass Study (1995) Carvalho and Pickles (1994) Report*

Table 3 20 Value of wood products in the Uganda economy, 1994

Product	Value* US$ Millions
Charcoal	12 1
Sawn timber	10 2
Poles	7 1
Fuelwood	
Household	36 1
Commercial	9 8
Industry	4 6
Total	79 9

Note * - Based on mid-year exchange rate of US$ = UShs970 US$ = United States Dollars

Source *Statistics Department MFEP 1995 Document*

Eco-tourism

An important actual and potential contribution of forests especially THFs, is in the area of eco-tourism While tourism is treated under a different chapter, it is important to highlight the eco-tourism attributes of forests

The concept of the recreational use of Uganda's forests dates back to the formulation of the sub-sector's overall policy One of the guiding principles of the current forest policy is that forests should be managed for production, recreation, amenity, tourism and education The current eco-tourism policy was developed in 1993, its objectives agree with the overall forest policy It focuses on continued protection of the forest resource as illustrated in **Box 3 3**

Uganda's THFs are one of the most biologically diverse ecosystems in the tropical world About 20,000 plant species exist of which 4000 are flowering plants (Pomeroy,1994) Due to their diversity in food and habitats, Uganda's forests are also rich in bird life eight families, 345 genera and over 1000 species have been listed of which 33% are entirely found in forest areas Uganda's forests support such rare species as the Mountain gorilla (*Gorilla gorilla berengei*) When compared to a temperate country such as Britain (similar size), Uganda supports more than five times as many birds, six times as many mammals, ten times as many reptiles and amphibians and three times as many higher plants (Groombride, 1992)

Currently, there are three operational eco-tourism sites in Uganda's forests two in Budongo and one in Mabira

3 4 3 Key Issues in Forest Management

Although Uganda's forest estate provides valuable products and services, it faces pressures There are many issues, some national, others location-specific The issues of deforestation, loss of biodiversity, pests and diseases, harvesting practices and policy are addressed in detail below

Deforestation

Deforestation is one of the major forms of land degradation **Table 3 21** shows a historical trend in the

Box 3 3
Budongo eco-tourism development

What was the idea behind developing eco tourism in Budongo Forest reserve? In 1991 it was recognised by the Forest Department (FD) that there were some serious threats facing Budongo Forest Reserve An obvious threat to the forest was illegal pitsawing but official logging proposals were also causing concern Of particular concern was Kaniyo Pabidi an area in the north-east of the forest which has never been logged or subjected to arboricide treatment and is therefore ecologically valuable There was a limited amount of pitsawing activity there and a local saw-mill was developing plans to log the area It was decided that if Kaniyo Pabidi was developed for eco tourism, the increased presence of people would control the illegal pitsawing problem and would also prevent the area being logged In other words right from the inception of the project the aim of developing eco-tourism has been conservation

Source *Forestry Department/Ministry of Natural Resources (1994) Workshop Proceedings on Nature Conservation for Senior Forest Officers*

rate of deforestation of THFs in Uganda from 1900 to 1987 Pressures contributing to deforestation in Uganda are mainly agricultural conversion as a result of both population increase and commercial agricultural expansion, urban demand for charcoal, and policy failures

Table 3 21 Historical Trends in Tropical High Forest Cover (1900-1987)

Year	THF Area (ha)	Share of land Area (%)	THF Shrinkage Index (1900=100)
1900	3 090 000	12 7	100
1926	2 627 700	10 8	85
1958	1 117 600	4 6	36
1967	688 937	2 66	21
1978	732 000	3 04	24
1985	765 000	3 17	25
1987	729 865	3 03	24

Source Forest Department Report (1994)

In 1991, Uganda's population growth rate was estimated at 2 5% per year, while the mid-1995 growth rate was estimated at slightly higher than 3 7% per annum (MFEP,1995) The population is about 88% rural, poor and using land-extensive agricultural techniques Even in areas with relatively low population densities, the need to open up virgin land for agriculture contributes to deforestation The promotion of non-traditional agricultural export (NTAE) crops and the revitalisation of cotton and tea industries are also resulting in the opening up of virgin land, some of it forested

For the period 1970 to 1986, Uganda lost an estimated net area of 256sq km of natural vegetation (including forests) to agricultural conversion Official estimates of land being cleared for agriculture in 1994 ranged from as low as 70,000 ha (MAAIF) to 200 000 ha (MFEP) **Table 3 22** shows the extent of forested areas for 1993-1994 with projections for the year 2006, using all available information and estimates, and assuming continuation of all present trends of agricultural expansion

Table 3 22 Predicted effect of agricultural expansion on forest vegetation, 1993 - 2006

	Forest vegetation	Area 1993/94 (Km2)	Area 2006 (KM2)(projected)
1	Plantations	350	500
2	THF (fully stocked)	6,500	5,000
3	THF (degraded)	2,750	2,200
4	Woodland	39,750	29,000

Source National Biomass Study, Report FD 1996 (preliminary figures rounded to the nearest whole number)

Unlike rural supplies of firewood gathered from dead branches and stems, charcoal production requires the felling of live trees The fast-growing urban population is increasingly dependent on charcoal for heating and cooking and is placing great pressure on surrounding forested areas In fact, urban areas are now sourcing charcoal from over 200km away Other urban activities such as building construction and hotels and restaurants exert additional pressure on forests

Finally, the turbulent political situation since the 1970s has been inextricably linked with forest loss A number of decrees and misguided policies gave people the right and actually encouraged them to settle anywhere after clearing forests for "development" **Box 3 4** gives examples of misguided policies Evidence of past official degazetting is shown in **Table 3 23** Deforestation has been responsible for the decline in hardwood timber production in the country and the scarcity of fuelwood in some areas Furthermore, deforested sites are often associated with serious erosion problems In highly-productive highland areas like Kabale, bare hills and loss of agricultural productivity are manifestations of the impacts of deforestation The depletion of forest cover on hilly areas has further led to reduction in water retention capacity of watersheds and the subsequent siltation and loss of wetlands Before its conversion into a national park, Mt Elgon Forest Reserve, which plays a vital role as a water catchment serving around one million people, had 34% of its area deforested (Howard, 1991) Current predictions are that if deforestation is allowed to continue, wetlands and open water areas estimated at 4830sq km and 36,910sq km will be reduced to 4500sq km and 36 900sq km respectively by the year 2006 due to the effects of agricultural encroachment and deforestation (UFD 1996) The annual cost of deforestation in Uganda has been conservatively estimated at US$3 8 - 5 7 million per year (Veitz and *et al* 1993) Incidence of forest degradation is presented in **Table 3 24**

Government, NGOs and the private sector have responded to the deforestation problem through afforestation and reforestation programmes including agroforestry, peri-urban plantations, private woodlots and the promotion of energy-efficient technologies Government in 1992 launched a National Tree Planting Programme to cover the whole country New legislation requires individual landowners and communities to plant trees in specific locations (steep slopes and river banks) and in specific quantities (minimum of 10% of any private land) The European Community (EC)-financed Natural Forest Management and Conservation Project has so far raised 53 million hardwood seedlings and planted an area of 12,760 ha This effort is backed by general rehabilitation and capacity building in the forestry sector The same EC-Project has also assisted in stopping encroachment of forest reserves A total of 98,200 ha has been cleared of encroachers

Also of recent, policies, laws and regulations relating to the forest estate have been strengthened or are under review A NORAD-funded nationwide project started in July 1996 aimed at strengthening the capacity of the Uganda Forest Department

Due to the extent that the high rate of growth of a largely rural population is the main cause of deforestation, responses aimed at the control of the rate of growth may be required Another constraint to appropriate response is the ownership pattern of the forest estate Deforestation is minimal in the gazetted forest reserves Most of the current deforestation is occurring on privately-owned or ungazetted public forests There are no institutional instruments in place to effectively intervene and control deforestation on private and public lands

Box 3 4
Effect of misguided policies on forest resources

After 1972 forest encroachment started on an unprecedented level After the expulsion of the Asians the President declared an economic war" followed by the double production campaign" in 1973 He declared that Ugandans were free to settle anywhere The land reform decree of 1975 strengthened peoples' hands in acquiring land supposedly for development" Under these concepts, forests were sometimes regarded as wastelands' which could be cleared Government officials started allocating gazetted forest land to either individuals or ministries for 'development Tree planting and other silvicultural activities came to a standstill

Source FAO 1988

Table 3 23 Major forest lands degazetted for settlement and other activities

Reserve	Allocated Area (ha)	Recipient
Agoro Agu	23 585	Individuals
Bukaleba	4 686	MAAIF
Echuya	300	MAAIF
Era	400	Individuals
Mt Kei	4 000	Individuals
Mt Elgon	6 000	(Ndorobo tribe)

Source *UNEP (1988) Strategic Resources Planning in Uganda Natural Resources and Environment in Uganda Strategies for Environmental Management, Vol 3*

Pests and Diseases

In recognition of the future pressure on natural forests, the Uganda Forest Department in the 1900s started an afforestation programme to meet the demand for industrial roundwood Areas were afforested with pines and cypress Until recently, these plantations were doing well except for scattered attacks from Lepidopterous defoliators such as *Gonmeta podocarpi, Buzura edwardsi* and *Pachymetana Sangcicinta*, which did not do serious damage to the plantations

Currently, three aphids are attacking the softwood trees namely the pine woolly aphid (*Prims pinii*), the pine needle aphid (*Eulachmus vileY*) and the cypress aphid (*Cinara cupressi*) The latter is the most damaging, especially at altitudes of 2000m a s l and above The unregulated importation of exotic tree species has been the main cause of the pest problems The cypress aphid originated from southern Europe and was first reported in Echuya Forest Reserve in 1989 from where it has spread to other plantations in the country (Kiwuso, 1991),

By 1991, approximately 5702 ha from Muko, Mafuga, Kiirima, Rwoho, Bugamba, Kagorra, Kyehara, Kikumilo, Kibale, Wampanga, Lendu, Usi, Awang and Okavo softwood plantations had been affected by the cypress aphid (Kiwuso, 1991) Softwood hedgerows of small farmers including shelter belts

Table 3 24 Incidence of forest degradation in selected districts, 1996

District	Fully stocked Sq km	Degraded Sq km	Total sq km Forest Area	Percent Degraded	Population Density persons per sq km
Bundibugyo	375 3	19 0	394 3	4 8	56
Bushenyi	678	32 6	710 6	4 6	135
Hoima	463 9	243 6	707 5	34 4	56
Iganga	32 8	160 7	193 5	83 0	196
Jinja	0 0	0 1	0 1	100 0	428
Kabale	81 4	3 4	84 8	4 0	246
Kabarole	716 7	194 1	910 8	21 3	92
Kalangala	221 5	6 2	227 7	2 7	38
Kampala	0 0	4 9	4 9	100 0	4581
Kapchorwa	193 7	139 9	333 6	41 9	67
Kasese	395 6	22 3	417 9	5 3	126
Kibale	671 3	343 4	1014 7	33 8	52
Kiboga	31 5	43 3	74 8	57 9	37
Kisoro	102 9	11 4	114 3	10 0	301
Luwero	1 4	61 2	62 6	97 8	53
Masaka	55 2	99 9	155 1	64 4	152
Masindi	509 4	19 8	529 2	3 7	31
Mbale	68 6	166 3	234 9	70 8	284
Mbarara	37 0	1 7	38 7	4 4	80
Moyo	12 7	0 1	12 8	0 8	38
Mpigi	270 8	420 6	691 4	60 8	202
Mubende	64 7	224 6	289 3	77 6	84
Mukono	500 6	534 3	1034 9	51 6	179
Nebbi	1 9	0 0	1 9	0 0	114
Rakai	183 6	32 1	215 7	14 9	99
Rukungiri	359 3	3 3	362 6	0 9	151
Soroti	4 6	0 0	4 6	0 0	50
Tororo	4 3	19 0	23 3	81 5	238

Source *Statistics Department, Statistical Abstract, 1996*

all over the country are infested The cypress aphid has posed a threat to afforestation programmes for the cypress species Its infestation is now referred to as the "AIDS of the cypress trees" Many farmers are reported to be reluctant to plant cypress in their woodlots With an estimated sustainable annual timber supply of about 470,000m^3 expected to be increasingly met from softwood plantations, the implications of the infestation for long-term sustainable industrial roundwood supply are significant Unless the infestation problem is resolved, there will be great pressure on the Forest Department to open up natural forest areas for logging

Whereas the use of pesticides could have some degree of success in controlling aphid infestation in the softwood plantations, the cost is prohibitive Moreover, the nature of the forest canopy does not allow for effective pesticide application Finally, the environmental impact of the pesticides would have to be evaluated

The Forestry Research Institute (FORI) of the National Agriculture Research Organisation (NARO) in collaboration with the International Institute of Biological Control (IIBC) and the biological control unit of Kawanda Agricultural Research Institute (KARI), has started working on a programme for biological control of the aphids To reduce further spread, 2500km of boundaries in the affected plantations have been opened Furthermore, a Forest Protection Unit charged with all aspects of research into forest pests and diseases has been set up within FORI In addition to softwood aphids, FORI plans to carry out research on the *Leucaena* psyllid, mvule gallfly, mahogany shoot-borer and pests of nursery tree seedlings and timber, with the aim of recommending possible control measurers For greater effectiveness, the institutional capacities of both FORI and the Forest Department have to be increased, in terms of manpower, equipment and funding

Harvesting and Processing Practices

Before the expulsion of Ugandan Asians in 1972, the country had a thriving wood processing industry Thereafter, insecurity and general macro-economic mismanagement all caused a decline in wood processing Pitsawing became the dominant means of converting round wood into sawnwood Originally pitsawing was meant for salvage to provide employment and timber to local communities and for harvesting in difficult terrain However, it has now become a characteristic feature on the forestry landscape and hence a management issue as almost all the timber on the domestic market is pitsawn In 1993 sawmillers processed just 22,000m^3 while pitsawyers processed 400,000m^3

Pitsawing licences are obtained annually from the Forest Department In addition to those with valid licences, there are many more illegal operators whose numbers are difficult to quantify

Pitsawing is a wasteful technology While sawmillers can achieve recovery rates of 36%, pitsawing recovers less than 20% (Carvalho and Pickles, 1994) In addition to being a wasteful way to convert logs, pitsawing also tends to "cream off" a forest by selecting premium tree species with large-sized stems But not all pitsawing is negative Many regard it as more environmentally friendly and more compatible with forest conservation principles than mechanical logging

Recently, as interest in sawmilling and plywood production picked up, the Uganda Forest Department began to re-examine the effectiveness of pitwawing Pitsawing is now being rigorously checked through a timber marking system, and a joint Uganda Revenue Authority/Forest Department task force established to monitor timber movements This task force should ensure that only legally

pitsawn timber is brought onto the market

3 5 WILDLIFE RESOURCES

3 5 1 Uganda's Wildlife

Wildlife can be defined as animals and plants which live and grow under natural conditions Uganda is rich in wildlife resources Wildlife occur in both protected areas and on private ungazetted public lands There are four types of wildlife protected areas, classified according to the degree of protection accorded Uganda has ten national parks (**Table 3 25**), ten wildlife reserves (**Table 3 26**), seven wildlife sanctuaries (**Table 3 27**) and 13 community wildlife areas (**Table 3 28**) The national parks occupy about 11,150sq km or 4 6% of the country, wildlife reserves occupy about 8760sq km or 3 6% consisting primarily of grassland with patches of dry woodlands and scrubland Wildlife sanctuaries cover 850sq km or 0 35% of the country and are made up of areas of different sizes designed for specific conservation purposes Several of the sanctuaries have been gazetted to afford particular protection to single species of national or global importance Community wildlife areas, originally known as controlled hunting areas, occupy about 27,600sq km or 11 4% of Uganda The objectives of management in each protected area category and permissible activities within it are presented in **Box 3 5** The wildlife estate of Uganda is the direct responsibility of the Ministry of Tourism Wildlife and Antiquities (MTWA) Originally, the Game Department (GD) and Uganda National Parks (NP) were the two institutions of MTWA responsible for the management of wildlife in protected areas However, having recognised the parallel and sometimes duplicating roles of NP and GD, as well as the need to strengthen and coordinate the management of wildlife, the government decided to merge the two institutions into a new parastatal called the Uganda Wildlife Authority (UWA), whose primary responsibility is " to conserve in perpetuity for Uganda and the global community the resources within national parks and other wildlife areas" The Protected Area Management Zones are outlined in **Table 3 32**

Protected wildlife areas occupy about 20 0% of the area of Uganda (**Figure 3 4**) This is quite significant The main economic benefit from the wildlife estate has been revenue earnings from tourism, which is just recovering Up to 1970, tourism was the third foreign exchange earner after coffee and cotton Ugandans also seek cultural and scientific benefits from the wildlife estate, including sustainable use of wildlife products The conservation of Uganda's wildlife resources generates benefits of global significance

Wildlife resources thus have multiple economic benefits direct, indirect and induced output, income and employment, and consumers' surplus to tourists While these are being realised in Uganda, there is as yet no detailed data available

3 5 2 Key Issues inWildlife Management

Despite the national and global importance of Uganda's wildlife resources and renewed efforts at management, several issues place their sustainability into question These relate to land use conflict, poaching, settlements within protected areas, tourist behaviour and historical policy setting as discussed in the following sections

Population Pressure

Uganda's population is largely rural and agrarian Human population increase is placing heavy pressure on the wildlife resources of the country, on both protected, private and unprotected public

Tables 3 25 National parks of Uganda, 1996

National Park	District	Areas sq km	Year of Gazettement
Murchison Falls	Gulu/Masindi/Apac	3860	1952
Queen Elizabeth	Kasese/Bushenyi/Rukungiri	1978	1952
Kidepo Valley	Kotido	1442	1962
Lake Mburo	Mbarara	365	1982
Bwindi Impenetrable	Kabale/Kisoro/Rukungiri	331	1991
Mgahinga Gorilla	Kisoro	25	1991
Rwenzori Mountains	Kasese	996	1991
Mountain Elgon	Mbale	1172	1993
Kibale	Kabarole	766	1993
Semiliki	Bundibugyo	220	1993
Total		11 155	

Source *MTWA Report, 1994 Restructuring of Uganda National Parks and Game Departments draft organisational and policy outline*

Table 3 26 Wildlife reserves, 1996

Wildlife Reserve	District	Area (sq km)	Year of Gazettement
Kigezi	Rukungiri	328	1952
Toro	Bundibugyo	549	1959
Katonga	Kabarole	207	1964
Karuma	Masindi	713	1964
Pian Upe	Moroto	2287	1964
Bokora	Moroto	2034	1964
Matheniko	Moroto/Kotido	1587	1964
Ajai	Arua	156	1965
Kyambura	Bushenyi	155	1965
Bugungu	Masindi	748	1968
Total		8 764	

Source *MTWA, 1996 Restructuring of Uganda National Parks and Game Departments draft organisational and policy outline*

Box 3 5
Categories of protected areas

National Parks

Objectives NPs are areas of national importance for nature and landscape conservation and natural heritage preservation They should be ecologically-viable units

Permitted Activities

Viewing and scientific research Hunting of wildlife and disturbance of vegetation prohibited Harvesting/removal of approved resources may be authorised in designated areas

Wildlife Reserves (formerly Game Reserves)

Objectives WRs are areas of importance for wildlife conservation, utilisation and management They should be of sufficient size for management of wildlife populations They may also serve as buffer zones to NP

Permitted Activities

Wildlife conservation recreation scenic viewing consumptive utilisation (including sport hunting), scientific research

Wildlife Sanctuaries (formerly Animal Sanctuaries)

Objectives WSs are areas of varying size designated for specific bio diversity conservation purposes including the preservation of a critical species

Permitted Activities

Recreation scenic viewing, scientific research
Hunting of animals and destruction of critical habitats are prohibited

Community Wildlife Area (formerly Controlled Hunting Areas)

Objectives CWAs are wildlife conservation areas that are jointly managed with the communities in the area which may directly benefit through tourism sustainable utilisation of wildlife etc

Permitted Activities

Tourism wildlife consumptive utilisation commercial and sport hunting and various mixed land use practices grazing and agricultural activities are allowed where appropriate

Source *Ministry of Tourism Wildlife and Antiquities (1996) A Draft Organisational and Policy Outline MTWA (1996)*

areas Several of Uganda's national parks (Mgahinga Mountain Gorilla National Park, Bwindi Impenetrable National Park, Rwenzori Mountains National Park and Mt Elgon National Park) are located in areas where the adjacent human population is in excess of 200-300 persons/sq km In these areas, land is scarce and decreasing in productivity due to overuse The need for agricultural land is overwhelming, putting intense pressure on the national parks Before the above mentioned areas were designated as national parks, they were forest reserves which allowed for resource use unlike the restrictive status of the parks Now the communities living around these parks have lost much of their access rights to the forests

Table 3 27 Wildlife sanctuaries, 1996

Wildlife Sanctuary	District	Area (sq km)	Year of Gazettement
Mountain Kei	Moyo	523	
Otze	Moyo	204	
Entebbe	Mpigi	51	1951
Jinja	Jinja	32	1953
Dufule	Moyo	10	1959
Kazinga	Kasese/Bushenyi	23	1959
Malawi	Tororo	7	1962
Total		850	

Source *MTWA, 1996 Restructuring of Uganda National Parks and Game Departments draft organisational and policy outline*

Table 3 28 Community wildlife areas, 1996

Community Wildlife Areas	Area (sq km) of CWA	District	Population of District	Year of Gazettement
Napak	225	Moroto	174 417	
East Teso	504	Soroti	430 390	
North Karamoja	10 793	Kotido/Moroto	370 423	1963
South Karamoja	7988	Moroto	174 417	1963
Sebei	1323	Kapchorwa	116 702	1963
West Madi	821	Moyo	175 645	1963
East Madi	1752	Moyo	175 645	1963
Lipan	900	Kitgum	357 184	1963
Karuma Falls	241	Masindi	260 796	1963
Kaiso	227	Hoima	197 851	1963
Buhuka	18	Kibale/Hoima	418 112	1963
Semliki Flats	504	Bundibugyo	116 566	1963
Katonga	2299	Kabarole	746 800	1963
Total	27 605			1963

Source *UWA (1996) Draft organisational and policy outline*

To reduce pressure on the national parks a number of integrated conservation and development projects (ICDPs) are underway the CARE Development Through Conservation project around Mgahinga and Bwindi, WWF Conservation Project for the Rwenzoris and IUCN Conservation Project around Mt Elgon The principal objective of these ICDPs is to raise agricultural productivity and provide alternative sources of income outside the parks Another initiative is the Mgahinga Bwindi Impenetrable

Forest Conservation Trust (MBIFCT) a World Bank, USAID and Government of Uganda-funded endowment meant to provide benefits to communities adjacent to the two parks in perpetuity

The extent to which wildlife resources are being lost on private and unprotected public lands is not known but is thought to be significant Most of the current deforestation is occuring on private and unprotected public lands

Encroachment

National parks have the highest conservation status, but pressures of high population density, inappropriate policies and sometimes benign neglect have resulted in encroachments on protected wildlife areas Sometimes encroachment also occurrs where human population densities are low In Semliki National Park, encroachment is a key issue as it is "a hard edge" park Approximately 100 huts are estimated to be located within the park, leading to intensive hunting of wildlife Matheniko Wildlife Reserve is surrounded by an area of low human population densitis nevertheless large mammals are few due to hunting The substantial numbers of livestock owned by the encroachers also compete with the remaining wildlife populations for both water and forage The heavy use of the protected area by livestock results in habitat destruction and loss of bio-diversity In parks like Queen Elizabeth, Kidepo Valley and Murchison Falls, encroachment is also significant

Wildlife protection authorities are evicting encroachers It has been found that most encroachers in areas like Semiliki and Matheniko do have access to land elsewhere To discourage future encroachment, park authorities are placing increased emphasis on community participation in wildlife conservation, including the sharing of any benefits resulting from the conservation

Settlements

Until the 1950s, wildlife moved relatively freely along their migratory routes in Uganda Since then, increased human population densities and unplanned settlement have resulted in the blocking of migratory routes For example, the Aswa-Lolim area used to be a migratory route for elephants between Murchison Falls National Park and southern Sudan When Aswa-Lolim was degazetted as wildlife protected area, human populations moved in and the migratory route was blocked It is believed that some elephants are still trapped in Zoka Forest, along the migratory route Elephants also used to move from Murchision Falls National Park through Masindi Hoima and Mubende Districts into Tanzania Recently some were sighted in Mubende and Luwero districts, apparently retracing their migratory routes

Many protected areas, as far as wildlife populations are concerned, are in effect "islands" surrounded by human settlements The compartmentalisation of protected areas has resulted into conflicts manifested by damage to crops, loss of human life and destruction of household property by "problem animals" (especially vermin)

Whenever feasible, animals that trespass onto farms are translocated to protected areas When damage is evident, farmers are usually compensated The Wildlife Statute, 1996, also authorises private persons to kill animals that have caused injury or damage to their persons or property including their crops or livestock, but they must report the incident to an officer of the protected area within one week By including local communities in wildlife conservation, there is better understanding of

the problems of vermin **Box 3 6** is an extract from the Wildlife Statute, 1996 regarding problem animals Those animals coming from private and unprotected public areas are relatively uncatered for except by Section 58 of the Statute

Fishing Villages

In wildlife protected areas with large open water bodies, fishing villages may present a real threat to ecological stability The villages were there before the areas were gazetted for wildlife protection They later became enclaves within the protected areas In the case of Queen Elizabeth National Park, commercial fishing contributed to further expansion of the fishing villages

The primary source of energy for the fishing villages is wood fuel, which is used for cooking, fish processing (mainly smoking and frying) and income generation Infield (1989) surveyed 409 heads of households in the fishing villages of QENP and found that 228 used firewood in open fires for cooking, 168 cooked on charcoal stoves (*jikos*), seven used kerosene stoves, and three had no preference Removal of biomass for energy by the fishing villages especially for charcoal production results in habitat destruction in the affected parks In QENP where the fisher-folk communities prefer *Acacia sieberiana* for charcoal production, there is competition with the elephant population for which the species is also a delicacy

To overcome the problem of the fishing villages, wildlife authorities have re-demarcated boundaries so that activities of the villagers are confined within specified areas Having done so, it is considered an offence to harvest firewood or produce charcoal outside of the designated areas There is also an effort to reduce the population of people living in the fishing villages, mainly through licensing to ensure that there is sustainable catch of fish

Poaching

Although the extent of poaching in protected areas has been drastically reduced, this illegal activity still occurs Much of the poaching for subsistence is done by surrounding communities, those in fishing villages within national parks, and others who have settled illegally within these areas There are also poachers with commercial interests in meat and trophies may not necessarily be members of the surrounding communities

Poaching has significantly reduced wildlife populations **Table 3 29** shows the status of animal populations in Kidepo Valley National Park Comparable data for selected animal species in Murchison Falls National Park is presented in **Table 3 30**

In some wildlife protected areas, the combined effects of poaching, settlement, encroachment and others have resulted in extinction **Table 3 31** shows some recorded extinctions in the various national parks

A secondary effect of poaching is vegetation trampling and bushfires caused by the poachers, leading to destruction of habitats for micro-organisms

Box 3 6

Sections of the wildlife statute dealing with problem animals

58 (1) The Board (of the Uganda Wildlife Authority) may on the Advice of the Executive Director, declare any animal or class of animals to be vermin

(2) The declaration under sub-section (1) many be effective for the whole of Uganda or for such part or parts of Uganda as may be specified in the notice

(3) The declaration of vermin shall be published in the *Gazette* and local newspapers having wide circulation in the areas affected

62 (1) Subject to this Statute any person having reason to believe that any protected animal is causing or may cause material damage to any land crop domestic animal, building, equipment or other property may report the facts to an officer

(2) An officer who receives a report under sub-section (1) shall, as soon as practicable, assess the extent of the threat posed by the said animal and take any necessary action he considers fit in the circumstances

(3) In deciding what action should be taken to minimise damage to property caused by a protected animal an officer shall carefully consider the status of the species and if he decides to kill or attempts to kill the animal, he shall do so only as a last resort and only if he has reasonable ground to believe that this course of action will not endanger survival of the species

Source Ministry of Tourism Wildlife and Antiquities 1995 Uganda Wildlife Statute 1996

Table 3 29 Wildlife population in Kidepo Valley National Park, 1996

Wildlife	1967 1972	1995	Net Change
Buffalo	1 000 2 000	800	200 1 200
Elephants	500 800	220	280 580
Eland	300	30	270
Bright s gazelle	250 600	00	250 600
Giraffe	200	5	195
Hartebeest	2 000	300	1700
Roan Antelope	120	00	120
Black Phino	50	00	50
Water buck	250	100	50
Read buck	n/a	300	n/a
Zebra	500	500	00

n/a = not available,

Source Lamprey and Michelmore (1996) Survey of the Wildlife Protected Areas of Uganda

Table 3 30 Comparable counts for Some Animals in Murchison Falls National Park, 1996

Wildlife		Year of aerial counts	
	1969	1980	1995
Elephant	14 500	1420	201
Buffalo	26 484	15,250	1087
Hartebeest	16,234	14,000	3068
Uganda Kob	n/a	30 700	6355
Water buck	n/a	5500	539
Warthog	10 987	n/a	n/a

Note *Results of aerial counts can only ever be rough estimates These depend upon the time of year time of day competency of pilot and navigator consistency of observation etc*

Source *Murchision Falls National Park (MFNP) (1996) A guide to Murchison Falls National Park and the Surrounding Game Reserves*

Table 3 31 Extinct Animals in various National Parks of Uganda

National Park	Species Extinct
Semliki	Red Colobus
Bwindi Impenetrable	Leopard, Africa Buffalo
Murchison Falls	White Rhino, Black Phino
Kidepo Valley	Black Rhino
Queen Elizabeth	Giraffe
Mgahinga Gorilla	Sitatunga, Yellow backed duiker

Source *Uganda National Parks (1995) Birds and Mammal Checklists for Ten National Parks in Uganda*

Authorities are responding to poaching by increasing the capacity of the rangers Penalties for poachers, once caught, are also now much more severe (**Box 3 7**) Finally, it is hoped that since communities adjacent to the park are the main poachers, involving them in protected areas management and sharing of benefits will encourage compliance and community-based surveillance

Box 3 7
Key provisions against poaching in Uganda Wildlife Statute, 1996

75 Subject to the provisions of this Statute a person convicted of an offence under this Statute for which no other penalty is provided shall

(a) in the case of a first offence be liable to a fine not less than thirty thousand shillings but not exceeding three million shillings or to imprisonment for a term of not less than three months or to both such fine and imprisonment

(b) in the case of a second or subsequent offence, to a fine of not less than three hundred thousand shillings but not exceeding six million shillings or to imprisonment for a term of not less than six months or to both such fine and imprisonment

76 Any person who is convicted of an offence involving

(a) taking hunting, molesting or reducing into possession any protected species or

(b) possession of selling buying transferring or accepting in transfer specimen of protected species,

(c) contravention of provisions of this Statute which provide for the conduct of a licence under a professional section 68 shall be liable to a fine of not less than seven years and in any case the fine shall not be less than the value of the specimen involved in the commission of the offence

Source *Ministry of Tourism Wildlife and Antiquities 1996 Uganda Wildlife Statute 1996*

Inadequate Budget

The integrity of protected areas in Uganda will rely heavily on continued financial support from government and other external sources

In recognition of the importance of the wildlife protected areas both to the country and the global community, government has attracted donor interest in the Conservation and Sustainable Tourism (CAST) Programme The CAST Programme is a multi-donor undertaking involving several projects and sub-projects The World Bank-supported Protected Areas Management Support Unit (PAMSU) Project is a component of CAST In addition, there are EU, German and USAID-supported projects within the CAST Programme The twin aims of CAST are to build institutional capacity and to promote the sustainable financial viability of the protected area system through increased tourism and small enterprise development around protected areas For its part the government through the newly-formed UWA is has promoted the awarding of multi-year concessions to tour operators The concessions cover the rehabilitation of former tourist facilities and construction of new lodges tented camps and associated tourist activities Some of the concessionaires have failed to honour the terms of their contracts, failing to pay annual fees or carry out the work they contracted to undertake Currently, UWA is reviewing the terms and conditions of the concessions with a view to improving upon how they operate

Tourist Behaviours A Case Study of Gorilla Trekking and Mountain Hiking

The promotion of Uganda as a valuable tourist destination by Uganda Tourism Board (UTB) has led to an increase in the number of tourists (see section on tourism) attracted by big game viewing in the

grasslands and eco-tourism in the forested national parks Eco-tourism goes beyond specialised tour sites to nature walks in the jungles, bird watching and viewing unique features Eco-tourism is the fastest-growing sector in the tourism industry, estimated to be at about 10-15% per annum

One major attraction of eco-tourism is gorilla trekking in Bwindi and Mgahinga National Parks

Experience in Rwanda and Zaire, where gorilla trekking has a longer history, suggests that the presence of tourists introduces two main risks

(a) the possibility of disease transmission from human to gorillas or vice versa, and,

(b) interference with the gorilla's normal living patterns

These two risks support the observation that gorilla tourism is sensitive, difficult and unsustainable unless carefully managed and controlled UWA has therefore restricted the annual number of eco-tourists allowed in both Mgahinga and Bwindi The number visiting any group of gorillas is limited to six For a recently-habituated group, it is advisable to start with one or two and then gradually increase up to six depending on the ease of the habituation process Second, gorillas can only be viewed by tourists for a maximum of one hour per day Third, humans are not allowed to approach closer than 5m to a gorilla and, should the gorilla show unease at 5m, then the tourist should carefully and slowly move away Fourth, children below the age of 15 years and sick persons are excluded from gorilla trekking Finally, tour guides are also trained to control any other interference or contamination arising from human use of gorilla habitat

Other ecologically-sensitive areas include the Rwenzori Mountains National Park (RMNP), a delight for hikers Climbing the mountains can take as long as seven days for a full circuit The terrain is fragile, and the park's authorities have pegged its carrying capacity at 1600 tourists per annum In addition to the fragility of the trails, hikers pose additional dangers to the pristine status of the park garbage disposal and the harvesting of firewood are problems

Management

Management of Uganda's wildlife has had institutional problems since the 1970s Most notabley, wildlife on private and unprotected public land is not protected

To increase effectiveness, the Wildlife Statute has divided the country into six wildlife management zones, including unprotected areas (**Table 3 32 and Figure 3 4)**

The new management structure has a Chief Warden with the status of Assistant Director, in charge of each of the six management zones The Chief Warden is based in the principal wildlife area of each of the zones, usually a national park if one exists It is expected that the new management structure will greatly decentralise wildlife administration and bring it close to the district level This will introduce sense of ownership for the resource among the districts and facilitate a process of community policing

Policy

Previous to the introduction of the new wildlife policy, it was recognised that wildlife management was exclusionary in that it did not involve the participation of the adjacent communities

A new wildlife policy was put in place in 1995, then translated into a law, and is now referred to as the Wildlife Statute, 1996

Highlights of the national wildlife policy are

> *to ensure in perpetuity for Ugandans and the global community, the wildlife resources within and outside protected areas and to enable the people of Uganda to derive ecological, economic, aesthetic, scientific and educational benefits from wildlife*[8] The significance of this is to involve the rural people who share much of the land with wildlife

This is conceived to take place in two principle ways

(a) by establishing communal wildlife areas within which local communities will be empowered to benefit economically from wildlife, and,

(b) by granting user rights, mainly to landowners who may be individuals, corporate or collective, and who may be entitled to manage non-endangered wildlife of their choice following a process of approval by the wildlife Authority

Presently six wildlife use rights have been established

(a) Hunting, class A wildlife user rights,
(b) Farming, class B wildlife user rights,
(c) Ranching, class C wildlife user rights,
(d) Trading in wildlife and wildlife products, class D wildlife user rights,
(e) Using wildlife for educational or scientific purposes including medical experiments and developments, class E wildlife user rights,
(g) General extraction, class E wildlife users rights

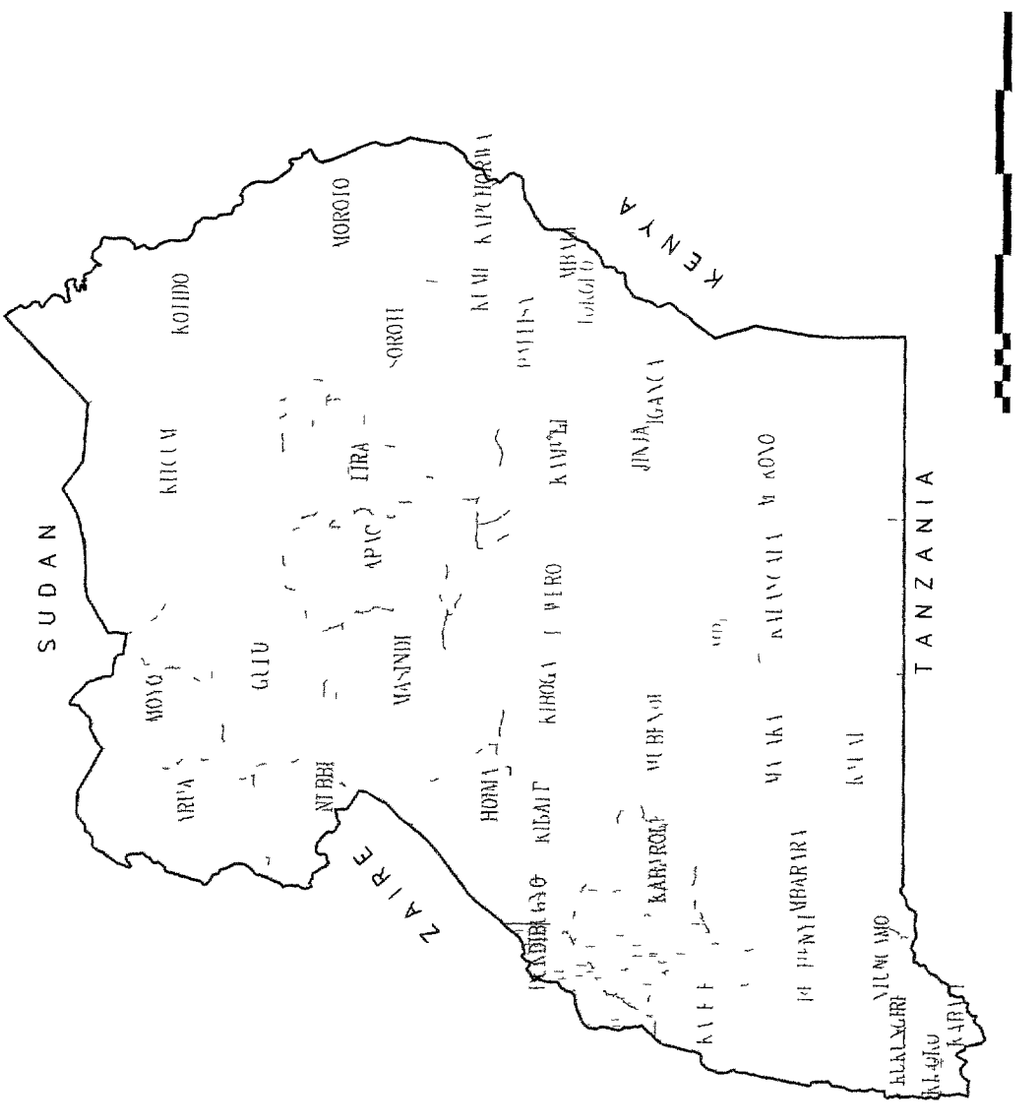
However, hunting was banned in 1979 and is still in force Therefore, for the moment, the Authority will not be granting class A wildlife user rights

Table 3 32 Protected area management zones

Zones	National Parks	Wildlife reserves	Wildlife Sanctuaries	Communal Wildlife Areas	District
North Western Zone	1 Murchison Falls	1 Karuma	1 Mt Kei	1 West Madi	1 Arua
		2 Bugungu	2 Otze	2 East Madi	2 Nebbi
		3 Ajai and Aswa Lolim to be regazetted	3 Dufule	3 Karuma Falls	3 Moyo
			4 Zoka		4 Apach
					5 Hoima
					6 Gulu
					7 Lira
					8 Masindi
					9 Kibale
North Eastern Zone	1 Kidepo Valley	1 Lain Upe	None	1 North Karamoja	1 Kotido
		2 Bokora		2 South Karamoja	2 Moroto
		3 Matheniko		3 Napak	3 Kitgum
				4 East Teso	4 Sorotu
				5 North Teso	
				6 Lipan	
South East Zone	1 Mt Elgon	None	1 Malawa	1 Sebei	1 Kapchorwa
					2 Mbale
					3 Pallisa
					4 Kumi
					5 Tororo
Western Zone	1 Kibale	1 Katonga	None	1 Semliki	1 Kabarole
	2 Rwenzori	2 Semliki		2 Katonga	2 Kasese (part)
	3 Semliki				3 Bundibugyo
South Eastern Zone	1 Queen Elizabeth	1 Kyambura	None	None	1 Kasese (part)
	2 Mgahinga	2 Kigezi			2 Bushenyi
	3 Bwindi				3 Rukungiri
					4 Kisoro
					5 Kabale
					1 Kampala
					2 Mukono
					3 Mubende
					4 Luwero
					5 Jinja
					6 Iganga
					7 Kiboga
					8 Mpigi
Lake Mburo Zone	1 Lake Mburo	1 Kikagati to be gazetted	1 Jinja	None	1 Mbarara
			2 Entebbe		2 Masaka
			3 Nkozi Islands		3 Rakai
					4 Kalangala
					5 Ntungamo
Central Zone	None	Mubende	1 Jinja 2 Entebbe 3 Nkozi Islands	None	Kampala Mukono Mubende Luwero Kamuli Jinja Iganga Kiboga & Mpigi

Source *MTWA 1994 Restructuring of Uganda National Parks and Game Department A Draft Organisational and Policy Outline*

Figure 3 5 Protected areas management zones of Uganda map



3 2 Agriculture

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3 3 Livestock

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CHAPTER FOUR

4 0 WATER RESOURCES AND AQUATIC ECOSYSTEMS

4 1 WATER RESOURCES

4 1 1 The Water Resources of Uganda

As the institutions responsible for water have put it *"water is life - cherish it"* Water is essential for the very existence of life on earth It is a major factor in the socio-economic fabric of Ugandan society and a major determinant of the development potential of the country The various uses to which water is put have important implications for the state of Uganda's environment as does the way water resources are managed

The water resources of Uganda consist of open water bodies (lakes and rivers described in **Chapter 1**), groundwater and rain-harvest These sources of water are used in several ways human consumption in both rural and urban areas, industrial use, livestock/wildlife consumption, marine transport and power generation In addition, the open water bodies are home to rich bio-diversity (see **Chapter 6**) including fisheries resources (described in detail in **Section 4 3**) Wetlands (**Section 4 4**) occupy the transition between open water bodies and terrestrial eco-systems and perform important regulatory functions

Sources

Surface Water

The whole of Uganda lies within the Upper Nile catchment, with numerous rivers flowing into Lakes Victoria, Edward, Kyoga and Albert, and also directly into the River Nile The main river which drains into Lake Victoria is the Kagera, originating from the highlands of Rwanda Uganda's rivers and lakes, including wetlands, cover about 18% of the total surface area of the country (**Table 4 1**) For operational purposes, the Directorate of Water Development (DWD) views the supply zones of surface water as consisting of eight basins These basins are of differing sizes and directions of flow as shown in **Table 4 2**

Rainfall is the principle contributor of water to the surface bodies To a large extent, availability of rainfall has also influenced settlement patterns Rainfall distribution in Uganda is discussed in **Chapter 1** Rainfall feeds surface water bodies through run-off, which in turn is governed by the combined effect of the rainfall event and evapo-transpiration In general, the seasonal variations of potential evapo-transpiration across the whole of Uganda are relatively small, in the order of 10%

Groundwater

Groundwater is found in aquifers, which are water-bearing formations with hydraulic characteristics that allow water to be extracted in significant amounts through the use of boreholes and dug wells In Uganda, productive aquifers are largely found in weathered bedrock and regolith overlying crystalline basement rocks and in faults and fractures in the basement Average hydrological parameters are presented in **Table 4 3**

Compared to the extraction of groundwater using boreholes, the construction of protected shallow dug wells is a fairly recent development in Uganda, promoted largely by NGOs and to some extent the DWD

According to DWD (1995), there are an estimated 200,000 protected and unprotected springs in Uganda These springs constitute an important water source, especially in the southeast, the mountainous parts of the east and the west and southwest of the country

Rain harvest

With an annual rainfall in the range of 600-2500mm, there is good potential for harvesting rainwater in Uganda Unfortunately, the current housing structures in the rural areas (grass thatched huts) and the additional investment required for storage tanks do not allow for extensive harvesting

Table 4 1 Total area of water bodies by regions

Region	Total Area(Sq km)	Open Water and Wetlands (Sq km)	Open water/wetlands as Percent of Total Land area
Central	61352 2	24001 5	39 1
Eastern	39524 9	11973 1	30 3
Northern	85392 9	2590 1	3
Western	55278 3	4399 5	8
Uganda	241547 6	44205 3	18 3

Source *Ministry of Finance and Economic Planning (MFEP) 1996 Statistical Abstract*

Table 4 2 Main basins and features of the Uganda drainage network

Basin Number	Area (sq km)	Direction of Discharge
1	59 858	Catchments discharge into Lake Victoria
2	57 669	Catchments downstream of Lake Victoria discharge into Lake Kyoga
3	26 796	Catchments contribute to the Kyoga Nile downstream of Lake Kyoga
4	18 624	Catchments downstream discharge into Lakes Edward and George
5	18 223	Catchments downstream of Lake Edward discharge into Lake Albert
6	26 868	The Aswa Basin discharges to the Albert Nile downstream of the Sudanese border
7	20 004	Catchments contribute to the Albert Nile within the Ugandan Territory
8		The Kidepo Basin in the extreme north western part of the country

Source *Directorate of Water Development 1995 Water Action Plan Rapid Water Resources Assessment Doc 007*

Table 4 3 Average hydrogeological parametres assessed by districts

Region	District	Yield (Cubic Metres/hour)	Drilling Depth (m)	Regolith Thickness (m)	Water Level(mbgl)
Central	Kalangala	1	44 8	46 5	17 8
	Kiboga	1 1	74 0	26 5	36 0
	Luwero	1 7	59 1	33 9	20 1
	Masaka	1 1	101 0	44 0	34 8
	Mpigi	1 8	70 2	38 7	23 6
	Mubende	1 0	76 3	37 7	25 8
	Mukono	1 4	65 3	38 3	24 2
	Rakai	1 5	103 0	46 5	28 8
Western	Bundibugyo	N	N	N	N
	Bushenyi	1 3	80 0	N	15 0
	Hoima	2 9	63 0	34 5	17 0
	Kabale	1 8/2 2 (1)	63 7	46 5	28/10 (1)
	Kabarole	1 8/2 2 (1)	84 0	N	N
	Kasese	2 2	41 0	46 5	14 8
	Kibale	N	N	N	N
	Kisoro	N	N	N	N
	Masindi	3 1	73 0	42 0	26 0
	Mbarara	2 9	92 8	64 4	26 7
	Ntungamo	N	N	N	N
	Rukungiri	1 2	64 0	34 3	15 0
Northen	Apac	3 7	78 2	N	22 2
	Arua	3 1	68 4	17 8	12 4
	Gulu	3 7	83 0	19 0	15 0
	Kitgum	1 3	59 7	26 7	18 7
	Kotido	0 8	66 3	24 0	27 0
	Lira	3 4	97 4	N	15 0
	Moroto	1 4	79 4	38 7	24 1
	Moyo	3 1	75 4	16 9	13/10 (1)
	Nebbi	1 8	69 7	34 4	17 6
Eastern	Iganga	5 1	52 0	28 2	19 8
	Jinja	2 2	88 0	38 0	26 0
	Kamuli	1 5	103 0	48 5	28 6
	Kapchorwa	2 5	90	38 7	
	Kumi	1 2	79 1	15 0	12 3
	Mbale	2 2	82 4	19 7	16 7
	Pallisa	2 0	72 5	22 3	25 0
	Soroti	2 6	82 0	25 9	13 0
	Tororo	3 6	56 5	21 8	14 3

(1) Second figures valid for rift valley sediments

Source Water Development Department 1993 Water Action Plan Rapid Water Resources Assessment Draft Technical Report No 1

4 1 2 Water Resources Use

Human Consumption

Uganda's largely rural population meets its needs from surface water (lakes, rivers and streams), springs and wells, and boreholes These water sources are of varying quality and availability In some rural areas, groundwater extraction rates sometimes exceed recharge rates resulting in the drying up of wells and boreholes Also, the quality of water for rural human consumption may deteriorate due to unsanitary conditions of water points and courses

Urban populations have more dramatic impact on water resources due to the concentration of population in a relatively small area Furthermore, urban households use slightly more water *per capita* than their rural counterparts In the urban setting, water quality may also be affected by the discharge of untreated sewage into the water bodies

Agriculture

Agriculture in Uganda is predominantly rainfed The area of concern in this sector is the use of wetlands for farming Draining of wetlands can cause a reduction in the replenishment of ground water Another concern is the potential use of water for irrigation Although irrigation is currently limited, earlier studies indicate that the potential for irrigation in Uganda is about 410,000 ha (FAO, 1987) This corresponds to a demand of 4 billion m^3 of water per year which represents 20% of the mean annual flow of River Nile at Owen Falls Dam If fully developed, irrigation would place the largest demand on the water resources

The livestock sub-sector and wildlife uses of water also place great pressure on water supply, particularly in the dryland areas of Uganda The areas adjacent to watering points in the dryland areas are often seriously de ded, leading to pollution of the water itself

Industry and Energy

Although industries requiring heavy usage of water are at the moment not that many in Uganda, the few that do have a significant impact where they are located They use large quantities of water relative to other users and are sources of water pollution through uncontrolled industrial discharges The current government policy on modernisation means that industrial demand for water is likely to increase

Interest in hydro-power generation is also increasing, both small and larger plants Hydro-power, once installed, has minimal impact on both the quality and quantity of water, unless there are environmentally destructive activities up-stream leading to erosion

Water Transport

Before the development of the existing road network, water transport used to be a major means of moving from the northwest to the south of the country There were steamer services from Nimule (in Sudan) to Pakwach and onto Butiaba on Lake Albert and from Masindi Port to Namasagali on Lake Kyoga These steamer services are no longer operational but could be revived Water transport continues to be important for communities living on the islands in Lakes Victoria and Kyoga

The use of inappropriate vessels and poor used-oil disposal methods can contribute to pollution of Uganda's water bodies On the other hand, the water hyacinth (**Section 4 2**), a different type of water pollution, is a hindrance to water transport

4 1 3 Water Supply Management Strategy

The overall policy of the government is to manage and develop the water resources of the country in a sustainable manner to ensure that both the quantity and quality are adequate The policy takes account of the on-going economic liberalisation/privatisation drive and decentralisation reforms The key aspects of the overall sectoral goal and strategy is systems sustainability, enhanced by community participation, capacity-building and a demand-driven community-based approach during the planning and systems development process The Water Statute, 1996, and the Water Action Plan, 1995, are the cornerstones of sustainable water resources management In pursuit of the goal to achieve the sustainable development of water resources, three broad areas which require action have been identified

- to create an enabling environment for water resources management by developing a framework of policies and regulations within national sector development and international relations,
- to improve the institutional framework for water resources management at national, distric and community levels, and,
- to plan and prioritise water development and management activities

The Directorate of Water Development (DWD) is the principle agency of government charged with the responsibility for water resources management and the provision of water supplies in rural areas and urban centres The National Water and Sewerage Corporation (NWSC), on the other hand, is currently in-charge of nine major towns Kampala, Jinja, Entebbe Tororo, Mbale Masaka, Mbarara, Lira and Gulu

The level of water services in the nine major towns of Uganda is estimated at 60-75%, while the level for the 250 small urban centres is below 50% Water supply coverage by DWD has grown steadily in recent years beginning at 28% in 1993, increasing to 31% in 1994, and 36% in 1995 Where communities are involved in water source management, a functional rate of 70% has been realised Also for every safe water source that is functional, 80% of its capacity is utilised On the other hand, although NWSC has carried out a number of water projects in the major urban centres, its coverage has been largely in the high income zones with very little improvement in the high-density, low-income areas where the majority of the urban population lives This situation, however, is being improved

Since 1981, the government has received World Bank assistance for five urban and water sector projects A more recent addition has been World Bank assistance through the Project for Alleviation of Poverty and Social Costs of Adjustment (PAPSCA), known as the Peri-urban Infrastructure Project The overall goal of this project is to enable institutions providing urban services (water supply, sanitation, solid waste management, roads and drainage) and environmental protection to deliver the services to peri-urban areas on a demand-driven and sustainable manner The Peri-urban Project is to be located around

targeted urban centres selected from among the nine towns (Kampala, Entebbe, Jinja, Masaka, Mbarara, Mbale, Tororo, Gulu and Lira) that are under the responsibility of NWSC The Peri-urban Project is expected to last five years (July 1996 - June 2001)

4 1 4 Key Issues in Water Resources Management

Despite the impressive efforts aimed at improving the accessibility, supply and quality of safe water, there are still a number of factors that affect the development and management of water resources

The key issues affecting water resources development and management include

- watershed conditions
- water accessibility and quantity
- water quality
- international water rights
- institutional capacity

These are discussed below

(a) Watershed Conditions

Water catchment or watershed management involves an attempt to ensure that hydrological, soil and biotic regimes, on the basis of water development activities, have been planned, can be maintained or even enhanced and are not allowed to deteriorate

Against a backdrop of land use pressures arising from increased human and livestock populations and the combined effect of agricultural encroachment and deforestation, Uganda's watersheds are experiencing serious levels of degradation Although not much is known about the extent of degradation of specific watersheds the main impact of deforestation and poor agricultural practices is sedimentation or siltation of water bodies caused by erosion which results from the removal of vegetation cover

Based on the severity and impact on water resources, Uganda is divided into ten erosion zones (**Table 4 4**) south-western mountainous areas, Mt Elgon and surrounding foothills, the Rwenzoris, the north-eastern pastoral area, the south-western pastoral area, the West Nile area, the south-western highlands, the western highlands, the south, and south-eastern lake area

These erosion zones were classified based on slope steepness, vegetation cover and management, and rainfall The most severe erosion has been identified to occur in the three mountainous areas Mt Elgon and surrounding foot-hills, the Rwenzoris, and the south-western mountainous region Next to these are the two major semi-arid regions north-eastern and south-western pastoral areas In the semi-arid areas the low rainfall and over-grazing result in poor vegetation cover, especially towards the end of the dry season, leaving the ground exposed to erosion by rainfall and surface run-off Elsewhere in Uganda, the impact of soil erosion on water resources is not severe

Table 4 4 Regional description of the extent of soil erosion and the impact on water resources

	Area	The extent of soil erosion	Main causes of soil erosion	Main impacts on water resources
1A	The south western mountainous area (Kabale Kisoro and parts of Rukungiri)	Very high	Cultivation on steep slopes High land use pressure Annual crop cultivation	water systems Reduction in sub surface water quantity
1B	Mt Elgon and surrounding foothills (Mbale Kapchorwa)	High	Cultivation on steep slopes High land use pressure Cultivation on river banks Forest encroachment	Siltation of rivers lakes and water systems Reduction in subsurface water quantity
1C	The Rwenzoris (Parts of Kasese Bundibugyo Kabarole)	High	Cultivation on steep slopes Medium livestock density Bushfire and burning of crop residues	Siltation of rivers lake and water systems Reduction in sub surface water quantity
2A	The north eastern pastoral area Karamoja (Moroto Kotido)	Medium to high	High intensity storms High soil erodibility Steep slopes Poor vegetation cover/bush fires	Siltation of valley dams and tanks Faecal contamination of water for domestic use
2B	The south western pastoral ares (Mbarara parts of Masaka Mubende and Rakai Mpigi Luwero Mukono)	Medium to high in specific areas	Overstocking Poor vegetation cover in the dry season/bushfires Highly degraded soils	Siltation of valley dams and tanks Siltation of rivers Faecal contamination of water for domestic use
3	The West Nile area (Arua Nebbi)	Low to medium to high in specific areas	Cultivation on steep slopes High population pressure Deforestation	Siltation of rivers Pollution of water sources
4	The south western highlands (Bushenyi Ntungamo parts of Rukungiri and Mbarara)	Low to medium in specific areas	High land use pressure High population pressure	Potential siltation of rivers Faecal contamination of water for domestic use
5	The western highlands (Kabarole Kibale Mubende and parts of Kiboga)	Low to medium in specific areas	Cultivation on slopes	Potential siltation of rivers Faecal contamination of water for domestic use
6	The south and south eastern lake area (Mpigi Jinja Iganga Tororo parts of Kamuli Pallisa Mukono Luwero and Masaka)	Low	High land use pressure High population pressure	Few possible siltation of rivers and possible pollution from fertilizers and agrochemicals
7	The north central area (Kitgum Gulu Moyo Masindi Luwero Lira. Soroti Kumi Pallisa Kamuli Kiboga)	Low	Poor vegetation cover High rainfall erosivity	Very few

Source *MNR/ DWD (1995) Water Action Plan Management Aspects Annex Report Vol 3 Doc 012*

According to DWD (1995), soil conservation measures are scarcely practised where soil erosion is severe There is no comprehensive extension service for soil and water conservation issues, there is no linkage between land and water management plans and practice As a result, DWD has recommended the need for

- cross-sectoral collaboration,
- community training and awareness on water resources management, and,
- removal of logistical constraints

Despite the paucity of soil and water conservation measures, some projects do exist, including

- AFRENA (Agro-forestry Research Networks for Africa) in the field of agro-forestry,

Box 4 1

Proposed land management actions to maintain water resources

Establish measurements of sediment load in connection with the rehabilitation of Uganda's hydrometric network

Establish non-cultivated zones along streams and rivers, if necessary through bye-laws

Include watershed protection issues in the activities of the District Health and Environmental Committees at the district level and User Committees at local level

Establish cross-sectoral collaboration at national, district and local levels

Identify soil and water conservation projects in the districts which are most severely affected by soil erosion

Promote more cross-sectoral courses in the education system

Establish a national policy (already done) and legislation on the reclamation and utilisation of wetlands

Undertake a national soil and land suitability survey

Strengthen the extension services on soil and water conservation at district level

Source *DWD (1995), Water Action Plan Management Aspects Annex Report, Volume 3 (DOC 012)*

- the Farm Forestry Project (FFP) aimed at encouraging individual farmers, especially women to establish private nurseries and woodlots,
- the Swedish International Development Agency (SIDA)-financed Uganda Soil Conservation and Agro-forestry Pilot Project (USCAPP), which was established in 1992 to generate experience on how soil and water conservation and agro-forestry activities can be carried out in Uganda, and,
- the Mount Elgon Conservation and Development Project (MECDP), one of the aims of which is to secure the quantity and quality of water flow

DWD has further proposed a number of activities that could be used as tools to reduce some of the negative impacts of land management practices on Uganda's water resources The proposed activities are listed in **Box 4 1**

(b) Water Accessibility and Quantity

Supply and Demand

The water resources of Uganda play a vital role in the lives of its peoples There are two categories of demand for water resources human and livestock, and all other uses, such as irrigation, sewerage, fish farming and hydro-power

(i) Human and Livestock Demand

Surface water

Large urban centres in Uganda depend largely on surface water Smaller towns are generally supplied from groundwater, with incremental supplies from surface water The majority of Ugandans who live in rural areas depend on groundwater sources, including springs Uganda's livestock populations generally utilise surface water sources

In the aggregate, it is estimated that Uganda's surface water resources are adequate for present and future demands of both the human and livestock populations For example, in the Background Resources Assessment document of the Water Action Plan, it was estimated that the total future (the year 2010) urban and livestock demand is approximately 325 million m^3/year or 10 3 m^3/sec as compared to the total resulting run-off of the Ugandan catchment of 220 m^3/sec

However, this overall water supply sufficiency is misleading because resources are unevenly distributed In several localised areas, there is fierce competition for these resources, especially where there are large variations in water flow and streams are non-perennial The lowest annual run-off volumes (less than 10mm) are found in parts of Mbarara, Mubende, Rakai, Masaka, Luwero, Kotido and Moroto districts On the other hand, the highest incidences of non-perennial streams are found in parts of Masaka, Rakai, Mbarara, Mubende, Kitgum, Kotido, Moroto, Lira, Soroti, Kumi and Mbale districts

Groundwater

Groundwater is the predominant source of water for the rural population Groundwater is also expected to supply water to some towns under the Rural Towns Water and Sanitation Programme By the year 2010, total rural demand for groundwater is expected to be about 219 million m^3/year or 6 0 m^3/sec

According to the Water Action Plan, on a national and sustainable basis the demand estimates for the year 2010 would translate into an annual recharge of 1 2mm over the total territory, corresponding to approximately 10% of the annual rainfall at values around 1000mm Therefore, average ground water demand represents only a small percentage of the annual groundwater recharge

(ii) **Other Demands**

Irrigation, sewerage, fisheries and other uses could also place significant demand on the water resources of Uganda This demand is expected to be fulfilled largely from surface water resources

Irrigation

There have been several plans to irrigate sizeable areas of Uganda If implemented, these could increase irrigated areas from the present 30,000ha to about 410,000ha (FAO estimates), consuming more than half of the total run-off from Ugandan catchment in the process But Halcrow's study in 1977 and HYDROMET's study in the same year placed the irrigation potential at the much lower levels of 186,000ha and 246,000 ha respectively While this irrigation potential is based on technical feasibility, other considerations (economic, social and financial) suggest that in the near term, large-scale irrigation is not feasible As such, the demands for irrigation water are not likely to be significant

Sewerage

At present, only 13 large towns of Uganda have water-borne sewerage systems (**Table 4 5**) The rest of the urban centres use a combination of septic tanks and pit-latrines As the rate of urbanisation continues to grow, the demand on Uganda's surface water resources for sewerage services will increase

Fish farming

In the sixties, aqua-culture had gained popularity with close to 4000 fish ponds in operation nationwide This practice declined somewhat but appears to be rebounding It is estimated that there are at least 2000 ponds presently stocked with fish The requirements of such ponds imply increased demand for surface water resources

Hydro-power

Table 4 5 Towns with Water-borne Sewerage Systems, 1995

Town	Population		Treatment		Amount m3/day	Receiving water
	Total	Served	Type	State		
Kampala	775 000	15%	S F D	Poor	20 000	Swamp > Lake Victoria
Jinja	61 000		P	Poor	7 650	River Nile
Entebbe	42 000		P	Rehab	835	Lake Victoria
Mbale	40		PP		2 910	River Namatala River Doko
Tororo	27 000		P	Poor	800	River Lurururo
Masaka	49 000		S A	Inadeq	460	Swamp > River Kamamba
Mbarara	40 000			Rehab		River Rwizi
Fort Portal	32 000		SE F	Poor		River Mpanga
Lira	27 000		PP		900	River Okole
Gulu	43 000	10 15%	P	Not Func	200	River Pece
Iganda	20 000	10%	S F	Not Func		River Walugogo
Kabale	28 000	4%	F SE	Not Func		
Soroti	41 000	20%	P F	Poor		

A Activated storage
D Sludge digestors
F Trickling filters
P Oxidation ponds
S Sedimentation
SE Septic tanks

Source MNR/DWD 1995 National Water Action Plan Rapid Water Resources Assessment Doc 007

Hydro-power development in the catchment areas are largely feasible at the mini-hydro scale The requirements for water resources at this level of hydro-power development are a function of an areas's topography and the proximity of a power demand

(c) Water Quality

The quality of any water body is influenced by both natural and man-made factors In Uganda, it is not possible to give a comprehensive and authoritative statement on the quality of the nation's water There is paucity of data (both current status and time trends) on the quality of the country's surface and groundwater There was a virtual collapse of the network of sampling stations during the times of civil unrest and mismanagement Hence, there is a 15-year gap in water quality data The small amount of data and information on water quality is presented below

(i) Surface Water

Natural Factors

According to DWD (1995), a major factor governing the water quality of Uganda's rivers and lakes is the wash-out of plant nutrients Analysis of the chemical composition of selected rivers in Uganda show relatively higher amounts of nutrients in the water in the southern parts of the country, compared to the drier north

Wetlands are known to retain nutrients by sedimentation, plant up-take and identification Wetlands, however, also release organic/humic substances as well as iron and manganese into the surrounding open water bodies

Being relatively stagnant, Uganda's lakes act as traps for both externally and internally-generated organic material which leads to a build-up of sediments For example, sediment build-up in Lake Victoria was estimated at an average of 3mm/year (Hecky, 1993) While the quality of the lakes is influenced by the external in-put of minerals and nutrients, another factor is the internal recycling of these chemicals from demineralised organic matter precipitated to the depths of the lakes It has been suggested that the internal recycling is the result of the relative shallowness of Uganda's lakes The shallowness in turn allows for at least seasonal vertical mixing of the water column

Human activities

Several human activities have direct impact on the quality of Uganda's waters These activities include mining, petroleum exploration, manufacturing industries, agriculture (soil erosion, agro-chemicals), sewage and solid wastes

Mining activities (see **Chapter 7**) impair the quality of surface water through contamination by minerals (including toxic heavy metals) as a result of process and drain water from the mines, as well as weathering of dumped or stocked by-products and wastes Also, discharged process water may be altered due to high concentrations of strong acids resulting in the lowered pH of the receiving water There is at present very little mining activity in Uganda, and as such it is not a major threat to the general quality of the surface waters in the country, except for localised problems

Petroleum exploration is currently going on While test drilling could induce some local pollution problems, impairment of water quality from hydrocarbons is not a national issue at present

Manufacturing activities declined substantially during the times of civil unrest and when the previous owners were forcibly expelled from Uganda Currently, industrial manufacturing is once again picking up as further explained in **Chapter 7** Uncontrolled industrial discharges are a major water quality problem in Lake Victoria For example,

- two breweries discharge 5000 m^3 of waste (17 5 tonnes of BOD_5) per day directly into Lake Victoria,
- two Sugar factories release 65 tonnes of BOD_5 per day into River Musambya (SCOUL sugar factory), and 112 tonnes of BOD_5 per day into River Kiko (Kakira sugar works)

Generally, the main water quality problem connected to Ugandan industries is organic waste from sources such as breweries, abattoirs, other meat and fish processing industries and the sugar industry (DWD, 1995) There are also a few industries that produce chemical hazardous wastes which are likely to seriously affect water quality at the local level (textile, paper and tanning industries)

Agricultural activities impair Uganda's surface water quality in several ways, including increased sediment loads to the open water bodies due to soil erosion, increased nutrient run-off due to application of fertilizers, and contamination by toxic chemicals such as pesticides and herbicides Currently, the use of chemicals in Uganda's agricultural systems is at a very low level

As mentioned earlier, only 13 towns in Uganda have waterborne sanitation systems Although few, those systems pose potential threats to surface water quality since the sewage is ultimately discharged into streams, rivers or lakes The water quality impacts of the sewage discharges are contamination with pathogenic b ..ia, viruses and parasites, organic loading resulting in oxygen depletion, nutrient loading contributing to eutrophication, and contamination with chemicals used in the households Not only are the sewage discharges a major source of concern, but the sewerage systems themselves are also in a state of disrepair

According to DWD (1995), the main issues relating to surface water quality which deserve urgent attention include the following

- eutrophication phenomena of Lake Victoria,
- organic and chemical pollution of Lake Victoria from Kampala, localised in the Murchison Bay area,
- proliferation of the water hyacinth in the Lake Victoria and Victoria Nile system, and,
- pollution by toxic metals and other hazardous chemicals from Kilembe mines

Furthermore, DWD (1995) suggests that, in addition to the above mentioned key issues, local surface water quality problems scattered around the country are likely to occur due to

Box 4 2
Areas of action for improving water quality

Water quality modelling for Lake Victoria in order to identify the reasons for the rapid development in eutrophication and to devise proper interventions The model should be capable of simulating effects in local water bodies like Murchison Bay

Identification characterisation and quantification of major pollution sources at sensitive water bodies

Environmental impact assessments of sector activities

Monitoring, control and regulation of significant polluting discharges

Establishment of surface water quality monitoring programmes to detect long-term trends or shifts in essential parametres (early warning)

Establishment of databases processing reporting and dissemination routines for water quality information

Source MNR DWD (1995) Rapid Water Resources Assessment Document 007 Uganda Water Action Plan

organic pollution from sewage outlets
organic pollution from food processing (including abattoirs)
chemical pollution from textile and other industries
pesticide contamination from crop protection, tick control and vector control

Excluding areas related to institutional and management aspects, possible areas of action are specified in the Water Action Plan, as indicated in **Box 4 2**

(ii) *Ground water*

The quality of Uganda's groundwater resources is influenced by both natural factors and human activities As far as natural factors are concerned, the quality of groundwater is governed by the surrounding environment which is in turn influenced by atmospheric, surface and sub-surface conditions Natural factors impairing the quality of Uganda's groundwater resources include aggressiveness and several chemicals including iron, fluoride, chloride and trace metals

On the other hand, the major impact of human activities on groundwater quality can be traced primarily to poor sanitary practices Also, isolated cases of quality impairment by deposits of industrial or domestic waste are known to occur Insufficient sanitary practices contribute to above normal levels of nitrates formed as a result of nitrification of ammonia

Despite the problems of paucity of data for specific areas, **Table 4 6** and **Table 4 7** illustrate some measures for the quality of Uganda's groundwater resources

Natural Factors

Table 4 6 Water quality data from 702 RUWASA boreholes and WHO recommended maximum limits for drinking water, 1995

Perameter	Average,Dug Wells (n= 234)	Average Protected Springs (n = 280)	Average Boreholes (n = 702)	WHO 1984 Guidelines
pH	6 8	5 8	6 7	6 5 8 5
Conductivity ms/cm2+ +F3+	390	113	737	
Total iron mg/l Fe	0 5	0 3	0 8	0 3
Manganese mg/l Mn2+	0 10	0 05	0 07	0 1
Alkalinity mg/l CaCO3	119 5	38 8	186 1	
Hardness mg/l CaCO3	124 6	48 4	229 8	500
Calcium mg/l Ca2+	41 0	20 7	94 1	
Magnesium mg/l Mg2+	9 1	5 2	22 1	
Bicarbonate mg/l HCO3	140 5	51 1	216 3	
Carbon dioxide mg/l CO2	97 5	126 5	165 6	
Sodium mg/l Na+	25 3	6 4	60 6	200
Potassium mg/l K+	5 6	1 6	5 1	
Chloride mg/l Cl	22 1	9 3	73 4	250
Sulphate mg/l SO42	27 8	12 8	57 5	400
Phosphate mg/l PO42	1 3	0 4	0 8	
Nitrate mg/l NO3	2 2	2 6	3 7	10
Flouride mg/l e	0 7	0 14	0 8	1 5
% water points with E coli count >0	34	13	5	0

Source *MNR/DWD 1995 Water Action Plan Rapid Water Resources Assessment Doc 007*

Table 4 7 Average values for water quality parametres of RUWASA dug wells, protected springs and boreholes, 1995

Perameter	Average Dug Wells (n= 234)	Average Protected Springs (n = 280)	Average Boreholes (n = 702)	WHO 1984 Guidelines
pH	6 8	5 8	6 7	6 5 8 5
Conductivity ms/cm2+ +F3+	390	113	737	
Total iron mg/l Fe	0 5	0 3	0 8	0 3
Manganese mg/l Mn2+	0 10	0 05	0 07	0 1
Alkalinity mg/l CaCO3	119 5	38 8	186 1	
Hardness mg/l CaCO3	124 6	48 4	229 8	500
Calcium mg/l Ca2+	41 0	20 7	94 1	
Magnesium mg/l Mg2+	9 1	5 2	22 1	
Bicarbonate mg/l HCO3	140 5	51 1	216 3	
Carbon dioxide mg/l CO2	97 5	126 5	165 6	
Sodium mg/l Na+	25 3	6 4	60 6	200
Potassium, mg/l K+	5 6	1 6	5 1	
Chloride mg/l Cl	22 1	9 3	73 4	250
Sulphate mg/l SO42	27 8	12 8	57 5	400
Phosphate mg/l PO42	1 3	0 4	0 8	
Nitrate mg/l NO3	2 2	2 6	3 7	10
Flouride mg/l e	0 7	0 14	0 8	1 5
% water points with E coli count >0	34	13	5	0

Source *MNR/DWD 1995 Water Action Plan Rapid Water Resources Assessment Doc 007*

According DWD (1995), aggressiveness is probably the most widespread groundwater quality problem Granitic and gneissic basement areas cover more than 90% of Uganda and are characterised by very low hardness values and consequently a reduced buffer capacity towards acids Consequently, when carbon-dioxide from the atmosphere and top-soil is introduced to such water, it forms carbonic acid and causes the water to become carbon dioxide aggressive This aggressive groundwater is the main cause of rapid corrosion of steel casing and galvanised iron riser pipes in many boreholes When such a corrosive situation is encountered, the best alternative is to use stainless steel or PVC, but these alternatives contribute to higher costs of borehole installation

Another natural factor impairing the quality of Uganda's groundwater resources is iron content, which has generally been found to be above the WHO guidelines value of 0 3mg per litre Higher iron content levels make groundwater objectionable due to bitterness in taste and discolouration of clothes and utensils Excess iron can easily be removed at a water treatment plant but this is not feasible for village boreholes

A third water quality problem, although restricted largely to the areas of the western rift valley and the volcanic areas of eastern Uganda, is fluoride concentrations Where present, high fluoride concentrations in drinking water above 2mg/litre cause discoloration and mottling of teeth (dental flourishes) and in severe cases (concentrations higher than 6-8mg/litre and long exposure) skeletal flourishes Appropriate technologies for fluoride removal in rural settings are known In the Ugandan context, however, cultural norms and conditions in rural areas may limit the applicability of these technologies Otherwise, for instance, tests with brick fragments (low temperature burnt clay) have shown a fluoride removal capacity in the order of 60% (from 4 1mg/l to 1 7mg/l) with a retention period of three hours (DWD, 1995)

Fourth, high chloride values are reported from a number of boreholes in the eastern districts of Uganda Chloride concentrations of up to several thousand mg/l are found in some locations in these districts, yet chloride contents in excess of 500-700 mg/l are known to make water unacceptable for human consumption Unfortunately, the exact cause of these high chloride concentrations is not well established

Finally, a natural factor influencing groundwater quality is the presence of trace metals There are no comprehensive data on the levels of trace metals in the groundwater resources of Uganda Two studies carried out in Mbarara and Apac districts (IDRC,1994) looked for 24 different metals in addition to iron and manganese These found levels below the WHO guidelines for drinking water quality

Human Activities

Unsanitary practices have the greatest impact of all human activities These introduce high levels of bacteria into the waters Significant amounts of faecal coliforms (*Escherichia coli*) have been reported in spring and borehole water from the UNICEF-supported SWIP project and the DANIDA-supported RUWASA project The high coliform recordings are reported to be the result of contamination during sampling and equipment installation

As far as contamination from pit latrines is concerned, this is dependent on the depth of the pit bottom relative to the water table If the pit bottom is kept clear of the aquifer, and construction is at a safe distance from a water source, the risk of contamination can be minimised The second source of contamination of groundwater resources by human activities relates to nitrates, introduced through fertilizers, human faeces and manure Ugandans presently use limited amounts of fertilizers therefore, nitrate concentrations in excess of 10mg/l are almost certainly the result of human/livestock contamination According to DWD (1995), high nitrate values can have health implications especially for infants, among whom they may cause menthenoglobinemia due to intestinal reduction of nitrate to nitrite This occurs when nitrite binds with haemoglobin, resulting in reduced capacity of the blood to transport oxygen

Finally, although currently at low levels, the increased use of agricultural pesticides and herbicides may in future contribute to contamination of some of Uganda's groundwater resources Although concrete data are not available, it is reasonable to assume that some toxic chemicals will find their way into the groundwater reservoirs of Uganda if not applied carefully

Monitoring

Establishing baseline data would be an important first step to managing Uganda's surface and groundwater resources Thereafter, trends in parametres defining quality have to be monitored **Table 4 8** shows a list of parametres of water quality that have to be monitored regularly In addition and perhaps as a supplement to monitoring, the National Environment Management Authority in collaboration with other lead agencies (including DWD) has developed provisional standards for water quality

(d) International Water Issues

Uganda and International waters

International water issues concern above all the ability of a state to utilise waters within its boundaries as it pleases, and pollution of such waters by upper riparian states and by the country itself before the water is received by the lower riparian states Uganda shares a number of open water bodies with other countries Lake Victoria is shared with Tanzania and Kenya and Lakes Albert and Edward with Zaire In the context of the Nile basin, Uganda is both an upper riparian (in relation to Sudan and Egypt) and a lower riparian (in relation to Kenya, Tanzania, Burundi, Rwanda and Zaire) state

Uganda's dual position means that the country is concerned about water pollution emanating from the upper riparian states of Kenya, Tanzania, Burundi, Rwanda and Zaire *Inter alia*, Uganda must also ensure that the lower riparian states of Sudan and Egypt receive adequate amounts and acceptable qualities of water through the Nile system As far as pollution is concerned, customary international law is clear a nation does not have the right to pollute shared water to the detriment of co-riparians International water law also endorses the *polluter pays principle,* requiring that a nation should bear the cost of the pollution caused by its activities

Customarily-accepted international water law also accepts the doctrine of *equitable utilisation of shared water resources* This doctrine recognises the sovereignty of a state over all water flowing through it The same doctrine also rejects the concept of absolute territorial integrity which holds

Table 4 8 Suggested parametres for water quality monitoring

Determinant	Justification
pH	Affected by photosynthesis industrial wastes and effects of some toxins
Conductivity	Indicates mineral content
Temperature	Affects biota and rates of natural processes
Dissolved Oxygen	Essential for aquatic life and is a product of photosynthesis
Total Suspended Solids and Transport	Affects light penetration and breathing of fish and other biota Indicator of the rate of erosion and transportation of eroded material
Biochemical Oxygen Demand (BOD)	Measure of bio degradable matter and potential uptake of oxygen
Chemical Oxygen Demand	Indicator of Organic Content
Total Organic Carbon	Measure of total organic content
Ammoniacal Nitrogen	Product of biochemical reactions in sewage and some industrial wastes is toxic and consumes oxygen
Organic (Kyeldahl) Nitrogen	Indicates potential to form ammonia during decomposition
Nitrate	A key nutrient
Phosphate	The nutrient most likely to be critical in eutrophication
Mercury	Toxic and bio accumulative Used in gold extraction in the region and could be present in industrial wastes
Lead	Toxic affects central nervous system detected in lake waters and industrial effluents in the area
Total Coliforms	Indicator of bacterial pollution and health hazard
Faecal Coliform	Indicator of faecal bacterial pollution and health hazard
Thiodan (endosulfan)	Very toxic pesticide widely used in the Lake Victoria region
Dieldrin	Acute and indiscriminately toxic environmentally persistent used in the region
Copper	Common in industrial effluents Blue copper widely used fungicide
Chromium	Toxic causes lung cancer especially common in tannery effluents
Chloride	Indicator of sewage pollution
Total Phosphorous	Phosphorus is a key nutrient
Colour	Indicator of pollution originating from industries (especially textiles)
Sodium Potassium Calcium and Magnesium	The SAR derived from their concentrations is crucial in irrigation
Discharge	Measure of quantity of effluents and water flowing per unit time on a number of rivers in the catchment

Source Ministry of Natural Resources, (1995) Lake Victoria Environmental Management Programme Report of National Working Group No 2 on Management of Water Quality and Land Use including Wetlands Uganda June 1995

that the lower riparian has the right to the continued uninterrupted natural flow of water from the territory of the upper riparian

There is a long history of agreements that have governed the management of Uganda's shared water resources These agreements include the following

- *Nile Waters Agreement of 1929* between Great Britain and Egypt This agreement contained a clause to the effect that no Nile basin countries under British Administration could take any measures or construct any works that would affect the flow of the Nile without the prior consent of Egypt

- *The Owen Falls Dam Agreement of 1949* between Great Britain and Egypt provided for the construction of the dam for purposes of hydro-electric generation for Uganda and for increasing the role of Lake Victoria as a storage reservoir for Egypt An Egyptian engineer was to be stationed at Owen Falls Dam Nothing was to be done that would contradict the provisions of the 1929 Agreement Egypt was to pay compensation for any damage caused by the raising of the Lake level The Agreement was to be reviewed 20 years after commencement

- *The Hydromet Agreement 1967,* later succeeded by the *TECCONILE Agreement of 1992* These agreements were in the form of projects to assist member states to develop the technical capacity and infrastructure needed for gauging the Nile basin water resources

- *The Kagera Basin Agreement 1977* is composed solely of the Upper Nile basin states and excludes Sudan and Egypt It covers all aspects of the development of the Kagera River Basin, which involves Burundi, Rwanda, Tanzania and Uganda

- *The Undugu G* ormed in 1983 is an informal group of all the Nile Basin states Its age da refl a common interest in an overall mechanism for cooperation regarding the Basin, largely in the political and economic spheres

At the time of Independence, Uganda repudiated all agreements previously entered into by the colonial government The Nile Waters Agreement of 1929 and the Owen Falls Agreement of 1949 became null and void However, Uganda has continued to observe the provisions of the 1949 Owen Falls Agreement An Egyptian engineer monitors water flows at Owen Falls Dam Although there was a provision for a review of the Owen Falls Agreement after 20 years of its existence, this was never done Also, Egypt was to pay compensation for any rise in the level of Lake Victoria A rise did take place but Uganda was not compensated

Another concern is the Permanent Joint Technical Committee of 1959 formed by Egypt and Sudan, which apportioned the utilisation of the flow of the Nile between the two countries and committed them to have a common position with regard to other Nile basin states While Uganda and the other upper riparian states have had informal consultations with the Committee, these have not been able to resolve the issues of apportionment of water rights between all stake holders

Protecting Uganda's interests

First, Uganda's dual position as both an upper and lower riparian state means that with respect to negotiation positions, the country's interests lie with Egypt and Sudan on water pollution issues They lie with Kenya, Tanzania, Burundi, Rwanda and Zaire on concerns relate to water apportionment

Second, Uganda needs the water resources of the Nile for socio-economic development According to DWD (1995), it could be argued that the economic costs borne by Uganda to conserve the quantity and quality of the water resources in Lake Victoria and the Nile system should be shared with the lower riparian states The Directorate further suggests that in an international dimension, such a concept would supplement the doctrine of equitable utilisation of a shared water resource with the obligation of all the states to participate in the conservation of the resource regardless of national boundaries The thinking behind this argument is that a multi-national basin-wide organisation concerned with management of the water resource would be contributed to by each state in accordance with the benefits derived from that resource

National Constraint

There is a general feeling that Uganda is not receiving the full benefits of its being a riparian state with both upper and lower status, partly due to institutional weaknesses In particular, there is no national coordinating mechanism for the formulation of policy regarding international water resources Currently, it is the Ministry of Foreign Affairs supported by the Ministry of Natural Resources that handles international water issues, while DWD staff normally act as representatives to the relevant international institutions There is, therefore, an urgent need to put in place an appropriate institutional mechanism to address this anomaly The DWD (1995) has suggested the proposed Water Policy Committee as a suitable institutional structure Such an institutional arrangement is justifiable on the grounds that

i There is an urgent need for a coordinated Ugandan policy regarding the water quality problems in Lake Victoria

ii The potentially high demand for the water resources of the Nile basin makes it imperative that a mechanism is quickly established for equitably resolving those demands (DWD, 1995)

(e) Institutional Issues

Institutional issues are addressed here because the current water resources management practices are not optimum In addition, as with any other sector, institutional issues address structures and instruments Inappropriate structures and instruments result in poor resources management practices

Overall Management

As a result of institutional weaknesses, the water resources of Uganda have not been managed well Until the promulgation of the Water Statute, 1996, laws relating to water resources almost exclusively dealt with supply issues Often in the past, water resources management decisions were made at the centre with minimal involvement of the ultimate users

In recognition of these and other management weaknesses, the Uganda Water Action Plan identified key management functions and potentials to be realised and the impending constraints These are presented in **Table 4 9**

- **Structures**

The National Water and Sewerage Corporation (NWSC) is responsible for water resources management in the nine largest urban centres The NWSC is a parastatal of the Ministry of Natural Resources

The Directorate of Water Development (DWD) is one of the four directorates of the Ministry of Natural Resources DWD has four departments, namely Water Resources Management, Urban and Institutional Water Development, Rural Water Development, and, Inspection and Support Services The DWD is responsible for water supply in rural areas and smaller towns Through a restructuring exercise, the regional offices of the DWD have been abolished There are, however, district officers still in place, and there are future plans to have water officers at the county level

Nevertheless, some degree of ambiguity still exists as a result of the Decentralisation and Resistance Council Statute, 1993 Water resource management is currently designated as a central government role, while at the same time management functions have been transferred to the districts In other words, it is expected that the central government through DWD will have the responsibility for setting policies, standards and management regulations, while water services are transferred to the districts and municipal authorities

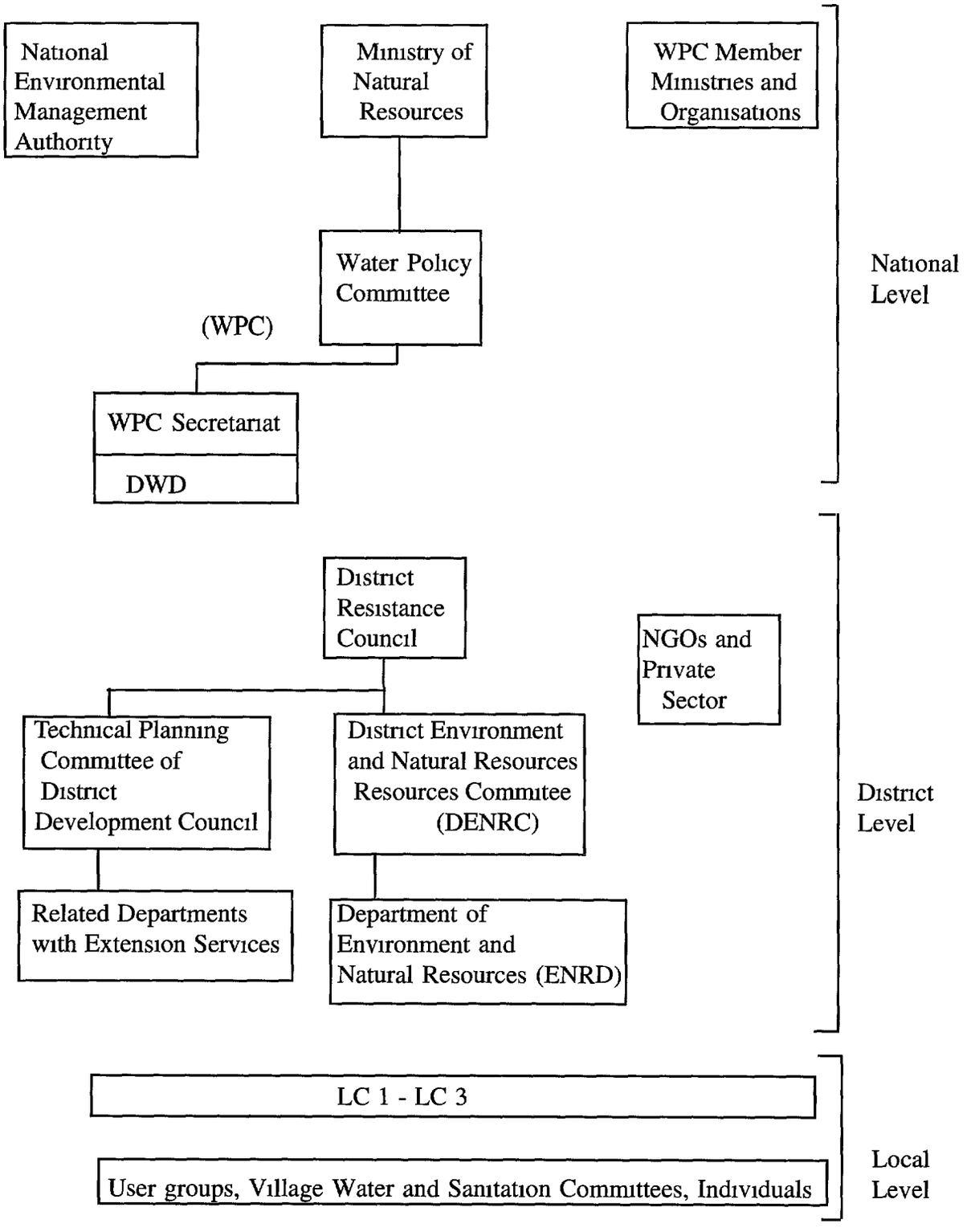
As an improvement to the institutional structure for water resources management, a new arrangement has been proposed by DWD and is shown in **Figure 4 1**

- **Instruments**

Prior to formulation of the Water Policy, the Uganda Water Action Plan (1995) and the Water Statute (1996), the institutional instruments for water resources management were very weak Despite the tremendous improvements in the areas of policy, action plan and law, some additional work remains to be done They include

- translation of the law provided for in the Statute into enabling regulations
- promotion of appropriate bye-laws at the district, country and sub-county levels
- issuance of guidelines by DWD to districts and community about their role in water resources management
- regulation of management of water extraction and waste water discharge through permit system

Figure 4 1 Proposed institutional structure of water resources management



——— *Line of Responsibility*
Lines of Communication Liaison and Services

Note *Lines of Responsibility from District to National Level will conform to decentralisation directive*

Source MNR/DWD 1985 *Water Action Plan Institutional and Management Aspects Doc 008*

Table 4 9 Summary of water resources management functions, potentials and constraints

Determinant	Justification
pH	Affected by photosynthesis industrial wastes and effects of some toxins
Conductivity	Indicates mineral content
Temperature	Affects biota and rates of natural processes
Dissolved Oxygen	Essential for aquatic life and is a product of photosynthesis
Total Suspended Solids and Transport	Affects light penetration and breathing of fish and other biota Indicator of the rate of erosion and transportation of eroded material
Biochemical Oxygen Demand (BOD)	Measure of bio-degradable matter and potential uptake of oxygen
Chemical Oxygen Demand	Indicator of Organic Content
Total Organic Carbon	Measure of total organic content
Ammoniacal Nitrogen	Product of biochemical reactions in sewage and some industrial wastes is toxic and consumes oxygen
Organic (Kyeldahl) Nitrogen	Indicates potential to form ammonia during decomposition
Nitrate	A key nutrient
Phosphate	The nutrient most likely to be critical in eutrophication
Mercury	Toxic and bio accumulative Used in gold extraction in the region and could be present in industrial wastes
Lead	Toxic affects central nervous system detected in lake waters and industrial effluents in the area
Total Co iforms	Indicator of bacterial pollution and health hazard
Faecal Coliform	Indicator of faecal bacterial pollution and health hazard
Thiodan (endosulfan)	Very toxic pesticide widely used in the Lake Victoria region
Dieldrin	Acute and indiscriminately toxic environmentally persistent used in the region
Copper	Common in industrial effluents Blue copper widely used fungicide
Chromium	Toxic causes lung cancer especially common in tannery effluents
Chloride	Indicator of sewage pollution
Total Phosphorous	Phosphorus is a key nutrient
Colour	Indicator of pollution originating from industries (especially textiles)
Sodium Potassium Calcium and Magnesium	The SAR derived from their concentrations is crucial in irrigation
Discharge	Measure of quantity of effluents and water flowing per unit time on a number of rivers in the catchment

Source *MNR/DWD 1995 Water Action Plan Institutional and Management Aspects Doc 008*

- establishment of a monitoring system and assessing both surface and groundwater resources with respect to quantity and quality

- ensuring financial resources are adequate for effective water resources management

4 2 WATER HYACINTH

4 2 1 The Introduction and Growth of Water Hyacinth

The water hyacinth is a flowering plant belonging to the family *Pontederiaceae* and is a native of tropical South America, especially the Amazon Basin in Brazil In its native habitat in South America, the water hyacinth is part of the complex ecosystem which includes various parasites, grazers and diseases These natural enemies which have evolved with the water hyacinth over many millions of years exploit it as a food source and in so doing, the water hyacinth's rate of growth and spread is kept in check In Africa, including Uganda, the water hyacinth does not seem to have natural enemies The water hyacinth can reproduce vegetatively and sexually New plants can be formed by runners Any complete leaf with stem and base is a reproductive unit Each unit can form a stolon, which in turn will form further plants from meristems along its length Where flowering and seed production occur, the seeds sink to the bottom and germinate allowing re-infestation to occur over several years[1]

Of the two methods of reproduction, vegetative propagation is the most important on Uganda waters Under favourable conditions of high nutrients and warm temperatures, multiplication is very rapid According to Bagnall (1978) the area under plant cover doubles every 6 to 15 days The water hyacinth is an outstanding example of problems caused by the uncontrolled introduction of alien species

The problems caused by the hyacinth (*Eichhornia crassipes*) have reached emergency status in Uganda in the less than ten years since its presence was reported According to the Ministry of Natural Resources (1995), the water hyacinth, the only important plant pest in Uganda's lakes and rivers , carpets more than 4000 ha of Lake Victoria and there is a weekly influx of about 3 5ha from River Kagera[2] At least 70% of the Ugandan shoreline of Lake Victoria is covered by the water hyacinth Water hyacinth mats have closed important landing sites, numerous domestic water sources, transport routes and fishing grounds It has caused financial loss to fisher-folk, water transport operators and hydro-electric power generation at Owen Falls Dam, Jinja

The effects of this water weed on the socio-economic activities in Brazil and Egypt is well documented in literature, but its effect in Uganda is rapidly being felt in magnitudes that spell disaster within the next five years if the weed is not brought under control The weed has now seriously affected all the major water bodies of Uganda including Lakes Victoria and Kyoga as well as the River Nile

At Port Kibanga, a large mat of water hyacinth was sighted in July 1995 By August 1995, the area between Entebbe and the Uganda/Kenya border was characterised by extensive mats of floating weed, and the average area covered by the mats was estimated at 1000 ha[3] The pier at Port Bell was completely covered by the weed, while at Murchison Bay drifting patches of weed mats were observed

It is also estimated that some 2000-4000 ha of Lake Victoria shoreline and bays lying within Ugandan territorial waters are now infested by the water weed The entire lake is estimated to contain over 1 25 million metric tonnes of the weed (Goodland, 1995)[4] The issue of water hyacinth needs to be seriously addressed otherwise Uganda might lose its valuable fresh waters

4 2 2 Impact of Water Hyacinth on Society

- **Transport Sector**

Water transport is a very important means of communication between people on islands and those on the mainland Water hyacinth infestations have resulted in disruptions, delays and rising operational costs in the transport sector The effects are already being felt within other sectors of the economy served by this important trade route, through rising costs and product prices For example, the recently expanding fisheries sector on the lakes requires quick and reliable delivery transport services in order to preserve fish quality The presence of the water hyacinth has resulted in delayed delivery, hence quality loss, low prices to fishermen who are unable to deliver their supplies to the market on time, higher operational costs for the motorised boat transport and short life span for the transport equipment

- **Water supply**

A serous problem being experienced at many urban water works is clogging at the water intake This impact is most serious at Entebbe Water Works where the intake pipe lies only one metre below the water surface Apart from physical obstruction of access to abstraction points for all water works, the water hyacinth has also reduced the quality of water When mats of the weed are blown away, they usually leave behind mud and extremely dirty water filled with suspended decaying organic matter of unpleasant odour which makes the water unsuitable for any domestic use This increases the cost of water treatment Frequent breakdowns of pumps is also experienced due to the roots and leaves being sucked into the system

- **Fisheries sector**

The infestation of the water hyacinth affects fisheries through reduced level of production, a reduction in species composition of the catch, poor quality of fish, rising costs of operation resulting in lower incomes to the operators, and/or higher prices to fish consumers

Reduction of the oxygen levels in the water by the water hyacinth creates an environment unsuitable for fish survival, and shading has been suggested as the main cause The lower light levels under the hyacinth mats restrict the development of photosynthetic algae (phytoplankton), which form the basis of the aquatic food chain During photosynthesis, oxygen is released, so the effect of shading is to deprive the water of this oxygen[5] Water hyacinth is believed to infest the bays more than any other part of the water body Murchison Bay has the highest water hyacinth biomass turnover rate along the Ugandan shores of Lake Victoria Virtually all the water weed that ends up at the Owen Falls Dam originates from here In July 1995, Murchison Bay was estimated to have had about 80 ha (about 500,000 tonnes) of lush water weed[6] The most vulnerable species are the nest-building and mouth brooding *Tilapia* These are exclusively shallow water breeders and feeders, which means that they have to compete with the expanding hyacinth biomass The colonisation of the bays has reduced the

number of artisanal fishermen forcing many out of operation and interfering with their source of livelihood and protein

Water hyacinth sweeps and entangles fishnets in the open waters, reducing fishing capacity and leading to the decline in fish catches Obstruction to fisheries operations as a result of water hyacinth has been found to increase catch delivery time on average by two to three hours daily[7] These delays usually result in deterioration in fish quality to an extent of being unsuitable for consumption

Water hyacinth mats raise the costs of operation Fishermen often have to hire labour to help cut their way through the mats This also reduces the operational life of the boats and engines It has been reported that the cost of maintaining boat engines has risen due to the weed getting sucked into the engine system

The root system of the hyacinth provides a good habitat for venomous snakes such as cobras which threaten the lives of the fishermen

- **Power generation**

The Owen Falls Dam, built in the 1950s, is a source of hydro-power for Uganda, Kenya, Tanzania and Rwanda Today a very large biomass of water hyacinth leans against the walls of the dam It is feared that this may weaken the dam and lead to structural damage A floating boom was installed in the original 1950 design of the dam between the river and the headrace which had prevented most weed from entering the headrace and the intake dam By mid-1996, however, the weed had proliferated to such an extent that the boom broke several times, permitting weed to enter the headrace and the intake dam In addition, when a huge amount of the weed accumulates, it slips under the floating boom These two situations lead to expensive problems at the dam First the trash-rack screens protecting the penstocks become choked with increasing frequency and have to be cleaned more frequently The cleaning process involves winching up the screen and removing the clogged weed mat To do this, the turbine must be shut down It takes nearly one day to shut down a turbine, winch up the trash-rack, clean it, refit the screen and start the turbine UEB estimates that they lose 72,000 units of electricity or UShs 6 212million for each four hour shut-down By October 1996, the screen cleaning frequency had reached twice a month

The second effect of the weed is on the intake for the cooling water of the transformers These are only two meters below water level and can easily be clogged by the weed mat Due to the frequent clogging of the trash-rack, UEB had to start an emergency programme of manual and mechanical weed removal from the dam in 1993 UEB was spending up to 20 million shillings per month on this exercise by the end of 1996

- **Environment and Health**

  A lot of concern has been raised about the effects of the water hyacinth on the environment, these cane traced to the structure and function of the weed Water hyacinth has blue-mauve flowers, a rosette of thick oval leaves with long bladder-like stalks, and a mass of hairy fibrous roots It grows to a height of over one metre which greatly increases the rate of transpiration Consequently, large mats of the weed are said to result in high rates of evaporation from a water body

The water hyacinth is 95% water but the 5% dry matter is over 50% silica During decomposition, much of this, together with some carbon, is deposited under the hyacinth mat thereby reducing the depth of the lake[8]

The water hyacinth has also been described as a health hazard in that it provides a habitat for vectors such as *Bulinus* and *Biomphlalaria* (snails) which are known to transmit the bilharzia parasites to humans It also increases the size of suitable habitat for the aquatic larvae of mosquitoes which transmit diseases such as malaria and elephantiasis

The water hyacinth causes severe skin rash It changes the colour of water from colourless to green and dirty, making it unsuitable for drinking and domestic use This imposes additional burden on the limited health services and facilities available to the poor rural communities living along shorelines

4 2 3 Control of Water Hyacinth

The water hyacinth problem has became a national crisis, and its control requires a coordinated and integrated approach Already the weed covers about 90% of Uganda's shoreline of Lake Victoria, 55% of that of Lake Kyoga, a considerable proportion of the northern shores of Lake Albert and about 500 km of the bank of River Nile in Uganda The socio-economic and ecological impact of the infestation is very great In response, in November 1995 the government of Uganda developed an emergency action plan for the control of water hyacinth This included medium and long-term control measures for combating the spread

The recommended or chosen method must depend on the area to be treated and environmental, social and economical factors relating to the problem area The following are some of the possible control methods

- **Biological Control**

Biological control means the direct or indirect destruction of an organism by another This is a slow process and should be implemented as soon as infestation and pest identity are confirmed The method is usually relatively cheap, permanent, entails little or no maintenance costs and is environmentally friendly The main disadvantage is the relatively long time required for it to achieve a significant effect At least seven years and perhaps much longer in a water body like Lake Victoria The serious hyacinth infestation in many areas of the Ugandan portion of Lake Victoria suggests that this approach is rather too slow

In 1961 intensive field research in Amazonia identified the first specific natural enemy of the water hyacinth weevils of the genus *Neochetina* After extensive screening over many years, involving 150 plant species from 50 to 60 different families, it is now concluded that *Neochetina bruchi* and *N eichhorniae* are absolutely specific to the water hyacinth[9]

When introduced these two species have successfully controlled the weed in many countries They are currently being reared and have been introduced in some Kenyan and Ugandan water bodies In Uganda, through the recommendation of the National Technical Committee on control and management of water hyacinth (NTWH), 600 of each of the two species were imported in July 1993 and are currently being reared at over 20 sites in and around Lake Kyoga[10]

The weevil damages the hyacinth in three ways

i) egg-laying punctures the weed petioles,
ii) the weevil grub from the hatched egg eat much of the stalk, and
iii) the adult damages the leaf by eating its waterproof surface

Rearing and distribution of the weevil involves placing adult weevils of both sexes in a basin of water in which fresh stalks of the weed have been placed The weevils feed, mate and lay eggs in the stalk These eggs are extracted from the petioles and put in groups of 8 on two mm^2 tissue of fresh water hyacinth This operation is usually done under a dissection microscope The two mm^2 tissue carrying the eggs are inserted into the fresh whole hyacinth plant The egg-infested water hyacinth plants are eventually transported and dumped in marked locations in the lake The generation time for *Neochetina bruchi* (developing from egg to pre-pupa) is approximately 64 days while that for *N eichhornia* is 96

- **Chemical control**

There is substantial data demonstrating that herbicides can be effective in controlling the water hyacinth[11] However, herbicides should be used with care because of the risk to the environment and human health Further reviews have indicated that the ecological impact of herbicides on fresh water becomes evident with time This includes direct and indirect toxicity to non-target plants, micro-organisms, invertebrates and fish

Many Ugandan scientists have criticised the use of herbicidal chemicals to control the water hyacinth The chief concern is toxicity to humans and aquatic bio-diversity and persistence in the food chain and environment

In addition, chemical control programmes pose the additional problems associated with the eventual disposal of the dead weed mass The danger exists that the dead mat of hyacinth will submerge and eventually sink to the bottom of the water body Once there, the dead mat depletes oxygen from the water column during aerobic decay Later the dead mat rots anaerobically, producing methane and causing the mat to float to the surface

- **Mechanical/Manual control**

Mechanical control involves use of equipment like an aquatic weed harvester, conveyors and push boats The method is quite effective in places where there is a large accumulation of the weed and the shore terrain is good for establishing shore-based disposal facilities like access roads and dump sites

The manual removal option is effective on a small scale considering the costs in tools and manpower

The major environmental problems associated with this control method are visibility and odour of the dumpsite, destruction or disturbance of the surrounding areas to construct access roads, and leaching from the decomposing weed at the dumpsite contaminating surface and ground water

- **Control responsibilities**

The control responsibility for the water hyacinth should involve all the concerned countries like Democratic Republic of Congo (formerly Zaire), Tanzania, Rwanda and Kenya This is so because the weed is never stationary, a clear landing site in the evening can be found to be completely blocked by the next morning Adoption of a specific control method by all the countries would help to combat the water weed

All government ministries, particularly Agriculture and Natural Resources ministries, should be actively involved in the control of the hyacinth Already the Ministry of Agriculture Animal Industries and Fisheries has teamed up with the Uganda Electricity Board (UEB), the Madvani Group, Jinja Municipal Council and the Ministry of Local Government to clear the weed from the Owen Falls Dam and construct a barrier at the source of the Nile to control the inflow of the weed into the dam reservoir

The control responsibility should also be extended down to the village level because these are the people most directly affected by the weed Earlier surveys indicated that there was a lack of awareness at high political and technical levels of the potential dangers of the spread of the weed This, however, is no longer the case, and the control or eradication of water hyacinth is now high on the government's agenda Budgetary provisions should be made to ensure continued surveillance of the problem, and monitoring of the spread of the weed should be maintained In addition, public meetings need to be encouraged to highlight the problems caused by the weed and identify methods of control

4 3 FISHERIES RESOURCES

4 3 1 State of the Fisheries Resource

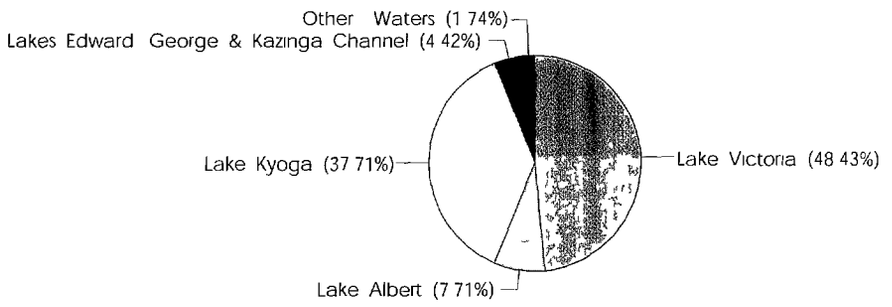
Owing to its many freshwater lakes and rivers, Uganda has substantial fisheries resources These lakes and rivers are located in at least 27 of the country's 39 districts Lake Victoria, the second largest lake in the world, has over 4000 landing sites on the Ugandan side (MAAIF, 1988)

Over the period 1985-1995, the annual catch of fish in Uganda's waters peaked in 1993 at 276,200 metric tonnes Lake Victoria supplied close to 25% (**Figure 4.2**) The catch, however, stagnated at around 103,000 metric tonnes in 1994 and 1995 This stagnation has been largely attributed to the impact of the water hyacinth which interferes with fish breeding grounds and fishing gear, consequently raising the cost of harvesting **Table 4 10** shows the quantity and value of fish harvested in Uganda by species in 1995

The fisheries resources of Uganda are important to the economy and the people They contribute to the gross domestic product (GDP), income generation, export earnings and nutrition **Table 4.11** shows the contribution of the fisheries sub-sector to the economy of Uganda The table shows the extent to which the contribution to the GDP declined in 1994 and 1995 mainly due to water hyacinth **Table 4 12** shows the value of fish and fish products compared to other non-agricultural exports for 1990-1995

Household expenditure on fish, export sales and institutional purchases provides a steady source of income for those engaged in the harvesting, processing marketing and distribution of fish and fish products Not only is this income significant, but it is available all year round The income generated by sale of fish and fish products is largely provided by two species (*Lates* and *Tilapia*) which contribute 46 5% and 39 3%, respectively, as shown in **Table 4 10**

Figure 4 2 Percentage Fish Catch by Water Bodies, (1985 -1995)



Source MAAIF/Fisheries Department Reports 1996

The fish in Uganda's lakes, rivers and wetlands are a major source of human food Fish and fish products contribute over 60% of the country's total protein supply, valued at over US$ 90 million in 1989 (NBU, 1992) This excludes the catch that does not pass through the formal monetary sector which is also considerable While a high quality protein, fish in Uganda is generally cheaper than other solid proteins and thus is accessible to a large segment of the population

4 3 2 Key Issues in the Fisheries Sector

- **Sustainability of the Resource and the Catch**

Uganda is gifted with more than 200 freshwater fish species The challenge is to sustain this genetic heritage which produces valuable food for the country and for export

The first systematic stock assessment of Lake Victoria was conducted by EAFRO FAO and UNDP in 1967 This was the first time Lake Victoria's ichthyomass was described with a standing crop of 179,000 metric tonnes of which the *Haplochromines* contributed 83%, *Bagrus docmas* 5%, *Clarias mossambicus* 4%, and *Synodontis victoriae* 3% The rest of the genera, including *Oreochromis, Tilapia, Mormyrids, Protopterus* and *Lates,* made up less than 1% At that time Nile perch made up only 0 0006% of the standing crop of fish in Lake Victoria estimated at 402 metric tonnes The shallow inshore water of the lake carried almost 50% of the lake ichthyomass, the deeper parts of the lake carried only 13 85% of the ichthyomass (Lake Victoria Environment Management Programme (LVEMP), 1995)

Table 4 10 Percentage shares of the quantity and value of fish harvested in Ugandan lakes by species in 1995

SPECIES	Percentage Shares	
	Quantity	Value
Lates sp	41 76	46 5
Tilapia	37 49	39 3
Hydrocynus	4 41	2 9
Alestes	1 04	0 7
Bagrus	2 20	2 4
Rastrimobola	6 21	2 1
Clarias	1 04	1 4
Protopterus	3 48	3 9
Others	3 41	0 8
Total	100 0	100 0

Source *Uganda Fisheries Department Report 1995*

Table 4 11 Contribution of the fisheries sub-sector to GDP, (UShs billions) 1985-1995

Year	Fisheries Sector Contribution			Percent of Total
	Monetary	Non Monetary	Total	
1985	37 501	4730	42 231	3
1986	37 707	4756	42 463	3
1987	39 246	4950	44 196	3
1988	40 222	5073	45 295	3
1989	40 072	5054	45 126	2
1990	46 022	5805	51 827	3
1991	47 843	6034	53 877	3
1992	49 720	6271	55 991	3
1993	51 803	6534	58 337	3
1994	50 145	6325	56 470	2
1995	51 275	6467	57 742	2

Source *MAAIF Statistics Department 1996*

Stock assessment surveys have not been conducted again for the whole of Lake Victoria except for some surveys in Kenya and Mwanza, Tanzania by Katabo *et al* in 1990 It is known, however, that far-reaching changes have taken place in its ecology There has been drastic reduction in species composition, the prolific production of the Nile perch has greatly increased the annual yield of Lake Victoria but greatly reducing the species composition

Box 4 3
Stunting of fish and declining fish catches in Lake Wamala

There has been concern over the health of the fishery and its sustainability in Lake Wamala which has an area of from 100 to 180 sq km and is the only lake in Mubende District

Lake Wamala originally had an impoverished native fishery consisting of *Protopterus aethiopicus* (Mamba) and *Clarias gariepinus* (Male) In 1956, the fishery was improved by stocking tilapia (Ngege) species *Oreochromis nilotica* (Nile tilapia) and *Oreochromis leucostictus* Nile tilapia established itself and the lake was opened to commercial fishing in 1960 under controlled exploitation Only 250 boats using gill nets of five inches (127 mm) stretched mesh size were permitted on the lake

There have been major changes in the fishery and in the lake habitat since then Fishing efforts increased beyond the permitted level to about 1000 boats by 1967 due to inadequate supervision Fish catches had increased from about 1000 metric tonnes in 1960 to a peak of 7100 metric tonnes in 1967 and remained between 4000 and 6000 metric tonnes annually From 1965 to 1967 it declined to about 1000 metric tonnes and remained low since then

During the 1970s the catches were dominated by Nile tilapia (67%) followed by Male (17%) and Mamba (15 1%)

Nile tilapia, which has been known to grow to 50 cm in other Ugandan lakes, decreased from 32cm in the 1970s to 22cm by the 1990s Tilapia now matures at less than 14cm As the tilapia become stunted, there was a shift in the mesh size of gill nets on the lake from 12 5cm during the 1970s to 6 25cm by the 1990s

Possible causes of the stunting of fish and decline in fish catches

Environmental stress caused by over-crowding of fish which is due to the shrinking area and volume of the lake The shrinking of the lake has been due to inadequate input of water from the catchment area as a result of drought and environmental degradation in the catchment area brought about by poor landuse practices The volume and area of the lake have decreased with the shoreline receding by about 0 5km in some places and the decreasing in depth from an average of 4 3m to about 1 7m

No efficient predator to control the proliferation of small fishes

Shift in the mesh size of gill nets used from larger to smaller meshes which resulted in over fishing

N B Nutrients cannot be a limiting factor because Nile tilapia feeds on algae and detritus Both are plentiful in the lake

Source *Dr Ogutu-Ohwayo (FIRI) Wondering About the Stunting of Fish and Decline in Fish Catches in Lake Wamala? NARO Bulletin, 1996 Vol 2 - No 5*

Note There have been no fish catch returns from Lake Wamala since 1990

Table 4 12 Value of fish and fish products as compared to total non-agricultural exports for 1990-1995 ('000 US $)

Year	Contribution to Non Agricultural Exports		
	Value of fish and fish products (000 US $)	Total Value of Non-traditional Agricultural Exports ('000 US $)	Percentage value of Non-traditional Exports Contributed by Fish and Fish Products
1990	1 386	24 972	0 8
1991	5 313	43 578	2 9
1992	6 498	31 252	4 4
1993	8 943	70 799	4 4
1994	10 403	93 092	2 3
1995	17 541	150 592	3 2

Source MFEP Statistical Abstract 1996

Table 4 13 Total nutrients inputs into Lake Victoria

Source	**Total Nitrogen**		**Total Phosphorus**	
	Kg/year	Percentage	Kg/year	Percentage
Urban	8,900,000	7	1,100,000	8
Rural	356,000,000	30	4,200,000	30
Agriculture	590,004,845	50	7 826 723	56
Rainfall	144,627,700	12	826,440	6
Total	118,000,000	100	13,953,163	100

Source Lake Victoria Environment Management Project (LVEMP) 1995

There is evidence that in some water bodies over-harvesting is occurring **Box 4 3** illustrates a scenario of over-fishing on Lake Wamala Poor enforcement of regulation in the fisheries sector is the main reason for over-harvesting Unregulated and inappropriate gears are used, and the opportunity to control harvesting through issuance of permits has not been fully exploited

It appears that the fisherfolk no longer use the recommended size of nets It is now common to find nets of 10 cm and below being used on Lakes Victoria, Kyoga and Albert, and yet the smaller sized nets were originally meant for Lake George, which is rich in small-sized fish species Another common feature is the use of beach seines on a 24-hour basis

- **Introduction of Alien Species**

The introduction of alien species such as the Nile perch (*Lates niloticus linn*) the water hyacinth (*Eichornia crassipes*) and *Tilapia zilli* have been identified as some of the causes of reduced biodiversity in the waters of Uganda Although fish species diversity is still high in Uganda's lakes it was once higher The commercial catch in the 1950s comprised many highly desirable food fishes like the two tilapine species (Ngege), *Oreochromis esculentus* and *0 variabilities,* and *Labeo victorianus* (Nigu) which are endemic to the Lakes Victoria and Kyoga and the satellite lakes that contribute to the commercial catches

By the 1960s, however, stocks of the native tilapine and other large species had been reduced by overfishing During the 1950s, four tilapine species were introduced in Lake Victoria These included *0 leucostictus O melanopleura, O niloticus* and *Tilapia zilli* During the same period, Nile perch was stocked in Lake Kyoga as an experiment prior to its introduction in Lake Victoria

From 1959, Nile perch was intentionally introduced in Lake Victoria The aim was that it would feed on the abundant and so-called trash haplochromines and convert them into a more acceptable fish flesh It was also hoped that Nile perch would extend the declining in-shore fishery to deeper off-shore waters and facilitate use of a wider variety of fishing methods and gear (LVEMP, 1995)

The International Union for Conservation of Nature (IUCN) in 1993 noted the alarming declines in the abundance and diversity of many endemic Lake Victoria fish species and attributed these declines to the introduction of Nile perch in the late 1950s and early 1960s The Nile perch and Lake Victoria *Lates niloticus* are species common enough in the Nile but not previously known in Lake Victoria

Following its establishment in the lake, the population of this large predator rose rapidly during the late 1960s, 1970s and early 1980s, leading, it is believed, to a 10,000 - fold reduction in the number of native fish which form the main diet of the Nile perch These dramatic population declines have resulted in the extinction of much of the lake's rich fauna of over 170 cichlid fish species, 98% of which were unique to the lake

An opportunistic feeder, the Nile perch feeds at almost all trophic levels above the producer This means that instead of supplementing the food-web structure, it has instead disrupted the food-chain in the ecosystem For example, the haplochromine population dropped from about 80% of the fish biomass in Lake Victoria in the 1970s to less than 1% in the 1980s, and about 200 species are now feared to have become extinct (LVEMP, 1995)

The phytoplankton composition has as a result changed and is now dominated by blue-green algae, the biomass of the latter being four to five times higher than the values in the 1960s The concentration of the vital nutrients has also changed Most notably the silicon concentration has decreased by a factor of ten, and phosphorus and nitrogen concentrations have both increased (MNR, 1995)

When the primary consumers die, they sink As they decay, they deplete the water column of oxygen The result is the development of extreme hypoxia in parts of the lake deeper than 40m, which makes a large volume of the lake no longer available to fish and other aerobic life This has been associated with mass fish kills in Lake Victoria as witnessed from time to time when the lake is turbulent and the

oxgyen deficient water rises to the surface
As part of the measures for the management of natural resources, government in May 1995 introduced the National Environment Statute In Section 35 it is stated, *"No person shall in relation to river or lake carry out any of the following activities Introduction of any animal, or micro-organism, whether alien or indigenous in any river or lake, or on, in or under its bed "*

- **Pollution**

The water hyacinth is a pollutant in the waters of Uganda Suspensions of decaying organic matter from the weed, as well as changes in water colour and the unpleasant odour are not suitable for most fish species Eutrophication caused by urban and rural discharges, agricultural activities and rainfall is also a major concern for aquatic life including fish **Table 4 13** shows quantities of nitrogen and phosphorus, which promote growth of algae, discharged into Lake Victoria from various sources From the data it emerges that agriculture is the main cause of eutrophication in Lake Victoria

- **Post-harvest Losses**

Post-harvest losses are a major problem associated with the traditional and predominant methods of fishing and processing These post-harvest losses were estimated at 20% in 1995 and 25% in 1996 In Tanzania, a recent survey established post-harvest losses for Nile perch at 4 1%, a figure which may be low

Losses occur during sun-drying, salting, frying and hot-smoking Losses also are caused by poor storage Fresh fish cannot move speedily to markets due to poor infrastructure affecting many landing sites It is only in areas where the catches are high that government has instituted mobile collection centres (for example, Rwampanga, Zengebe and Kazwama in Luwero district) Other ways to reduce post-harvest losses include improving upon traditional processing methods, provision of storage facilities and improvement of roads

The 1995 and 1996 post-harvest losses were considered unacceptably high The Uganda Fisheries Department is attempting to encourage processors to reduce losses to below 15% Also with the liberalisation of the economy, a number of fish processing factories have been established As greater efficiency is expected from the modern facilities, it is hoped that the aggregate rate of post-harvest losses will be reduced

- **Fisherfolk Communities**

Fisherfolk communities represent a special settlement pattern These communities are scattered along lake shores and river banks Key issues for these communities are poverty, localised deforestation, and water and sanitation

- **Poverty**

Most households in fisherfolk communities are poor, despite having an almost assured source of income on daily basis Worldwide, fisherfolk communities are not known to be wealth accumulators

In Uganda, a very small percentage of households in fisherfolk communities have income in excess of USh 50,000 per month Since most of the households do not own land in the areas where they live, they have very little incentive to build permanent structures One possible explanation for the poverty of fisherfolk households is that they receive less than 25% of the price that fish fetches in urban areas In general, urban households are much better off than households in rural communities, however fisherfolk households with estimated monthly incomes of USh 25,000 and above, fare better than rural farmers

With the introduction of better infrastructure, increased awareness of the fish marketing systems, and greater competition among the traders, it is hoped that the percentage share of value accruing to the fisherfolk communities will increase

- **Localised Deforestation**

Frying and hot-smoking are the most popular artisinal processing methods, and these have greatly contributed to environmental degradation through excessive harvesting of firewood in areas around fishing villages To make matters worse the smoking of Nile perch creates an even greater demand for firewood due to its high fat content

The harmful effects of deforestation are already evident around certain settlements of the western lakes complex and on the islands of Lake Victoria (Dunn, 1989) The fishing population living in the enclave villages of Queen Elizabeth National Park (QENP) in western Uganda is experiencing serious levels of firewood scarcity, as are the communities on the in shore areas of Lake Albert

- **Water and Sanitation**

The sources of water and types of sanitation facilities have a direct bearing on the health of fisherfolk communities Malaria, diarrhoea and dysentry are common illnesses A survey of fisherfolk around Lake Victoria (MAAIF, 1991) shows that malaria accounts for almost 40% of all illnesses This is due to the lifestyle of the fisherfolk, most of whom live in temporary shelters some of which are built near stagnant water, others spend nights on the open water Lack of safe drinking water and poor sanitation also contribute to high disease frequency The lake is a major source of drinking water but also serves as a bathing and dumping place for wastes Nearly 60% of households in fishing villages do not have proper latrines and ease themselves in the open or in the lake itself Human waste is washed into the lake by rain The 1991 MAAIF survey shows that over 90% of households in fishing communities fetch their drinking water from the same lake

4 3 3 Policy and Institutional Arrangements

The Fisheries Policy aims to regulate protect, promote, conserve, develop and sustainably exploit and utilise fish and fish products to provide food, employment, income and foreign exchange earnings through the export of surplus fish and other fish products The policy recognises the role of artisinal fishermen who catch more than 85% of the fish landed and consumed in the region and for the export market The policy is, however, silent on the development of industrial fishery

The Fisheries Policy's main objectives are

(i) To efficiently utilise sustainably available aquatic resources in order to increase fish production so as to improve the nutritional standards of the people and at the same time contribute to the growth of the national economy

(ii) To improve employment opportunities through fishery, fish processing, fish distribution, boat-building and their supplementary activities

(iii) To earn foreign exchange through export of fish and fish products

(iv) To encourage utilisation of unaccustomed fish species and products and improve on traditional processing methods

(v) To protect the environment, recognise and promote the multiple use of lakes and rivers

(vi) To promote and strengthen international collaboration and cooperation with neighbouring states so as to sustain the shared fish resources and the environment

(vii) To improve the quality and enhance availability of both more seaworthy fishing crafts through mechanisation and improved gears

(viii) To promote and propagate aqua-culture in order to enhance fish production from lakes, swamps, reservoirs, and in order to provide income from fishing

(ix) To promote tourism fishery

- **The National Environment Statute, 1995**

The National Environment Statute' put in place on 17 May 1995 under the Ministry of Natural Resources, contains a crucial section concerning Uganda's water bodies The National Environment Statute, No 4 of 1995, Section 36 states

(1) The Authority shall in consultation with the lead agency, take all measures it considers necessary in order to protect the banks of rivers and the shores of lakes in Uganda from human activities that will adversely affect the rivers and the lakes

(2) Each District Environment Committee with assistance of the Local Environment Committees, shall identify the banks of rivers and the shores of lakes within its jurisdiction which are at risk from environmental degradation or which have other value to the communities and take necessary measures to minimise the risk or recommend to the Authority the need for the protection of those areas

(3) The Minister may, on advice of the Authority, by statutory instrument, declare protected zones along the banks of rivers and the shores of lakes within such limits as it considers necessary to protect those rivers and lakes from deleterious human activities

(4) In declaring protected zones on the banks of a river and shores of a lake under sub-section (3), the Authority shall take into account

a) the size of the river or lake in determining the area of the protected zone, and,
b) the existing interests in the land covered by the protected zone

(5) Notwithstanding the provisions of this section, sustainable uses of the protected zone which do not adversely affect the river or the lake may be permitted by the Authority, except that where there is doubt relating to sustainable use, an environmental impact assessment in accordance with section 20 shall be conducted

- **Administrative Structure**

Uganda has undergone major changes in its administrative structures and organisations, at both ministerial and departmental levels

Institutionally, two major changes have affected the way the fisheries resources of Uganda are managed The first change has been through the Decentralisation Statute 1993, whereby Fisheries Officers at the district level report directly to the district instead of the Department of Fisheries, Ministry of Agriculture, Animal Industries and Fisheries The second change involved the transfer of the research arm of the Fisheries Department to the National Agricultural Research Organisation (NARO), an autonomous organisation, as the Fisheries Research Institute (FIRI) These two changes reduced the role of the Fisheries Department in both research and management at the district level It is too early to determine whether the two changes constitute an institutional improvement for the better management of the fisheries resources of Uganda

Another significant institutional restructuring is within the ministry The Directorate of Extension Services of MAAIF has been created at the ministry level and is responsible for providing extension services to the departments of crops, animal husbandry, fisheries and entomology A senior officer of the Fisheries Department at the rank of Assistant Commissioner has been posted to the Directorate of Extension Services to facilitate liaison with the parent department This has further reduced the role of the Department in extension work

4 4 WETLANDS RESOURCES

4.4 1 The State of the Wetlands Resource in Uganda

According to the Ramsar Convention, wetlands are defined as areas of marsh, fen peatland or water whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salty, including areas of marine water, the depth of which at low tide does not exceed six metres Furthermore, wetlands may incorporate riparian and coastal zones adjacent to the wetlands, and islands of water bodies of marine water deeper than six metres at low tide lying within the wetlands

Many Ugandans think that wetlands are the common swamps they usually see, however, swamps are just a subset of wetlands The National Wetlands Conservation and Management Programme (NWCMP) defines wetlands as *"an area that stays wet long enough for only certain plants and animals to grow even when there is no rain"*

Uganda's wetlands can be categorised as papyrus swamps, swamp forests, riverine wetlands, lake edge, floodplains, damboos and artificial wetlands The current Ugandan position is that the term "wetlands" should include all those areas where plants and animals have developed in association with temporary or permanent flooding

Wetlands often possess distinct trees, shrubs and grasses The soil found under a wetland is quite different from the normal soil because it is formed under low oxygen conditions and is very heavy with clay or has large amounts of plant material (peat)

There has been inconsistent information about the size and distribution of Uganda's wetlands The 1990-1991 coverage estimated the total area of wetlands at only 14 200 sq km Since then, the Ministry of Natural Resources has upgraded the figure to 23,000 sq km, which represents about 10% of the area of the whole country On the other hand, using the Langdale-Brown *et al* (1964) vegetation classification, Uganda's wetlands occupy 29,589sq km to which an additional 1300 sq km of papyrus wetlands and 500 sq km of seasonal wetlands could be added to give a total of 31,389 sq km

The most recent comprehensive data on the extent and size of wetlands is that of the National Biomass Study, carried out in 1993-1994 using Remote Sensing and Geographical Information Systems (GIS) Technology According to the findings of the study, Uganda's wetlands occupy an area of 30,105 sq km Wetlands are found throughout Uganda, the greatest concentration is in Soroti district and the smallest in Kampala district **(Table 4 14)**

In Uganda, there are basically two broad distributions of wetland ecosystems The natural lake and lacustrine swamp wetlands include the Lake Victoria region, the Kyoga-Kwania Lake and Swamp Complex Lake George area, Lake Albert area, the Bunyonyi Lake and Swamp complex, the Bisina and Opeta Lake Complex, the Lake Wamala area, and wetlands associated with minor lakes The riverine swamps and flo lains wetlands include the Okole System, the Kafu System and the Nile (Okole) area The wetlai Uganda serve four principal physical functions

- **reg ulation an onservation of water** by acting as large sponges which absorb water directly from precipitation and run-off from catchment areas and release it steadily through evapo-transpiration into the atmosphere and by gravity drainage into rivers and streams This water holding capacity and buffering effect ensures that rivers and streams continue to flow during the dry season and that groundwater supplies are sustained,

- **sediment and nutrient trapping** especially from the effects of soil erosion, industrial discharges, and use of agro-chemicals,

- **climate modification** through evapo-transpiration **(Box 4 4)**,

- **acting as a habitat for flora and fauna** including the rare *Sitatunga,* the shoe bill stock, crowned cranes and the swamp warblers

They also provide a number of products and services including the following

- Papyrus and similar plants that have traditionally been harvested for every day necessities such as thatching, weaving mats and baskets, palms and smaller-sized trees are harvested for structural building materials

Table 4 14 Distribution and size of Uganda's wetlands in square kilometres

Districts	Total wetland	Total permanent wetland	Total seasonal wetland	Total permanent converted	Total Seasonal converted	Total Wetland converted	Converted in % of total wetland
Jinja	99 6	12 5	87 1	0 0	75 9	75 9	76 2
Kisoro	33 4	21 5	11 9	11 6	10 9	22 5	67 4
Kabale	110 8	50 6	60 2	14 2	49 8	64 0	57 8
Iganga	1214 9	328 0	886 9	20 0	571 0	591 0	48 6
Tororo	786 5	231 5	555 0	4 6	368 6	37 4	47 5
Pallisa	710 8	337 6	373 2	4 6	253 2	257 8	36 3
Rukungiri	145 5	36 3	109 2	0 8	44 3	45 1	31 0
Kamuli	1079	397 1	682 8	0 3	315 7	316 0	29 3
Kampala	32 6	16 3	16 3	1 6	6 4	8 0	24 5
Mbale	355 5	57 7	297 8	1 9	65 8	67 7	19 0
	987 1	454 1	533 0	0 0	109 2	109 2	11 1
Kumi	988 9	299 3	689 6	0 0	60 7	60 7	6 1
Moroto	2218 8	23 8	2195 0	0 0	120 3	120 3	5 4
Bushenyi	182 5	96 2	86 3	0 0	7 3	7 3	4 0
Lira	1091	297 1	793 9	0 2	37 1	37 3	3 4
Rakai	1278	225 7	1052 3	0 0	43 2	43 6	3 4
Mubende	758 1	171 7	586 4	0 0	24 8	24 8	3 3
Kibaale	535	110 8	424 2	0 0	11 2	11 2	2 1
Kabarole	946 3	218 5	727 8	0 0	15 7	15 7	1 7
Mbarara	1108 5	208 7	899 8	0 0	15 3	15 3	1 4
Mpigi	1053	572 9	480 1	0 0	14 6	14 6	1 4
Kiboga	844	142 0	702 0	0 0	11 2	11 2	1 3
Apac	1147 4	294 4	853 0	0 0	13 4	13 4	1 2
Bundibugyo	911 5	103 1	808 4	0 0	10 7	10 7	1 2
Luwero	2421 5	412 2	2009 3	0 0	27 7	27 7	1 1
Nebbi	111 3	32 7	78 6	1 0	0 0	1 0	0 9
Ntungamo	107 6	70 0	37 6	0 0	1 0	1 0	0 9
Masaka	1424 5	446 3	978 2	0 6	11 3	11 3	0 8
Masindi	983 1	195 6	787 5	0 0	8 3	8 3	0 8
Kapchorwa	105 2	20 6	84 6	0 0	0 8	0 8	0 8
Soroti	320ɔ 8	842 8	2363 0	1 1	8 1	9 2	0 3
Arua	215 7	112 4	103 3	0 0	0 0	0 0	0 0
Gulu	609 9	73 7	536 2	0 0	0 0	0 0	0 0
Hoima	183	61	122 0	0 0	0 0	0 0	0 0
Kalangala	39 7	7 1	32 6	0 0	0 0	0 0	0 0
Kasese	407 2	68 8	338 4	0 0	0 0	0 0	0 0
Kitgum	592 3	48 2	544 1	0 0	0 0	0 0	0 0
Kotido	844 ɔ	1 2	843 3	0 0	0 0	0 0	0 0
Moyo	234 2	196 0	38 2	0 0	0 0	0 0	0 0
Sub Total	30105 1	7 296 0	22 809 1	62 5	2 313 9	2 376 4	7 9

Source *MNR/FD National Biomass Study 1996*

- Fishing between a swamp and open water, which is a highly productive but complex part of the wetland ecosystem It provides food, refuge and breeding sites for commercial fish including tilapia

- Parts of the wetland where the soil is permanently or seasonally moist have been used for cattle grazing, particularly during the dry season Clean water supply by acting as a filter, cleaning water supplies for human consumption Wetlands perform such a function for the water supply of Masaka town Without the filtration function of the wetland, Masaka town would have to install expensive water treatment facilities

Wetland vegetation is capable of stripping nutrients and toxic chemicals from in-flowing water thereby protecting the quality of water downstream (nutrient and toxic chemicals retention) The wetlands systems around Kampala City perform this important function absorbing urban sewage flow and industrial discharges

In 1986 the importance of wetlands to national development was formally recognised Concerned about threats to the wetlands, in 1986 the government banned further large scale drainage of wetlands and instituted the National Wetlands Conservation and Management Programme within the then Department of Environment Protection to analyse existing activities and assess the full range of functions and values provided by Uganda's wetlands Uganda also has global responsibility to conserve wetlands and utilise them sustainably under the provisions of the RAMSAR Convention on Wetlands of International Importance of which the country is a signatory and contracting party

4 4 2 Reclamation of Wetland for Agriculture and Industrial Development

The drainage of a wetland might be carried out by pumping or excavation of channels, perhaps combined with the use of a fast-growing fuel tree such as *Eucalyptus* The building of a dam upstream can have the effect of excluding water entering the wetland, as would excessive abstraction of water from a river entering a wetland

Drainage and reclamation of land worldwide until very recent times, has been considered a practical and prudent answer to people s ever increasing demand for land As unused arable land diminishes, people have turned to the wetlands, resulting in serious consequences such as reduced water tables, changes in micro-climate and loss of biological diversity

Drainage changes the water table and by its very nature causes the wetlands to dry out The immediate effect is the shrinkage of soils and the oxidation of organic matter over a period of time In specific circumstances where there is excess sulphur, oxidation will convert reduced sulphide to sulphate and extremely acidic conditions ensue Soil acidification, which renders the soil non-productive, is noticeable in Kabale district

The most serious effect of large scale drainage is the loss of the water-holding capacity of wetlands and their inability to act as a buffer to water flow When coupled with poor management of the catchment, flash floods can result, and storage water is lost from the system The overall ground water may be lost altogether

Drainage destroys habitats which may lead to loss of species Breeding habitat for fish is lost leading to reduction of fish stocks It also causes loss of valuable water which would otherwise be important for plant growth This leads to disruption of the food chain

Box 4 4
Climate change and the wetlands

The Department of Meteorology in conjunction with the National Wetlands Conservation and Management Programme has analysed several climate parametres in areas where wetland modification has taken place The main climatic parametres which can directly impact on wetlands are rainfall temperature and evaporation Of these three changes in temperature and rainfall have been analysed Currently it is established that there has been a gradual warming (temperature increase) in the areas of Kabale and Tororo both of which have suffered from extensive swamp reclamation The rate of warming is estimated at 0 2 °C per decade in Kabale

The question which has not been answered is whether this warming is part of the global warming effect or a purely local phenomenon Many scientists now think that it is a combination of both especially on account of the different warming rates at different stations

Source S A K Magezi & V K R Baryomu Dept of Meteorology 1995

Rice cultivation does not destroy wetlands completely but changes its fauna and flora from a natural ecosystem to a domesticated environment Thus, the community structure and wildlife associated with the wetlands also change Professor Derek Pomeroy (MUIENR) and Paul Mafabi (NWCMP) studied the interrelationship of managed wetlands, particularly rice schemes, and their avifauna They reported that the Kibimba and other rice schemes in Eastern Uganda support thousands of ducks and geese and large numbers of other water birds Crowned crane, on the other hand, have been found to require natural swamps for breeding Paddy rice also has the advantage of maintaining the soil structure of wetlands as a "sponge" and therefore is preferable to large scale drainage schemes

4 4 3 Degradation

Wetlands have been found to significantly improve water quality This is because they have the ability to filter common waste water pollutants

Kampala city discharges raw secondarily treated waste water into the Nakivubo Swamp mainly via the Nakivubo Channel which ends 1 2km from Lake Victoria at the inner Murchison Bay The bulk of Kampala's water supply is drawn from the same bay at a location only about 4 km from the waste water discharge zone Although it has been appreciated that there is considerable improvement in the quality of water entering and that leaving the swamp, it is not known how much longer the swamp can take discharge without drastic effect on its ecosystem This is especially so since the nutrient rich effluent from the municipal sewage treatment works at Bugolobi is discharged into the Nakivubo Channel without further treatment If this effluent were to pass through the treatment plant or swamp unmodified, there would be a high risk of eutrophication of the Murchison Bay This would eventually affect the quality of the city water supply

Taylor, Finlayson *et al* and Malthy carried out research to determine the role of wetlands in sewage treatment Their studies had the following specific objectives

- To determine the effect of the swamp on several physio-chemical and biological parameters including Biological Oxygen Demand (BOD), coliform bacteria count, pH, and electric conductivity

- To compare the performance of Nakivubo Channel with that of other wetlands elsewhere in the world

They found out that there was a general decline in pollution as one moves toward the lake This implies that the swamp is still buffering the environment even in the presently uncontrolled situation In essence, the swamp is providing the city with a relatively efficient waste water treatment system

In addition, the swamp is protecting the city's source of water supply since the raw water quality in Murchison Bay is probably dependent to a large extent on the swamp effect on the influent waste water Sustainable utilisation of the swamp in this role will only be possible if its importance is recognised and suitable management measures are put in place by the relevant authorities

Another example of the degradation of wetlands can be seen in the Lake George area When the Kilembe Copper mine shut down in 1982, it left behind a million tonnes of cobalt-rich pyrites concentrate stockpiled on the surface Over the years, erosion and intensive leaching have carried a trail of potentially toxic sediment towards Lake George destroying the vegetation and threatening the major fishery and other aquatic life of Uganda's only Ramsar site The concentration of copper in plants and soil at the edge of the lake is at a toxic level, and high concentration of heavy metals have been found in fish off-shore High concentration of copper can reduce photosynthesis in phytoplankton and puts at risk the Lake George ecosystem

Kasese Cobalt Company has proposed to extract the cobalt using naturally-occurring bacteria The acidity of the bacterial culture will be controlled by adding crushed limestone from the lime quarries before major impurities such as copper and zinc are removed from the effluent by solvent extraction Finally pure cobalt will be extracted by electrolysis

4 4 4 Harvesting

Many Ugandans depend on the natural products of wetlands for their basic needs, including household items and building materials Some cottage industries, such as brick and handicraft making also depend on wetlands for their raw materials Increasing population pressure and the demand for the products of the cottage industries have put great pressure on the capacity of wetlands to meet these requirements

Lubigi wetlands in the south-western part of Kampala is the main source of papyrus used for screen making To be able to harvest papyrus sustainably requires a nine month rotation Unfortunately, due to high demand, the current rotation has been reduced to 2-3 months, with the result that a lot of immature papyrus is being harvested Over-harvesting of plant and animal products causes adverse changes in the wetland ecosystems thus threatening the life of some aquatic species and degrading breeding grounds

Brickmaking is the best example of over-harvesting of wetlands Both clay and firewood are harvested from the wetlands in a destructive and unsustainable manner The clay excavation pits are almost always left open presenting very ugly sites Brick kilns also require substantial amounts of firewood, leading to destruction of local woodlands

4 4 5 Institutional Instruments

Since 1994, there have been policy developments in the area of wetlands management The following are the most significant

(a) The National Environment Statute

The National Environment Statute (1995), statute No 4, section 37, restricts the use of wetlands It states that

1 No person shall

(a) reclaim or drain any wetland,

(b) erect, construct, place, alter, extend, remove or demolish any structure that is fixed in, on under or over any wetlands,

(c) disturb any wetland by drilling or tunnelling in a manner that has or is likely to have an adverse effect on the wetlands,

(d) deposit in, on, or under any wetlands any substance in a manner that has or is likely to have an adverse effect on the wetland,

(e) destroy, damage or disturb any wetlands in a manner that has or is likely to have an adverse effect on any plant or animal or its habitat and,

(f) introduce or plant any exotic plant or animal in a wetlands unless he has written approval from the Authority given in consultation with the lead agencies

(b) The National Wetland Policy

Uganda was the first African country to develop a national wetlands policy The National Wetlands Policy, adopted in 1995, complements the goals and objectives of the National Environment Action Plan (NEAP) process and sectoral policies, including those of fisheries, forestry, wildlife, water, land tenure and soils, among others as well as the Ramsar Convention on Wetland of International Importance

In support of this aim, the National Wetland Policy sets five goals, namely

i) to establish the principles by which wetlands resources can be optimally used now and in the future,

ii) to end practices which reduce wetlands productivity,

iii) to maintain the biological diversity of natural or semi-natural wetlands,

iv) to maintain wetland functions and values, and,

v) to integrate wetland concerns into the planning and decision making of other sectors

Three principles apply in pursuit of these goals

a) wetlands resources form an integral part of the environment and their management must be pursued in the context of an interaction between conservation and the national development strategies and activities,

b) wetlands conservation can only be achieved through a coordinated and co-operative approach involving all the concerned people and organisations in the country including the local communities, and,

c) it is of vital importance for wetlands conservation and management that the present attitudes and perceptions of Ugandans regarding wetlands be changed

In particular the policy aims at

ensuring that no drainage occurs unless more important environment management requirements supercede,

ensuring that only non-destructive uses are carried out in and around wetlands,

ensuring that wetland developers are subject to Environment Impact Assessment and Audits, and,

maintaining an optimum diversity of uses and users and consideration for other stakeholders when using a wetland

4 4 6 Achievements in the Areas of Wetland Protection

National Wetlands Conservation and Management Programme was launched in 1989, to assist government in developing long-term policy and necessary capacity to implement the policy (the Wetlands Policy) The long-term goal is *conservation of Uganda's wetlands and maintenance of their socio-economic functions as well as ecological and biological values* The programme was charged with assessing the full range of functions and values provided by Uganda's wetlands As a result of this effort, some steps were taken, including the following

a study was commissioned in 1990 to determine the values of wetlands in addition to the assessment of the environmental and social impacts of previous wetlands developments,

at the launching of the Wetlands Policy in 1995, it was recommended among other aspects that a comprehensive landuse policy at national level be formulated In addition, this policy must be coordinated with other broad National Policies, such as the National Refugee Settlement and Disaster Policy, Industrial Policies, and Urban Planning,

at least eight pilot districts have been selected as a starting points to implement policy objectives on wetlands conservation These are Tororo, Pallisa, Bushenyi, Iganga, Kabale, Kampala, Masaka, and Mpigi districts,

a number of seminars for Wetland Resource Users have been carried out for local communities to make them aware of wetland values and functions and to introduce the "wise use" concept in some cases, an action plan for the area was developed This was the case for Kitanga in Kibale and Kyoja in Masaka, in 1995 where the focus was on eco-tourism These are essentially demonstration sites

a number of Wetlands Committees have been formed in some areas up to the sub-county level, to oversee the activities carried out in a wetland area,

the Uganda National Wetlands Inventory (in line with the Protection of East African Bio-diversity) was initiated by the National Wetlands Programme to provide a comprehensive overview of the extent, diversity and significance of Uganda's wetlands It would permit the elaboration of an environmentally-sound policy for the utilisation of these resources Three key players involved in the inventory exercise included the Wetlands Programme, the National Environment Information Centre (NEIC), and the National Biomass Project This involved mapping the country's wetland resources at 1 50,000 and making the information available in a the GIS format It will take many years for all the wetlands in the country to be studied fully,

the country is linked to the Programme through publication of the Newsletter (*WetNews*), newspaper articles, and other educational materials, in order to provide information on wetlands and related activities to the general public

Designation of Lake George as a Ramsar Site in 1988 as one of steps taken by government to implement the Ramsar Conventions Other actions include, among others, creating awareness at the national, district and school levels, data collection and research on values and functions of wetlands An Inter-Ministerial Committee is in place to ensure cross-sectional linkages for wetland management

Phase Two of the Wetlands Programme ended in June 1996 and funding for Phase Three has been secured The objectives of Phase Three include

strengthening the national capacity for wetland conservation and management,

developing the capacity for wetland conservation and management at the district level, and,

developing and extending methodologies for wetland resource management by local communities

At national level, the Wetlands Unit is to be the lead agency in providing advice on wetlands conservation and management At district level, technical officers will be trained to enable them to have capacity to assess wetland resources, ensure proper planning and wise use of wetlands, based on the wetland inventory At community level, methodologies for local management of wetlands will be developed at selected demonstration sites and extended to the other communities

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CHAPTER FIVE

5 0 BIODIVERSITY

5 1 What is Biodiversity?

Bio-diversity is a word that has entered common usage during the past few years, gaining particular prominence with the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992 and with the coming into force of the Convention on Biological Diversity (CBD)

Biological diversity refers to the range of variations or differences in living organisms and their environments, distinguished by the three main levels of biological hierarchy genes, species and ecosystems First, scientists are concerned with ensuring sufficient variation in the genetic make-up of species Second, there is concern to conserve biological diversi y by reducing threats to species richness Third, at the broadest level, Bio-diversity is concerned with the conservation of natural ecosystems and their components in the face of conversion and modification by human activities[1] For practical reasons, the living world has traditionally been categorised in terms of species, this gives rise to the emphasis on species diversity, or species richness (measuring the number of species in a habitat, (WCMC, 1992))[2] More recently concern has grown about the role of biodiversity in maintaining the functioning and resilience of ecosystems, and the implications of any ecological disruptions resulting from biodiversity loss on human economic activity, welfare and ultimately existence [3] An ecosystem's resilience, its capacity to recover from external stresses and man-made or natural shocks, will depend on the biological diversity of the system[4]

The variability and resilience of all living organisms in Uganda can be expressed as different vegetation types (ecosystems), species (antelopes, cows, fish, trees crops, etc), and genetic material contained in the individual members of the various species

The living organisms in Uganda represent the country's stock of natural resources or biological assets These assets are the main engines of the country's economy, contributing well over 50% of GDP For the rural population, biological assets represent their very means of existence and survival These biological assets will continue to be important for a long time into the foreseeable future It is essential therefore, that Ugandans conserve them

5 2 Biodiversity in Uganda

5 2 1 Extent

In general, as one moves from either the North or South Pole towards the Equator, biodiversity or species richness becomes greater Uganda, straddling the Equator and having in addition a wide range of altitudes and climatic conditions, is extremely biologically diverse Biodiversity is expressed as the number of species per unit area

Africa has a number of distinct bio-geographic regions or phytochoria, Uganda is located in an area where several of them meet [5] According to White (1983) there are seven major bio-geographic regions in Uganda, each with its distinct flora and possibly a similar distribution of fauna [5] Each phytochorion has more than 50% of its species confined to it, this is the basis of Uganda's endemism The country is also in a privileged position because of its proximity to the hypothetical Pleistocene forest refugium of eastern Zaire [6] Most of Uganda's biodiversity is in the natural forests but a consid

erable amount is found in open waters, wetlands and dry/moist savanna Uganda is estimated to have a quarter to half a million species, with flowering plants numbering over 4500 Due to Uganda's location in a zone between the ecological communities characteristic of the drier East African savannas and the more moist West African rain forests, combined with high altitude ranges, the country exhibits great biological diversity Although Uganda occupies only 2% of the world's areas, it has over 11% and 7% of the known world total of bird and mammal species, respectively [7]

Biodiversity in some areas such as the Albertine rift valley is truly spectacular, but other parts of Uganda also have noticeable biodiversity The Lango Bay ecosystem of wetlands and forests has 14% of the fish species of Uganda and 41% of its birds It has endemic fish (such as *Oreochromis esculentus and O variabilis),* dragon flies *(Macromia bispina)* and butterflies *(Tametheira timon orientalis, Elymnias bammakoo ratrayi, Charaxes imperialis ugandicus)* The dry montane forests of Karamoja contain a number of rare and restricted range species not found in other parts of Uganda The area has thirty known regional endemic species of birds, among them the globally-threatened Karamoja Apalis *(Apalis karamojae),* and several endemic species of butterflies *(Papilio nobilis, Charaxes smaragdilis elgonae)*

The importance of Bio-diversity is not confined to natural ecosystems Agricultural biodiversity, in predominantly altered or human-made ecosystems, is also of great interest

5 2 2 Uses and Values of Biodiversity

The native plants and animals of Uganda can be used in a variety of ways Through domestication and direct harvesting from the wild, Ugandans derive food, medicines and a wealth of raw materials The diverse wildlife of Uganda has recreational and aesthetic values, while the introduced plants and animals constitute the basis of Uganda's agriculture

5 2 3 Current Status

In recognition of the importance of biodiversity, Uganda ratified the Convention on Biological Diversity (CBD) in 1993 But Uganda's biodiversity continues to be lost at an alarming rate, despite the CBD, efforts to conserve critical sites through formaly protected areas, and to conserve critical sites through introduction of National Environmental Management Policy and Legislation The main reasons, either singly or in combination, are habitat conversion, introduction of alien species, pollution and excessive harvesting Some losses are barely perceptible, others are quite dramatic, such as the extinction of both the Black and White Rhino in Uganda

5 3 Principal causes of Loss of Biodiversity

5 3 1 Habitat Conversion

A principal cause of habitat conversion is human population pressure Despite the high incidence of disease including AIDS, Uganda's population is growing fast and is over 80% rural Annually, more land must be brought under cultivation to feed the increased number of people In places such as Kabale and Kisoro, the increased demand for agricultural land has led to land fragmentation In other areas, the response has been to encroach onto protected areas or extend cultivation into ecologically-fragile zones

Other factors contributing to habitat destruction are bushfires, poor agricultural practices, mining/ drilling, inappropriate sectoral policies and legislation, and armed conflicts and civil unrest Annual

bushfires lead to alteration of ecosystems Some species become extinct while others proliferate The domination of savanna woodland by fire-resistant *Acacia sp* is one example

Poor agricultural practices, such as over-stocking of rangelands and cultivation on steep slopes, contribute to erosion and siltation of water bodies, thereby altering ecosystems, including changing species composition

Inappropriate policies, such as the agriculture policy of modernisation, implicitly encourage monocultural and agrochemical-intensive farming systems that contribute to loss of genetic diversity through over-specialisation and pollution of sub-soil ecosystems The introduction of high-yielding maize varieties and promotion of clonal coffee are current examples

Armed conflicts have contributed to the cutting down of forests and the abandonment of the management of protected areas The insecurity in south-western Uganda makes it difficult for managers to be effective custodians of the wildlife-protected areas in the region In the early 1980s, many peri-urban plantation forests were cleared for security reasons This has in turn led to greater pressures on the surrounding natural forests for fuelwood, poles and timber Equally civil unrest in neighbouring countries has resulted in influxes of refugees into Uganda These refugees need land on which to settle, poles with which to build settlements and fuelwood for cooking and heating In Moyo district, where the refugee population is high, areas of general land degradation including deforestation are evident

5 3 2 Introduction of Alien Species

Many of the crops (coffee, cotton and tea) and livestock (exotic cattle) which form Uganda's food and cash earnings base were introduced to this country Uganda's forest plantations, both hardwoods (largely *Eucalyptus spp*) and softwoods *(Cypress and pine)*, are also exotic These introductions have been beneficial in large measure, but other alien species have had negative impacts As detailed in **Chapter 4**, the introduction of the Nile perch and water hyacinth has been extremely damaging for biodiversity The *Lantana camara* brought into Uganda as an ornamental plant has now become a common weed and a nuisance to farmers across the country There is as yet no negative impact of the weevils imported for the biological control of water hyacinth

It is possible to construct a cause-and-effect hierarchical relationship between the introduction of alien species and Uganda's biodiversity

The introduction of Nile perch into Lakes Kyoga and Victoria has changed their limmology Both lakes have now less aquatic biodiversity than before the introduction of the Nile perch Certainly, if one were to use species composition of annual catch as a proxy for biodiversity, then clearly the Nile perch is the most dominant However, annual catches may also reflect fisherfolk's preference for Nile perch as opposed to other species and their devoting more effort to catching it In general, introduced species alter ecosystems by reducing endemism and causing loss of germplasm

5 3 3 Pollution

While the level of industrialisation in Uganda is still very low, the industries that are in operation are significant sources of pollution as shown in **Chapter 7** Many operate with obsolete equipment, others use environmentally-inappropriate technologies Nutrient-rich industrial discharges (effluents) into Uganda's open waters, particulary Lakes Victoria and George, have contributed to eutrophication

The reduced oxygen in areas where eutrophication occurs means that species favouring anaerobic conditions thrive at the expense of those that must have oxygen

Smoke emissions from annual bushfires dissolve in rain and precipitate nutrient-rich (sulphur, nitrogen and phosphorus) material into Uganda's water bodies, thus contributing to eutrophication The destruction of fringing vegetation (wetlands) and its subsequent decay also contribute to eutrophication, as does the decay of masses of water hyacinth Eutrophication as a result of decaying vegetation and dissolved smoke will alter the species composition of aquatic ecosystems if allowed to persist for long In Uganda, at present, the impact of eutrophication is somewhat localised at discharge points and around shorelines where there is persistence of the water hyacinth

5 3 4 Over-harvesting and Trade in Live Plants, Animals and Derived Parts

Inappropriate policies and inadequate inventories of Uganda's biodiversity have in the past contributed to non-selective harvesting of various species Also, little grasp of ecology and taxonomy, low levels of enforcement including monitoring and evaluation, and unrealistically high international prices for some species and their derived products have historically led to over-harvesting These and the indiscriminate harvesting of Uganda's biodiversity have in the past contributed to the loss of the country's species richness, particularly where wildlife is concerned Currently, there are five mammalian species on the IUCN list of endangered species in Uganda These are

Mountain Gorilla	*Gorilla berengei*
Northern White Rhinocerous	*Ceratotherisus semum cotton*
Black Rhinocerus	*Diceros bicornis*
African Wild Dog	*Lycaon pictus*
Rwenzori Black Fronted Duiker	*Cephalophus nigrifrons rubidus*

5 3 5 Climate Change

As detailed in Section 8 2, the main impact of climate change in Uganda is climatic variability, the results of which are droughts and floods Droughts lead to the drying of rivers and streams, floods result in submerged ecosystems Although Uganda is a net-sink for greenhouse gases, as part of this planet, the country is also impacted by the adverse effects of global warming Above all global warming is contributing to the alteration of climate as evidenced by the increasing frequency of droughts in Uganda The ultimate effects of droughts, floods and global warming on the country's biodiversity are most likely to be those that alter various ecological systems

5 4 Controlling the Loss of Biodiversity

5 4 1 Overview

If the extent of forest cover (including tropical high forests and woodlands) is taken as a proxy for Uganda's biodiversity, clearly the country has registered significant loss Forest cover has declined from 45% in 1890 to about 20% in 1996 of the area of the country (National Biomass Study, 1996) It is unlikely that Uganda's biodiversity has declined by similar amount, since forests and woodlands are not the only reservoirs of biological diversity, nevertheless the example is telling There is tremendous pressure on Uganda's biodiversity While it may be impractical to advocate for a complete stop to biodiversity loss, it is necessary to attempt to control it

Uganda has approached the control of biodiversity loss in number of ways including the following,

among others institutional capacity building implementation of projects and active participation in regional and international fora

5 4 2 Institutional Capacity-building

- **Institutional structures**

NEMA has a cross-sectoral mandate and is the principal national authority on environment matters, including biodiversity The mandate of NEMA for the environment includes responsibility for the implementation of the provisions of the Convention on Biological Diversity (CBD) NEMA works in a coordinating, supervisory and monitoring role with the following lead agencies

Uganda Wildlife Authority (UWA), created in 1996 by an Act of Parliament, is a merger of Uganda National Parks (NP) and the then-Game Department (GD) For increased management effectiveness and to allow foi greater community participation, UWA has zoned Uganda into six wildlife areas An area may include national parks, wildlife reserves, wildlife sanctuaries and community wildlife areas Furthermore, the Wildlife Statute, 1996, places ownership of all wildlife in the country in the hands of the state This means UWA can manage wildlife in both protected and unprotected areas

National Agricultural Research Organisation (NARO) was established in 1994 as an autonomous research organisation The various institutes of NARO address different aspects of biodiversity conservation and sustainable utilisation For example, the Fisheries Research Institute (FIRI) is responsible for aquatic biodiversity, while the Forestry Research Institute (FORI) deals with biodiversity in forest areas The various agricultural research institutes also have set up crop and livestock genetic resources conservation programmes

NARO and its institutes work closely with the Consultative Group on International Agricultural Research (CGIAR) and its various international agricultural research centres (IARCs)

Legislation and policies

A number of regulations have been put in place to protect the Ugandan environment including the conservation and sustainable utilisation of biodiversity

The Constitution (1995) charges the state, including local governments, to promote the rational management of natural resources as a measure to safeguard and protect biodiversity Under Article 237, Clause 2(6), there is a provision for the protection of water bodies wetlands forests, national parks and any land to be reserved for ecological or tourist purposes for the common good of all citizens

The Environment Statute (1995) provides for sustainable management of the environment One of the principles of environment management is to maintain stable functioning relations between the living and non-living parts of the environment through preserving biological diversity and respecting the principle of optimum sustainable yield in the use of natural resources

The Wildlife Statute (1996) aims to enhance economic and social benefits from wildlife management by permitting wildlife user rights in community wildlife areas It also emphasises

public participation in wildlife management

The Water Statute (1996) emphasises the rational management of water resources

The National Wetlanas Policy (1996) was the first of its kind in Africa and aims to curtail the rampant loss of wetlands resources and to ensure that benefits from wetlands are sustainable and equitably distributed to all people of Uganda

The Decentralisation Statute (1993) is the legal framework for decentralisation or devolution of power to the district and lower level It provides for the establishment of the District Environment Committee (DEC) as a functional committee of the district local council (DLC)

Statutory Instruments There is a provision in Uganda's legislative system under which certain categories of leaders such as cabinet ministers, commissioners or directors are allowed to issue regulations called statutory instruments, as follow-ups to Acts of Parliament Statutory instruments offer the flexibility to plug regulatory loop-holes in any of the statutes dealing with the conservation and sustainable utilisation of biodiversity

Local legislation consists mostly of bye-laws at the district, sub-country and village levels where in fact biodiversity is most abused or negatively impacted upon The ability to pass bye-laws at the lower levels offers additional flexibility for strengthening the regulatory framework for the conservation and sustainable utilisation of biodiversity

5 4 3 Programs to enhance biodiversity conservation

Uganda has projects which specifically target conservation and sustainable utilisation of biodiversity A few are listed below

Institutional support for the Protection of East African Biodiversity, a UNDP/GEF regional project (ended in 1996) It supported biodiversity inventories in the Forest Department and National Wetland Project and provided institutional support to Makerere University, in the faculty of Agriculture and Forestry and the Institute of Environment and Natural Resources (MUIENR) A national Biodiversity Data Bank was established at MUIENR

Lake Victoria Environment Management Programme (about to start) funded by World Bank The project is meant to support the protection of catchment areas in ten districts around Lake Victoria and will be implemented by Forest Department, NEMA, UWA, NWSC, among others

Innovative cross-border approaches to the reduction of loss of biodiversity within selected sites in East Africa (at proposal stage) funded by UNDP

Makerere University Biological Field Station (MUBFS) does ecological monitoring in parts of Kibale National Park and provides post graduate training and post doctoral research

The Conservation and Sustainable Tourism (CAST) Programme is an ambitious multi-

donor multi-institutional investment package which includes the Protected Areas Management and Sustainable Utilisation (PAMSU) programe funded by the World Bank Other donor participants are the European Union, USAID and GTZ

EC Natural Forest Management and Conservation Project of the Forest Department expanded the area managed as nature reserves to cover 20% of the estate, where prime management objective is the protection of biodiversity with no consumptive use of resources permitted and 30% as buffer zones where low impact uses are allowed, and the production zone where the management objectives is to provide maximum sustainable forest resources

National Wetlands Management and Conservation Programme funded by the Dutch has undertaken inventories of wetlands resources in may districts of Uganda and was also responsible for producing Africa's first National Wetlands Policy

NGOs have projects supporting biodiversity conservation, such as CARE-DTC in Mgahinga and Bwindi, WWF at Bwindi and Rwenzori Mountains National Park, AWF at Lake Mburo National Park, and IUCN at Mt Elgon and Kibale National Parks Several of the NGO activities are integrated conservation and development projects (ICDPs) designed to help communities living adjacent to protected areas better appreciate the values of these resources

5 4 4 Regional and International Conventions

Uganda has acceded to a number of regional and international conventions relevant to biodiversity As a result of the National Environment Policy (1994), the National Environment Statute (1995), and other sectoral policies and legislation, the policy and legal framework in the country is conducive and allows the operationalisation of the provisions of the conventions However, shortfalls still exist, and there is need to provide secondary legislation to cover these shortfalls For example, in examining the legal implications of the CBD for Uganda, it becomes obvious that secondary legislation is needed to address such issues as bio-safety, genetic access and benefit-sharing arrangements

Some of the key conventions and agreements Uganda is a party to are the following

a) **Global**

Convention on the Continental Shelf, Geneva (1958)

Convention on Fishing and Conservation of the Living Resources of the High Seas, Geneva (1958)

Convention on the High Seas, Geneva, 1958

Treaty Banning Nuclear Weapons Tests in the Atmosphere in Outer Space and Under Water, Moscow (1963)

Convention on Wetlands of International Importance Especially as Water Fowl Habitat, Ramsar (1971)
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Washington (1973)

Vienna Convention for the Protection of the Ozone Layer, Vienna (1985)

Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 1985

Convention Concerning Safety in the Use of Asbestos, Geneva, 1986

The Convention on Biological Diversity, Rio de Janeiro, 1992

The Framework Convention on Climate Change, New York, 1992

Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and management of Hazardous Wastes Within Africa, Bamako, 1991

16 International Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, Paris, 1994

17 Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons, and their Destruction, London, Moscow, Washington, 1972

b) **Regional**

African Convention on the Conservation of Nature and Natural Resources (1968)
Protocol Agreement on the Conservation of Common Natural Resources (1982)
Agreement of Cooperative Enforcement and Operations Directed at Illegal Trade in Wild Fauna and Flora (Lusaka Agreement) 1994
The Inter-Governmental Agency for Development (IGAD)

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CHAPTER SIX

6 0 POPULATION AND SOCIAL DEVELOPMENT

6 1 Population, Environment and Development

Development is a multi-dimensional concept that encompasses not only the economic and social aspects of national activity, but also those related to population and the use and management of environmental resources To-date, many people still look at the environment in isolation of its relationship to people and development The relationship is indeed complex because population, environment and development interact in different ways, places and times The rate of development, its content, location and distribution determine, to a reasonable degree, the state of the environment These factors also influence the growth, distribution and migration of population Thus, environmental resources provide the foundation for development, just as environmental factors constitute part of the improvement in the quality of life that sustainable development is meant to bring about The challenge for Uganda is to ensure that its society, with its production and consumption patterns, avoids situations where severe stress is put on the life-supporting capacities of the environment

6 2 The population of Uganda

6 2 1 Size, Distribution and Density

With a 2 5% growth rate between 1980 and 1991, Uganda's population grew from 12 6 million to 16 7 million In 1996 the population was estimated at 19 8 million[1] About 89% of the population is still rural, deriving its livelihood directly from the natural resources Eleven percent live in cities, towns and other urban areas The average density is 85 people per sq km, but regional and district variations exist Rural settings in Kisoro, Mbale and Kabale have high densities of 301, 284 and 246 people per sq km respectively On the other hand, Moroto, Kotido and Kitgum have low densities of 12,15 and 22 people per sq km respectively

6 2 2 Fertility, Age and Dependency

Nationally, an estimated 47 3% of the population is under 15 years of age Over the years, the dependency ratio, which is the number of people young and old as a percentage of those between 15 and 64 years, has increased In 1969 it was 100, in 1991 it was 102 According to the Uganda Demographic and Health Survey (UDHS), in 1995 it was 122 This trend is explained by a multiplicity of factors First is the fertility rate, currently estimated at 6 8 children per woman[3], high by sub-Saharan Africa standards Second, the contraceptive prevalence rate is still very low at 16% However, this is a improvement on the even lower level of 5% which prevailed in 1988-1989 **Table 6 1** summarises Uganda's demographic trends

6 2 3 Family Size, Fosterhood, Orphanhood and Disability

Overall, the household size in Uganda has been fairly stable over the past three decades[5] On average, there are 4 8 people per household, with rural households having 4 8 people and urban households having 4 2 people[6] Male-headed households account for 75 6% of all households, while female-headed households make up 24 4% Of particular note is that 25 1% of all households have foster children under age 15 living in a household with neither their biological mother nor father present) The presence of foster children intensifies the economic burden on the heads of these households With the current high prevalence of AIDS, the percentage of households with foster children is likely to rise even higher

Table 6 1 Selected demographic characteristics 1948-1996

	Census Year				
Indicator	1948	1959	1969	1980	1991
Population (Thousands)	4959 5	6536 6	9 535	12636 2	16671 7
Intercensal growth rate (%)	-	2 5	3 9	2 7	2 5
Sex ratio (males per 100 females)	100 2	100 9	101 9	98 2	96 5
Crude birth rate (per 1000 people per year)	42	44	50	50	52
Total fertility rate (per 1000 persons)	5 9	5 9	7 1	7 2	7 1
Crude death rate (per 1000 persons)	25	20	19	20	17
Infant mortality rate (per 1000 live births)	200	160	120	115	122
Population urban (%)		4 8	7 8	8 7	11 3
Density (pop/sq km)	25 2	33 2	48 4	64 4	85
Dependency ratio				100	102

Source *Uganda Demographic and Health Survey (UDHS) 1995*

As of 1995, 10% of children under 15 years of age had lost their fathers, 5% had lost their mothers Two percent of children had lost both parents[7] The position seems to have worsened since 1991, even though the age reference for orphanhood was different In 1991, of children under 18 years of age, 9% had lost their fathers and 3 6% had lost their mothers Only 1 1% had lost both parents[8] The underlying factors for this trend include insurgency in some areas and AIDS, which has greatly affected the central region districts of Masaka and Rakai **Table 6 2** shows districts with the highest incidence of orphanhood

The 1991 census disclosed that 190,435 people or 1 2% of the population had a disability A disability is defined as "any condition which prevents a person from living a normal social and working life"[9] The disability rates for males and females were 1 3 % and 1 0% respectively The growing number of foster children, orphans and people with disabilities necessarily invite a review of the social security systems in the country In the long run, poor households alone may not cope with these problems without greater community and public support

6 2 4 Urbanisation

In Uganda, all gazetted cities, municipalities, towns and trading centres with a population of more than 1000 persons are categorised as urban areas With this criterion, during the census of 1991, 11 3% of the population lived in urban areas The current low level of urbanisation of 11 3% is mainly explained by a decline in the urbanisation rate between 1969 and 1980, measured at only 3 93% as compared to 8 17% between 1959 and 1969 The expulsion of Asians in 1972 by the then government, together with the decline in economic activities in urban areas and growth in insecurity was responsible for that low

Table 6 2 Districts with high orphanhood as of 1991 Census

	Immigrants	Percentage	Emigrants	Percentage
High ranking districts	1 Kampala	15 14	1 Kabale	11 09
	2 Mpigi	7 63	2 Mpigi	7 25
	3 Mukono	7 62	3 Tororo	5 71
Low ranking districts	1 Kapchorwa	0 21	1 Kalangala	0 15
	2 Kakangala	0 22	2 Kapchorwa	0 25
	3 Bundibugyo	0 25	3 Kotido	0 29
High ranking districts	1 Kampala	57 45	1 Kabale	35 33
	2 Jinja	45 79	2 Kampala	32
	3 Kalangala	40 03	3 Kalangala	30 83
Low ranking districts	1 Kabale	1 96	1 Kotido	4 29
	2 Arua	4 45	2 Kapchorwa	6 1
	3 Kitgum	4 75	3 Kasese	6 37
National average rate		17 68		17 68

Source MFEP [1992] The population & Housing census 1991

level of growth The urban population is now growing at 6 33% per year

Central region accounts for 62 4% of the urban population, but Kampala City alone within the same region has 41% of all Uganda's urban population

In urban population trends, there is a consistent drop in the gender ratio from 119 9 in 1969 to 99 9 in 1980 and 94 2 in 1991 This implies either an increasing proportion of females in urban areas or a decreasing proportion of males For example, Hoima experienced a negative growth rate of 3 8% between 1980 and 1[illegible] partly due to the low number of immigrants and low level of economic incentives, the majority remained in rural areas In contrast, Busia and Lira experienced high positive growth rates of 11 2% and 10 4% respectively during the same period, partly due to increased trading activities and number of immigrants Soroti and Gulu also recorded growth rates of 10% It is projected that by the year 2015, over 26% of the population will be living in the urban areas, compared to the present 11 3%

6 2 5 Migration and Environment

Migration is the movement of people that leads to a change in the place of usual residence Movement across administrative boundaries is internal migration while that across national boundaries is international migration

1 Internal Migration

The 1991 Census found about 2,872,000 people or 17 7% of the population were life time internal migrants Females out-numbered males with a ratio of 90 1 males to 100 females This is lower than the overall sex ratio of 96 5 for the total population There are variations in the rates of migration among districts **Table 6 3** shows the districts with extreme cases of both in and out-gration

There are environmental, economic and social reasons underlying the current patterns of internal migration The traditional cause of massive internal migration was resettlement due to population pressure and the opening up of new areas through eradication of disease vectors such as the tsetse fly The high numbers of emigrants from Kabale district date back to the 1940s when the residents, the Bakiga, were resettled elsewhere owing to the shortage of land In decreasing order of magnitude, they resettled in Kabarole, Hoima, Rukungiri and Bushenyi districts On the other hand, many immigrants to Kampala, Mpigi and Mukono are attracted by economic and social opportunities particularly, employment, trade and education The high immigration rate to Kalangala is due to fishing opportunities, but the emigration rate is also high, making the net immigration in absolute numbers very low Unfortunately, this has been accompanied by massive deforestation in search of firewood to smoke fish It was strongly observed in the 1994 SOER that migration in search of new lands *per se* is not a panacea to population pressure Cultural and technological aspects of land use need to change The same view is still held Owing to the internal strife that has characterised the history of Uganda, there has been population displacement in central Uganda (the Luwero Triangle), the Kumi-Soroti areas and northern Uganda Such displaced populations have normally returned to original homes after restoration of peace and their exact number is not known

Table 6 3 Percentage distribution of immigrants and emigrants among selected districts, 1991

	Immigrants	Percentage	Emigrants	Percentage
High ranking districts	1 Kampala	15 14	1 Kabale	11 09
	2 Mpigi	7 63	2 Mpigi	7 25
	3 Mukono	7 62	3 Tororo	5 71
Low ranking districts	1 Kapchorwa	0 21	1 Kalangala	0 15
	2 Kakangala	0 22	2 Kapchorwa	0 25
	3 Bundibugyo	0 25	3 Kotido	0 29
	Immigration rate		Emmigration rate	
High ranking districts	1 Kampala	57 45	1 Kabale	35 33
	2 Jinja	45 79	2 Kampala	32
	3 Kalangala	40 03	3 Kalangala	30 83
Low ranking districts	1 Kabale	1 96	1 Kotido	4 29
	2 Arua	4 45	2 Kapchorwa	6 1
	3 Kitgum	4 75	3 Kasese	6 37
National average rate		17 68		17 68

Source *MFEP (1995) 1991 Population and Housing Census*

International Migration

Only 115,655 lifetime immigrants moved into Uganda during the five years prior to the 1991 census Of particular significance is the fact that 50% were from Sudan, most of them settled in Arua and Moyo districts Overall, neighbouring countries account for 96% of the total recent immigrants

In 1996, Uganda had a refugee population of 244,780 people from Sudan, Rwanda, Zaire and Somalia[10] The government also estimates that there may be as many as 50,000 unassisted refugees In 1994, the total number of refugees was 286,500, in 1995 it had risen to 346,711 people By any standard, the number of refugees has been and is still high Women and children make up an estimated 60% of the

total refugee population The majority are of rural background and are subsistence farmers **Table 6 4** shows major locations of refugees in Uganda

Table 6 4 Refugee Population in Uganda

Districts	Population (30/06/96)
1 Sudanese Population (Arua District)	
Koboko	26905
Ikafe	45299
Rhino Camp	20750
Mvepi	9321
Moyo District	
Adjumani	74 293
Palorinya	20 331
Kitgum District	15 725
Masindi District	
Kiryandongo	
2 Rwandan Population(Mbarara District)	
Oruchinga	5 834
Nakivale	
3 Zairian Population(Kabarole/Kisoro Districts)	
Kyaka	12 525*
Kisoro	2 589
4 Somali Population & Urban Caseload(Ethiopian Kenyan Burundian Liberian) All refugees registered as vulnerables or security cases	458
5 Unassisted	not known
Total Refugees in Uganda	244 780

** - A considerable number of refugees may have spontaneously repatriated, accounting for the drop in numbers from the previous months

Source *Report by United Nations High Commission for Refugees (UNHCR), (1996)*

Many responses have come from government, international agencies and NGOs to deal with the refugee problem in Uganda In an effort to decongest the transit camps, the government of Uganda allocated a total of 1333 sq km of land for the development of settlements with the aim of allowing agricultural self-sufficiency[11]

Uganda is unique in Africa in that it is the only country willing to give land for refugee settlement Refugees can, through inter-cultural exchange, enrich hosting communities and contribute much to the development of Uganda In short, "refugees are an asset" Nevertheless, several factors complicate the development of the refugee-affected areas in Uganda External forces, such as rebels and bandits, disrupt the delivery of needed supplies In 1996 as many as 107 refugees were killed by rebels in northern Uganda

There is an environmental impact associated with absorbing nearly a quarter of a million refugees Deforestation from fuelwood gathering is one of the most critical environmental problems Approximately 120 metric tonnes of wood is extracted daily from the forest areas surrounding the camps of east Moyo alone[12] The possibility of an organised wood supply has been studied, but the fact that some 25 camps and settlements would need fuelwood on a regular basis renders impractical such a scheme Given the visible signs of depletion, there is a certain urgency in making an inventory of the vegetation cover to enable further monitoring Another problem is that the numbers of young refugee women foregoing education in the face of heightened home responsibilities limit the rate of development in refugee communities

6 3 Consequences and Implications of the Population Situation

6 3 1 Family and Individual Welfare

What people do with their lives and those of their children affects their health far more than what the government does But what they can do is determined, to a great extent, by being empowered through income earning and knowledge enhancement activities, factors that are not completely in their control The relevance of the family to understanding Uganda's social development and environmental quality is justified on grounds that it is the basic unit of reproduction and production in the community The individual family's reproductive behaviour influences the national population, its productive capacity determines the nation's wealth Hence, the impact of population size, growth and structure will ultimately be felt in the level of welfare of individuals and the family

One of the consequences of the high fertility rate and the youthful age structure in Uganda is the building-up of "population momentum" This phenomenon is the result of the relatively large number of young women who continually enter the reproductive age group as opposed to the much smaller number of women who move out of the child-bearing age bracket through ageing The existence of this relatively large number of potential childbearers means that even if fertility were to drop drastically to replacement levels of around two children per woman, the population of Uganda would still continue to grow for at least 40 to 50 years This situation has far reaching implications for the development of the individual within the family and the nation at large, particularly given that the level of technology is still low

First, the health of both mothers and children is adversely affected by high fertility The risks of maternal, infant and child morbidity and death increase with pregnancies that are too early (births to mothers under 18 years), too frequent (birth interval of less than 2 years), too many (more than four) and too late (after age 35) In addition, short breast-feeding durations (less than 18 months) have adverse effects on the health of children

Second, the high level of infant and child mortality tends to induce couples to have more children than they ultimately want in order to achieve the desired number of surviving children This has health implications for both mothers and children Third, early child-bearing has certain socio-economic and health consequences In Uganda, 43% of females aged 15 to 19 have begun child-bearing Teenage pregnancies among single mothers who lack material resources can affect the initial development and growth of their children Early child-bearing encourages the school drop-out phenomenon and acts as a barrier to the educational and career advancement of women and their future economic independence Exposure to AIDS is also increased with early pregnancies

6 3 2 Increased demand for health services

Uganda has set itself to achieving adequate health services for the entire population, through the Primary Health Care (PHC) approach These efforts, however, are likely to be made difficult by prevailing high fertility, mortality and the recent scourge of the AIDS epidemic Due to these variables, the demand for health services is rising at a time when the health infrastructure is still characterised by uneven distribution and poor access to facilities, inadequate services and low per capita expenditure Health sector spending is still biased toward curative as opposed to preventive services Expenditure on health care, from both public and private sectors, is only US$5 65 per capita per year or about 50% of the absolute minimum level of US$ 12 necessary for proper care

6 3 3 Increased demand for education services

Government has set itself to achieve universal primary education (UPE) by the year 2003 Presently, it has committed itself to meet the primary education costs of four children per household However, the current high birth rate and momentum of population growth may hinder the government's ability to extend the coverage and improve the quality of primary education The primary school age population (aged 6-12 years) is expected to grow from 3 3 million in 1991 to 7 2 million by the year 2021 As primary school enrolment rises towards universal primary education, much larger expenditures will have to be incurred to pay for the increasing number of teachers, school administrators and classrooms and increased scholastic materials and equipment

6 3 4 Labour Force and Employment

Population growth accounts for a substantial expansion of the labour force which is mostly engaged in agriculture and the informal sector The potential labour force (aged 15-64 years) is projected to grow from 8 2 million in 1991 to 16 8 million by the year 2021 Given the restricted absorptive capacity of the formal sector, which currently engages only 12% of the total labour force, the extent to which employment opportunities can be generated for new entrants to the labour force is limited and constrained further by t ie on-going structural adjustment programmes As a result, limited opportunities for growth in the economy aggravate the problems of unemployment, underemployment, rural to urban migration, (aindrain and crime

6 3 5 Urbanisation

The rapid increase of the urban population has not been matched by the growth and development in basic physical infrastructure, housing, social amenities, management and skills It has led to overcrowding spread of squatter settlements, dilapidated housing and poor sanitation Rural to urban migration, which has con..buted to the development of the urban areas through the provision of needed labour and skills, has also increased the number of the urban poor, aggravated problems of unemployment, slums and increased pressures on existing social services

6 3 6 Housing and Related Services

Housing is a basic human need It has far reaching implications for the health and productivity of the population The provision of adequate housing in Uganda is not keeping pace with the demand in rural and urban areas due to population growth In addition, housing has over the years suffered neglect with very meagre resources being allocated to the sector While the urban population continued to grow in the 1970s and early 1980s, there was little expansion in urban housing In addition, the existing structures received little or no maintenance, and many were destroyed during internal conflicts Among the significant outcomes of these trends are over-crowding, growth of slums and deterioration of basic

facilities Urban housing is characterised by high room occupancy rates especially in Kampala, where the average household size is 14 persons, and 58 percent of the households live in one room accommodation Furthermore, if the current urban growth rate continued, the total urban population would increase five-fold by the year 2021 , requiring substantial increase in the number of new housing units and other infrastructure

According to the 1991 Census, 48 5% of occupied dwelling units had grass and banana leaves as roof materials and mud and wood (wattle) as wall materials The situation is of particular concern in the rural areas where 54 5% of the rural dwelling units have grass and banana roofs and wattle walls This compares to 8 5% in urban areas

The proportion of the population having access to the various infrastructural services is a highly inadequate situation The 1991 Census indicated that only 25 8 and 5 6% of the total households had access to safe drinking water and electricity, respectively The National Integrated Household Survey,1992-1993, found that only 6 3% of households had access to electricity While 86 6% of households in Kampala had access to safe drinking water, only 64 2% and 18 5% had access to such a facility in the other urban and rural areas, according to the 1991 Census

Pit latrines are the dominant form of toilet facility in the country According to the 1991 Census, about 4 7% and 32 2% of households in urban and rural areas, respectively, had no toilet facilities These examples illustrate that continued population growth without supportive infrastructure stands to undermine sustainable livelihood, both at household and national level

6 3 7 Demand for Social Security

With the increase in people with HIV/AIDS, the elderly, orphans, the unemployed, the disabled and amidst general poverty, extended family is strained to the limit In the absence of a comprehensive social security policy and programme by government, individual households must be compelled to take a lead One way to do that is to control unplanned population growth

6 3 8 The Demand for Environmental Resources

One of the impacts of high population growth is the degradation of the environment Land fragmentation is increasingly common Fallow periods are no longer sufficient to allow soil fertility to be restored, crop yields have fallen as a result Currently, the gap between present and potential yields ranges from 200% to 300% countrywide[13] Without the means to invest in intensive agriculture, households are increasingly encroaching on marginal lands which cannot support agriculture sustainably

The impact of a growing population on forest cover has also been observed, about 97% of the population use firewood and charcoal as the main source of energy for cooking The expansion of agricultural land to meet the increasing demand for food has led to depletion of wetlands and encroachment on forest reserves and game parks These, to a large extent, explain the decline in Uganda's forest cover from an estimated 31,000sq km in 1900 to 6000sq km by 1985 This in turn has caused a reduction in the water catchment, further environmental degradation and a decline in agricultural productivity

6 4 The Population Policy

In 1995, the government endorsed a National Population Policy whose goal is "to influence future demographic trends and patterns in desirable directions in order to improve the quality of life and standard of living of the people" The policy has specific objectives relating to personal and family health, children and youth, women and the elderly, environment and development, information policy and research It also has strategies for education, employment, housing, urbanisation, food security and nutrition The policy has specific provisions to address the plight of people with disabilities Basing itself on the past demographic variables, and those in the 1991 Population and Housing Census, the government has set targets for the year 2000

The targets are set against a background which showed that a high level of fertility (7 1 children per woman as per 1991 census results) and the youthful age structure were building a "population momentum" which needs to be brought within the capacity of the economy and environment to sustain The targets of this population policy are given in **Box 6 1**

Box 6 1

Population targets by the year 2000

A Demographic targets

i) Reduction of infant mortality rate from 122 to 112 per 1000 live births
ii) Reduction of mortality among children aged 1-4 years from 93 to 85 per 1000 live births
iii) Reduction of maternal mortality ratio from 500 to 330 per 100,000 live births
iv) Reduction of total fertility rate from 7 1 to 6 5
v) Increase in life expectancy at birth for both sexes, from 48 to 53 years

B Health service targets

i) Increase in full immunisation from 31% to 62%
ii) Increase in supervised deliveries from 38% to 76%
iii) Increase in contraceptive prevalence rate from 7 8% to 15%

C Social services targets

i) Raise the educational attainment rate of females aged 13-24 years in post primary and higher levels of learning from 12% to 18%
ii) Increase in literacy rate from 40% to 60% among women and from 60% to 80% among men
iii) Increase in provision of safe drinking water to the rural population from 18% to 36%,
iv) Reduce the proportion of households without toilet facilities from 29% to 14%

Source MFEP Population Secretariat (1995) National Population Policy for Sustainable Development

6 5 Human Settlements

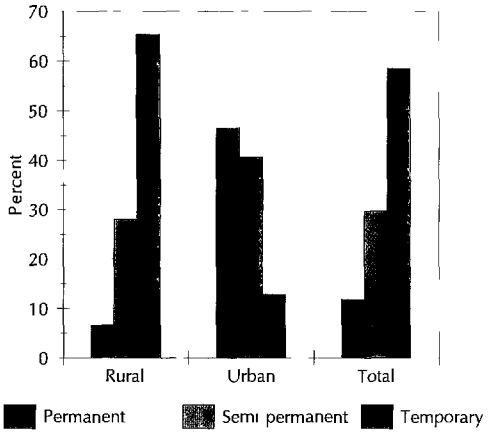
6 5 1 Introduction

Housing is a long-term investment requiring a large capital outlay, but at the same time it is a basic need Accordingly, it should be available for all Provision of housing under overall human settlement strategy requires that it should be guided by land use planning settlement planning and management in disaster-prone areas Simultaneously, settlement should be integrated with provision of environmental infrastructure water, sanitation, drainage, solid waste management, energy transport systems and a sustainable construction industry It is in this broad context that the state of human settlement in Uganda is reviewed

6 5 2 Housing Stock Conditions and Characteristics

The housing situation in Uganda leaves a lot to be desired both in terms of quality and quantity The underlying reason is that there has been no significant housing development for the last two decades This historic problem is reflected in a number of indicators First, there is a housing backlog of about 44,000 housing units in Kampala, 63,000 in other urban areas and 238,000 in rural areas Second, 63% of urban households stay in dwelling units constructed more than 15 years ago Third, the average number of persons per room is still high, at 1 9 Finally, 56% of the household population live in dwellings which are temporary in the sense that both wall and roof materials are temporary (grass thatch, mud and wattle walls) The national urban and rural outlook is given in **Figure 6 1**, regional variations are given in **Table 6 5**

Figure 6 1 Percent distribution of households by location and permanency of dwelling unit



Source *Population and Housing Census Report 1991*

6 5 3 Durable Household Goods

Table 6 6 gives a picture of durable household goods in the country Ownership of radio and television is an indicator of access to mass media, some of which could be used for environmental programmes Telephone ownership is a measure of access to an efficient means of communication, refrigerator ownership indicates the capacity for hygienic food storage, ownership of a bicycle, motor-cycle or private car shows the means of transport available to the household It is evident that bicycles are more popular in rural areas, one third of households own bicycles Radio is widespread with almost 40% of households having a radio

Table 6 5 Regional variations in housing characteristics (percent)

Characteristics	Uganda	Central	Eastern	Northern	Western
1 Type of housing unit					
Detached house	48 9	59 6	32 4	17 1	73 7
Semi detached house	8	11 2	8 5	2 7	7 5
Tenement/Muzigo	8 1	17 7	5	1 1	3 7
Hut	33 3	8 6	52 3	78 1	14 4
Others	1 7	2 9	1 8	1	0 7
2 Tenure of dwelling unit					
Owner occupied	81	65 8	85 4	90 1	89 6
Free/subsidised	6 9	10 2	5 7	6 5	4 1
Rented	12	23 9	8 8	3 4	6 3
Others	0 1	0 1	0 1	0	0
3 Permanency of dwelling unit					
Permanent	11 8	24 6	10 3	3 4	4
Semi permanent	29 7	43	24 5	7 4	33 2
Temporary	58 5	32 4	65 2	89 2	62 8
4 Number of rooms					
1	35 6	30 9	47 3	59 5	13 6
2	23 9	26 1	23 7	20 9	23 3
3	17 1	17 4	14	9	25 3
4 or more	23 4	25 6	15	10 6	37 8
5 Roof material					
Iron sheets	37 8	60 6	31 6	8 4	35 4
Tiles	2 1	3 4	2 8	1 1	0 8
Grass	52 8	31 2	58 4	89 9	48 8
Others	7 3	4 8	7 2	0 6	15
6 Age of dwelling unit					
0 4 years	42 8	34 5	44 2	56 3	42 3
5 9 years	21 5	18 5	22 4	21 9	24 3
more than 10 years	35 7	47 0	33 4	21 8	33 6

Source 1991 Population and Housing Census Report

6 5 4 Sources of Household Livelihood

From the national point of view, employment means the total number of persons gainfully occupied with a regular activity from which they obtain livelihood The Human Development Report, 1996, emphasises that development should not render people jobless Today, the total labour force is estimated to be 7 3 million people or 41% of the total population Of these, 50 1% are females and 49 9% are males It is evident in **Figure 6 2a** that males compare more favourably than females in government public employment opportunities and in the private sector The dominance of females (70 7%) in household enterprises is also noticeable The majority of people are self-employed (56 6%) or engaged in household enterprise (28 0%) The public sector takes only 5 0% while the private sector employs 9 4% This position is depicted in **Figure 6 2b**

Table 6 6 Percentage of households possessing various durable consumer goods by urban and rural residence, 1995

Durable goods	Residence		
	Urban %	Rural %	Total %
Radio	67 2	32 8	37 5
Television	17 3	0 6	2 9
Telephone	2 4	0 1	0 4
Refrigerator	4 8	0 1	0 7
Bicycle	24 5	35 7	34 2
Motorcycle	1 7	0 6	0 7
Private Car	5 4	0 7	1 3
Non of the above	26 8	51	47 7

Source *MFEP Uganda Demographic and Health Survey (UDHS), Report 1995*

From **Figure 6 2c,** it is clear that the major source of household livelihood is farming, occupying 70 3% of the population Therefore, to benefit the majority of people, there will be need for improvement in agricultural incomes, rural terms of trade, extension services, agricultural technologies and environmental restoration

Terms of trade simply measure the purchasing power of a given crop in terms of production inputs and a basket of consumer goods required by the family They are an important indicator, showing the direction of inter-sectoral price movements and transfers of incomes from one sector to another If the purchasing power of a particular farm product falls, this affects the incomes and living standards of those farmers growing that crop, and they may shift to other crops with higher purchasing power If the terms of trade parity is more than one, the terms of trade are favourable to farmers If it is less than one, then they are against farmers

Food crops have over the years showed higher purchasing power than cash crops The underlying reason is that for quite a long time, the marketing of food crops has been handled by private entrepreneurs without much government interference Cotton is still facing a number of bottlenecks such as lack of adequate production incentives, and families would be insecure to solely depend on it

6 5 5 Rural Non-farm Activities and Employment

By definition, rural non-farm activities include all activities other than those performed on the farm or related to farming such as manufacturing (including processing), handicrafts construction, transport, trade and services The important contribution that rural non-farm activities can make to rural employment effort has not received adequate attention Yet employment promotion in the non-farm sector has a role in employment generation and in combating under-employment in agriculture

First, rural non-farm sector activities can provide employment and an alternative source of income for the landless and the increasing number of traders and artisans Second, non-farm activities have great potential to supplement incomes of households during the slack seasons particularly for small-scale farmers or households with very little land Third, the non-farm sector can stimulate agricultural pro-

duction by providing essential in-puts such as farm tools and implements and market outlets for agriculture Fourth, the sector can provide some of the commodities and services required to meet basic needs and at the same time contribute to skill formation and the development of entrepreneurship Finally, non-farm activities can assist in generating and saving foreign exchange through production of exports and import substitution

In summary, there are important forward-and-backward linkages between agricultural and rural non-farm activities Information on this sector is inadequate and far from precise The Integrated Household Survey, which specifically deals with small scale establishments and household enterprises, shows that about 6 7% of all households in Ugandan rural areas are engaged in rural non-farm activities[14] This excludes those engaged in large-scale processing of sugar, tea and cotton If these are included, then the percentage would rise to 12 6%[15] This compares favourably with the average for SSA where rural non-farm activities offer 10-20% employment of the rural labour force[16] They provide 25 to 30% of total income of rural dwellers in SSA

The Population and Housing Census, 1991, indicates that the average number of persons engaged per enterprise was 1 67 while hired labour made up about 0 2 persons Men dominate mining, quarrying, pitsawing, *waragi* (alcohol) distillation and transport, while women dominate food processing The amount of capital invested is still very small Rival non-farm activities would be better linked to the natural resource base if it were not for the constraints they face Chief among them is lack of appropriate technology and equipment, lack of finance, skills and infrastructure

6 6 Provision of Water and Sanitation

6 6 1 Sources and Quantity of Domestic Water

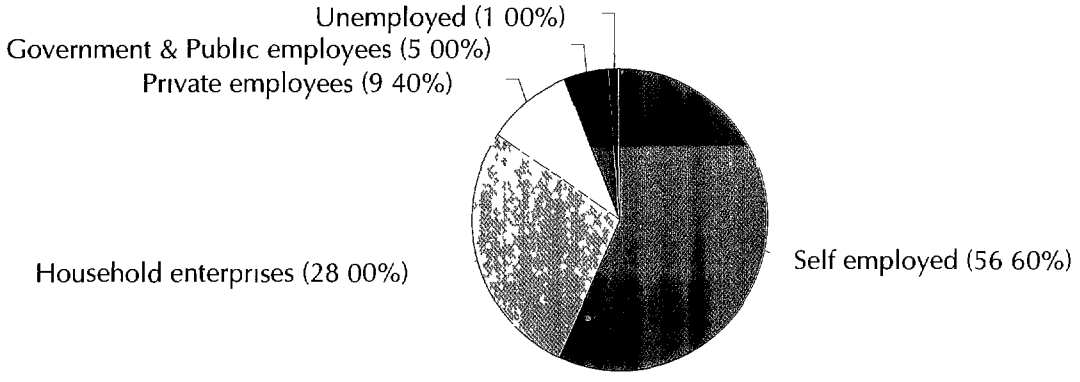
Domestic water supply is based on both surface and ground water sources Surface water is the dominant source for larger urban supplies, while groundwater forms the basic source for rural supplies and a number of smaller towns In 1991 the total population with access to safe water represented 25 8%, corresponding values for the rural and urban areas were 18 5% and 74 5% respectively By 1993, however, the water supply average of the Directorate of Water Development (DWD) had reached 28% and continued to rise to 31% in 1994 and 36% in 1995 for the whole county Uganda is therefore still lagging behind despite the abundant water resources available However, DWD aims to attain a coverage of 100% and 75% for urban and rural areas respectively by the year 2000 The current degree of accessing water is closely linked to the method of distribution Piped water supply, boreholes and protected wells and springs are considered to be safe water sources, water from other sources is considered unsafe unless otherwise treated

Table 6 7 gives the methods of water distribution in Uganda by percentage of population served It also shows the large regional differences in access to safe water, the central region has the highest level of coverage The location of water sources and distribution facilities relative to consumers has a bearing on the amount of water consumed with consumption varying inversely with distance to the source This is demonstrated by differentials in rural and urban domestic water demand (25litres/capital/day and 50litres/capital/day respectively)

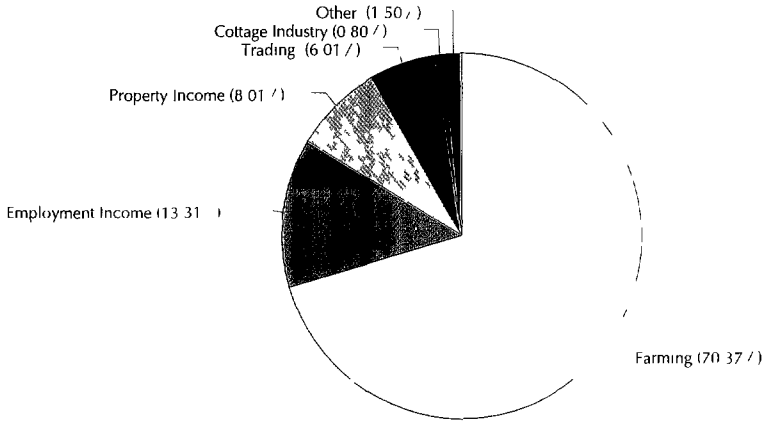
Figure 6 2 Sources of employment and Livelihood in Uganda

(A) Employment by Gender

(B) Type of Employment



(c) Source of Income



Source MFEP Population and Housing Census 1991

Table 6 7 Water access methods, rural and urban by region, 1991

Description	Regional Variation						
	Rural%	Urban%	Total%	Central %	Eastern%	Northern%	Western%
Piped water inside	0 15	6 24	0 94	11 26	6 91	0 29	3 39
Piped water outside	1 58	30 32	5 29	11 26	6 91	0 29	3 39
Boreholes	7 56	10 57	7 95	3 33	8 64	21 11	3 89
Protected springs	9 25	27 36	11 59	13 60	9 45	6 36	14 77
Open well/springs	56 53	19 39	51 73				
Stream/river	15 53	3 16	13 93				
Lake/pond dam	8 95	2 49	8 11	71 81	75 00	72 24	77 94
Other	0 45	0 48	0 45				
Total	100	100 00	100 00	100	100	100	100

Source and *MFEP 1991 Population and Housing Census Analytical Report Vol III (Household Housing Characteristics)*

6 6 2 Sanitation and Sewerage

Sanitation and sewerage are two important environmental issues with a direct bearing on the health and well-being of human beings In Uganda, there are variations in accessibility to sanitation, based on spatial distribution and socio-economic stratification In urban areas, the sanitation coverage is 73 6% while in rural areas it is 57 8% It is the projection of DWD to attain 100% and 75% coverage in urban and rural areas, respectively, by the year 2000 Central Region has a gap of only 13% in coverage, compared to the west with 14 3%, east with 38% and north with 64 1% gap Socio-economic stratification plays a role in access to sanitation facilities Only 4 1% of the households headed by someone that has attained at least an advanced level of education did not have access to adequate sanitation facilities, while the corresponding figure for households headed by non-educated people was 39% (MFEP,1991) Current sanitation choices include conventional waterborne facilities, improved and unimproved pit latrines, bucket systems and others Nevertheless, a big proportion, that is 28 6%, have none of these (**Table 6 8**) Only a handful of towns in Uganda are supplied by water and sewerage facilities from the National Water and Sewerage Corporation The treatment methods used include large septic tanks, sedimentation (mechanical treatment), traditional trickling filter plants providing mechanical and biological treatment, activated sludge systems and stabilisation ponds The general state of the sewerage treatment facilities is very poor, causing some sewerage to be discharged into the environment untreated

6 6 3 Waste Management

Waste can be defined as a movable object or matter (substance) which has no direct use in a particular place at a particular time and is discarded permanently There are two main categories of waste, namely

- Rural household waste
- Municipal waste

Table 6 8 Existing sanitation facilities by proportion of population served in rural and urban areas

Description	% Rural population served	% Urban population served	% Total Population served
Waterborne not shared	0 19	6 43	1 00
Waterborne shared	0 20	6 19	0 97
Pit latrine not shared	48 43	15 13	44 13
Pit latrine shared	18 50	67 26	24 79
Other	0 50	0 28	0 47
None	32 18	4 72	28 64

Source *MFEP (1991) Population and Housing Census Report*

1 Rural household Waste

There is a tendency for many people to think that waste generated by households in rural areas does not pose the same problems as in cities This used to be true when population densities in rural areas were low However, in places like Kabale or Kapchorwa, which are densely populated in addition to being mountainous, the problems of waste management are similar to those of small/medium-sized towns In these places, although each household may own its compost pit or dumping site, they are so close to each other that when it rains the pollutants merge to form one source which can easily contaminate water sources Second, unlike in the old days, when rural wastes were exclusively biodegradable vegetable waste, today hazardous wastes have already penetrated rural areas It is also important to note that pollutants are transported by water and wind, and so where they are initially deposited may not matter

In addition, rural areas presently consume the biggest portion of certain hazardous waste-generating products such as plastics, dry cell batteries, synthetic fibres, synthetic foot wear, and so on, as well as toxic chemical contaminated containers for water storage These waste types are non-biodegradable and, therefore, the traditional composting disposal method is no longer effective There is, therefore, need to develop a national mechanism of collecting these hazardous wastes for proper disposal

Municipal Waste

There is already a solid waste problem in all towns of Uganda, including Kampala city The only means of solid waste disposal is open dumping for both towns that have some garbage vehicles as well as those that do not Some towns dump their waste in swamps For example, Kampala City Council dumps waste into Lweza and Lubigi, which are unsuitable sites for waste disposal, they are wetlands, and the wastes may pollute ground and surface water Solid waste collected from towns is usually less than 50% of the total generated, **Box 6 2** highlights the problem of waste management in Kampala

The composition of municipal waste for Kampala City is reported to be as follows paper, 5 4%, metal, 3 1%, plastics, 1 6%, glass, 0 9%, wood, 0 7%, vegetable, 73 8%, other, 5 5%, with a per capita rate of 0 8 kg per day The composition of waste for smaller towns is likely to be similar This classification is, in reality, very simplified Municipal waste in Uganda is composed of practically all wastes such as livestock waste types from urban farming and industrial, medical, commercial and domestic waste This makes municipal waste a big source of water and air pollution because there is no sorting of

Box 6 2
Solid waste management and urban farming in Kampala

As the urban population grows the challenge is to sustain the funding for disposal of the solid waste in the city Not meeting this challenge would result in environmental health related problems Presently the solid waste generation rates range between 0 5 and 1 1 kg per capita per day, but an average value of 0 8kg per day is usually accepted Solid waste generation is higher among high-income populations In composition solid waste is mainly organic composed of vegetable matter 73 8% tree cuttings 8%, street debris 5 5%, paper 5 4% and metals 3 1% Others are sawdust 1 7% plastics 1 6% and glass 0 9% With a population of about one million people, Kampala generates about 800 tons of solid waste per day The average density of solid waste is 450 kg/m^3 which results in an average daily volume of 1777 m^3/day

In response to the above the City Council spends US$ 3 4 per capita or US$ 3,400,000 per year to deal with the problem At the current rate of efficiency, this investment would need to double to solve the problem This is because only 850 m^3 of the solid waste is collected, representing 48% of the waste generated The dumping is done at a landfill opened in 1996 at Mpererwe at a cost of US$ 600,000 The Council has 475 skips and a fleet of 20 trucks On average only 12 trucks are opera tional at any one time because of financial problems Each truck makes an average of 7-8 trips a day at a cost of US$ 13 per ton Daily US$ 3900 is spent to collect 300 tons To deal with the whole problem would require recurrent outlay of US$ 10 400 per day

Under the present circumstances the Council is not able to manage solid waste effectively Private sector participation has not been fully explored One firm has specialised in collection of scrap metal for recycling at a cost of US$ 40 60 per ton to the suppliers Other responses employed are burning burying open dumping and very limited recycling Scavengers like Marabou storks are actively participating in waste reduction by feeding on solid waste Even though some members of the public have raised an outcry against the marabou storks because of their filth they are nonetheless indicators of the existence of uncollected waste Despite the enormous amount of organic waste in urban areas, there is poor linkage to the urban farming activity Through out Uganda, urban farming is a very common practice It occupies a significant portion of the urban land area in the form of both indi vidual residential plots and open public land It was started in the hard times of the 1970s and is mainly subsistence Urban farming tends to be an aspect of life of poor urban dwellers who supple-ment their meagre income by producing food on any available land In Kampala alone, it is estimated that 36% of the residents benefit from urban farming and of these as many as 71% are female

The Urban Authorities Act gives the urban authorities power to ban agricultural cultivation within their areas if they so wish, but by the same token, it grants the power to allow urban cultivation if the Councils think there is a good reason for it Unfortunately often it is restricted on grounds that it is inappropriate and unhealthy Yet the possibilities of urban waste recycling are probably one of the greatest potentials of urban farming given that waste disposal is currently one of Kampala City Council s biggest problems Other potentials it offers are those related to food security and utilisation of under-utilised urban resources The Urban Farming Study of Kampala concluded that urban farming is a productive economic activity and an integral part of Uganda s urban culture With change in the past regulations and a clear urbanisation policy urban farming could address both basic needs and environmental problems in Uganda

Source Kampala Urban Farming Study

hazardous from non-hazardous wastes nor is there any kind of waste treatment New regulations are needed to cater for wastes that require treatment before disposal

The composition of municipal waste in Uganda suggests that there are two major options for its dis-

posal These are composting and land-filling with or without gas collection In order to use either of the two disposal options, hazardous wastes must be separated from the compostable components A land-fill for non-hazardous wastes is cheaper to construct than that for hazardous wastes or a mixture of the two

Poor collection of municipal waste has resulted into a practice of households burning solid wastes within towns In order to reduce the volume of uncollected garbage, it is simply set on fire in compounds The burnt garbage contains plastic bags, other plastics including polyvinyl chloride and polystyrene, the emissions of which are very toxic, and other synthetic polymer materials such as rubber products, old synthetic clothes and shoes Since these wastes are burnt in the open instead of in high temperature incinerators, toxic products of incomplete combustion (PIC) are released into the environment in form of ash and gaseous compounds PIC are more toxic than unburned waste and, therefore, the burning of these synthetic materials should be discouraged

Unlike in other countries where old pneumatic tyres are collected for proper disposal, in Uganda they are used during celebrations to make long-lasting fires Tyres are also used in stone quarrying where they are burnt to heat rocks to ease the quarrying It is important to note that like plastics, tyres are not supposed to be burnt in the open or used as firewood substitutes It has also been observed that blood-boilers, in Kampala slaughter houses (abbatoirs), use this type of fuel to prepare blood, which is then used as one of the raw materials in the processing of chicken feeds Apart from polluting the air, the feeds are contaminated by the pollutants from burnt tyres

6 6 4 Household Energy Sources for Cooking and Lighting

The order in ranking of sources of fuel for cooking are firewood, charcoal and electricity, used by 88 1%, 10 1% and 0 9% of the households, respectively Rural and urban variations exist As many as 97% of rural households depend on firewood, in urban areas charcoal is used by 60 7% of households, followed by firewood (29 7%) and electricity (6 3%)

On the other hand, the sources for lighting are paraffin, firewood and electricity used by 83 1%, 10 0% and 5 7%, respectively, Soroti and Kumi districts largely depend on firewood for lighting, 59 7% and 44 3%, respectively

Important observations can be made about household energy sources First, the new and renewable sources of energy are still poorly developed, even those that may have great potential, such as solar energy If well developed, this source could reduce pressure on the forests Second, the traditional three-stone fireplace, the least efficient technology for consuming fuelwood, is common throughout Uganda These fire places also contribute to indoor pollution and consequently contribute to women and childrens' health problems Given that most rural households collect rather than buy their fuelwood, the incentive to use it efficiently is not great Third, despite a good number of urban households using electricity for lighting (33 5%), the low percentage of the same households using it for cooking (6 3%) implies that some households have electricity connected to the houses but do not use it as the main source of energy for cooking Whether the reasons are socio-cultural or economic, there is energy wastage in urban areas Fourth, the lack of a comprehensive energy policy (that incorporates the renewable and traditional energy sectors) and weak institutional coordination are responsible for wasteful energy use, deforestation and health problems

6 7 Education and Literacy

Uganda believes that three major enemies of its citizens are ignorance, disease and poverty By fighting ignorance, it is possible to reduce the incidence of disease and poverty Education is a key factor in determining access to formal employment, household livelihoods, well-being of women, adolescents and children It is also instrumental in influencing adaption and attitudes Seen in this context, a literate and affluent society is important in the quest for sustainable development

The national literacy rate stands at 54% The rate, however, differs between sexes The literacy rates for females and males are 45% and 64%, respectively The urban and rural populations show wide variations in the literacy rates with the urban areas having a rate of 81%, 30 5% more than the rural rate This is due to the greater opportunities available in the urban areas in addition to higher demand for literate people in such areas Literacy rates for Moroto and Kotido districts are the lowest 11 4% and 12%, respectively They are followed by Kisoro (32 9%) and Kitgum (39 3%) Since most literacy is attained through the formal education system, it is imperative to review the indicators in the country's education system

Uganda's formal education is based on seven years of primary school and six years of secondary school Vocational, technical and academic courses are offered through post-primary and secondary institutions The education system is still centrally managed by the Ministry of Education and Sports, although primary education is supported jointly by Local District Administrations Formal and non-formal education are provided jointly by the above Ministry and that of Local Government Non-governmental organisations also contribute substantially to providing education

It is observed in **Figure 6 3** that enrolment rates have increased, after suffering declines in the 1970s Female enrolment has also improved (**Figure 6 3a**) Despite overall improvement in enrolment and growth in the number of schools and teachers, a number of indicators invite serious review of the human development philosophy and policy First, only 58% of 6-12 year olds in Uganda were in school in 1991 School attendance varies among districts The districts lagging furthest behind are Moroto and Kotido with general enrolment rates of 5 9% and 8 5%, respectively Kisoro and Kalangala's rates are also low, at 26 81% and 32 9%, respectively

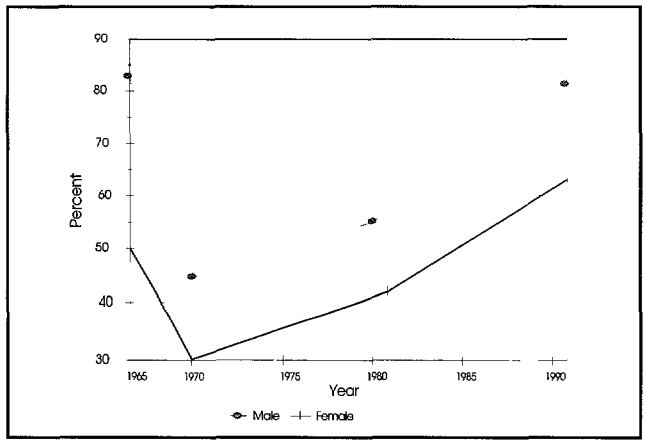
Second, at any level of school education, boys out number girls, at the initial primary enrolment (P1) the ratio of girls to boys is almost the same, but by the end of the cycle (P7) the ratio of boys to girls is 6 4, at Senior 6 it is 7 5 2 5 (**Figure 6.3b**)

Third, smaller proportions of pupils are completing primary school now than 20 years ago Of the children who enroled in P1 in 1975, 90% reached P7, considerably higher than the 30% who started in 1988 and finished in 1994 (**Figure 6 3c**)

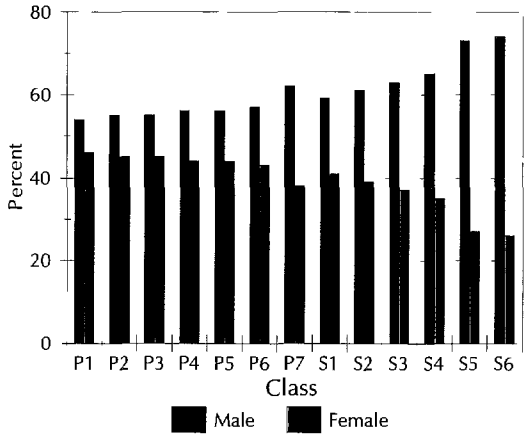
A number of factors account for this state of affairs in the education sector First, the improvement in enrolment is a result of general improvement in the economic situation Female enrolment is lower because girls are not first priority in households which are poor Their higher drop-out rates are also due to adolescent pregnancies Costs of education have been an inhibiting factor Between 1989 and 1990 and 1992 and 1993, the share of GDP spent on primary education increased from 0 4% to about 2% The proportion of the recurrent national budget spent on primary education has increased from 7 2% in 1990-1991 to 11 5% in 1992-1993 Despite these improvements, the greatest part of the economic burden for secondary education still falls on parents and students An estimated 76% of primary

Figure 6 3 Enrolment in primary and secondary schools by gender

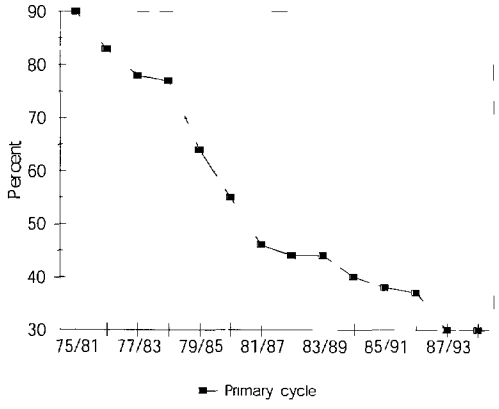
(a) School enrolement by gender



(b) Enrolment in primary and secondary school by class and gender



(c) Trends of primary one enrollees reaching primary seven (1975-1981 to 1988-1994)



Source GOU/UNCC (1994) Equity and Vulnerability A situation analysis of women adolescents and children in Uganda

education costs and 56% of secondary school costs have been met by students and their families Starting with 1997, however, the government has pledged to meet the costs of education of four children per household under the universal primary education (UPE) scheme This will include provision of text books, school infrastructure and teachers salaries This will constitute about 80% of the total cost of primary education per child

Over the last five years, the government has also taken some responsive measures to improve the education system in the country One aim is to increase vocational training Pre-vocational preparatory courses are to be taught in upper primary school and technical vocational courses in secondary school The cost of education to families is going to be reduced with introduction of free education for four children per household Adequate facilities for girls are to be provided in coeducational post-primary institutions to balance enrolment

6 7 1 Enrolment Characteristics

With respect to primary education, there has been a rapid increase between 1970 and 1995 In 1970, there were only 2755 primary schools Since then, there has been an increase of 300% Enrolment-wise, the number of pupils in 1970 was 719,000, in 1980 it was 1,302,377, in 1990 it was 2 4 million students Today, it is estimated to be around 2 6 million The number of teachers similarly went up from 21,471 in 1970, to 38,422 in 1980, 86,394 in 1990 and 86,821 in 1992 Of these, 49% were untrained The primary teacher/student ratio today is 1 to 35 Urban primary schools, however, are generally crowded while many rural ones are nearly empty As shown in **Figure 6 3(a)**, female enrolment in primary schools has equally improved over the years, from 30% in 1970, to 43% in 1980, and currently, 70%

6 7 2 The School System

The colonial structure of education consisted of a 7-4-2-3 system, meaning 7 years for primary education, 4 years for secondary, 2 years for advanced level and at least three years for university Following the passing of the White Paper on education, the new structure will have a single track of 8-3-2-3 combination The 8-year primary education is to have lower and upper primary stages The former is to consist of 4 years with the mother-tongue (language) as the medium of instruction The latter primary stage, that is, primary five to primary eight, will have English as the medium of instruction An important innovation to be initiated in upper primary grades is the progressive introduction of practical subjects under the vocationalisation of education

Post-secondary education in Uganda is perhaps the least developed compared to neighbouring countries Candidates who qualify to enter higher education range between 9000 and 12,000 per year, but only about one-quarter of these are absorbed The rest are left to fend for themselves Makerere University is Uganda's oldest and best known institution of higher learning, accounting for 95% of total university enrolment The remaining 5% is shared between six other small universities at Mbarara, Nkozi, Ndejje, Nkumba, Mbale and Bugema Besides universities, other institutions of higher learning also exist Among these are four technical colleges, one polytechnic, ten teachers' colleges, one college of business studies, five colleges of commerce and one institute of teacher education These are small institutions, each admitting not more than 200 students per year

6 8 Environmental Health

The environment has a great influence on the well-being of people and their health Although it is known that genetic factors are responsible for congenital diseases and environmental factors responsible for acquired ones, the two factors interplay Humans are largely responsible for the quality of the environment that surrounds them Such activities include water supply and its maintenance, provision of dwelling units, infrastructural services and utilities, food production and distribution industrial development, pollution and waste management, and many others Depending on the attention given to these activities, there will be variations in air, water and food quality, these factors will eventually come to bear on an individual's health and welfare In the absence of proper attention, both the individual and society in general are forced to spend highly on curative instead of preventive measures

The SOER, 1994, listed seven basic principles for promoting good health safe environment, enhanced immunity, good nutrition and sensible behaviour, care for children prudent health care and institutional support They are repeated here in **Box 6 3** for emphasis because individuals, communities and society as a whole have not invested in them sufficiently to reap their economic benefits It must, however, be stressed that it is not merely the absence of disease or infirmity that should concern the country Uganda should also be interested in seeing a state of complete physical, mental and social well-being, keeping equilibrium between humans and the physical, biological and social environment It is in this framework that the key health indicators of Uganda are reviewed

6 8 1 Life Expectancy

Life expectancy is a measure of the average length of life expected at birth given the current rates of mortality It is one of the key indicators of health Ordinarily it increases as a country develops According to the latest estimates by World Health Organisation, between 1980 and 1993, overall global life expectancy increased from 61 to about 65 years Unfortunately for Uganda, it has declined because of AIDS and could drop to 40 7 years by the year 2000 Life expectancy at birth is strongly influenced by mortality among the youngest members of the population

The infant mortality rate (IMR) has dropped to 97 per 1000 live births in 1995, from 120 just four years ago Although this trend is encouraging, it is still high compared to the rate in neighbouring Kenya which is 67 per 1000 live births Major factors contributing to infant death are mostly preventable They include malaria, acute respiratory infections (ARI) and diarrhoea The underlying causes are extreme household poverty and food insecurity, low literacy especially for women, public insecurity, and low access to health care

The 1989 UDHS described some of the risk factors associated with infant mortality First is the risk linked to births that are too frequent Children born less than two years after another sibling have more than twice the risk of dying in infancy than those born four or more years after a prior birth In other words, shorter birth intervals mean greater risk for early death among infants Second is the risk associated with adolescent mothers (less than 20 years old) and older mothers (more than 40 years) Their children are more likely to die in infancy Third is the risk associated with low maternal education

The positive trend observed is nonetheless, commendable and is attributed to a combination of factors, notably improvement in economic conditions and incomes, improvement in housing conditions and food supplies, improved access to safe water and sanitation, and increased use of family planning

Box 6 3
Principles for promoting good health

Safe Environment	Control physical, chemical and biological hazards
Enhanced Immunity	Immunise to protect individuals and communities
Sensible Behaviour	Encourage healthy habits, discourage harmful habits
Good Nutrition	Well-balanced diet, neither too much nor too little to eat
Well-born Children	Every child a wanted child, every mother fit and healthy
Prudent Health Care	Continuous scepticism is better than uncritical enthusiasm
Institutional Support	Good policies and institutions to support healthy delivery systems

Source *Adopted from Last M J (1987) Public Health and Human Ecology*

There are, however, variations by district By national standards, infant mortality rate (IMR) is particularly high in Gulu (172), Kitgum (165), Bundibugyo (150), Moroto (147), and Kotido and Mbarara (each with 145)

6 8 2 Major Causes of Diseases and Death

The SOER, 1994, gave details about trends in infant, child and under-five mortality rates since the 1970s It also gave the structural shifts among the top ten causes of in-patient mortality over the last 15 years Since then, few changes have taken place Malaria continues to be responsible for the largest number of under-five in-patient deaths (21 4%), followed by measles (9 9%), diarrhoea (8 2%), pneumonia (7 5%), and AIDS (5 1%) Other causes account for 47 9% of deaths

Malaria

Malaria is one of the most serious public health and environmental problems in the developing world It is endemic in 102 countries, Uganda inclusive It is the overall leading cause of death for the country, responsible for 17 9% of all deaths in health units Up to 30% of all deaths among the two to four year-old age group in health units are caused by malaria[17] Among Ugandans, both health care providers and consumers, malaria tends to be over-diagnosed, any fever is usually, treated as malaria, and self-medication is common Clinical and consumer over-diagnosis of malaria leads to wastage of drugs and poor quality of care

Guinea worm

Guinea worm affects up to 20% of the population in north and north-eastern Uganda It is responsible for a disease called *Dracunculiasis* It is mainly caused by lack of readily available safe water for drinking In certain places where boreholes have been sunk to provide safe drinking water, the water is salty and unpleasant to drink In high guinea worm areas like Kitgum, the majority of the population (93 4%) use unsafe sources for drinking water, only 1 person in 16 drinks borehole water[18] It is gratifying to note that Uganda moved from being the second worst guinea worm-affected country in the world in 1992 (with 126,400 cases) to the sixth at the end of 1995 (with only 4810 cases)[19]

(Figure 6 4) If the current effort to control guinea worm is maintained, it will be eradicated in the near future

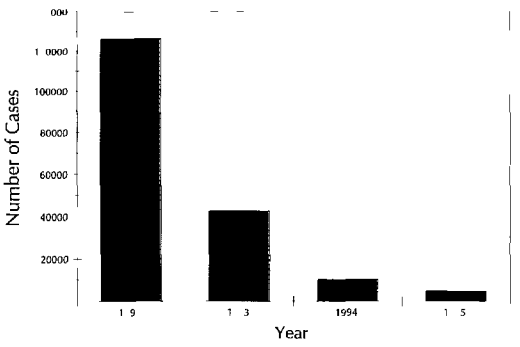
Diarrhoea

Diarrhea is one of the leading causes of infant deaths In studies asking mothers to recall episodes of diarrhoea among their children within the previous two weeks, 8 to 20% said that diarrhoea had been experienced in their families The situation is worse for under-two-year-olds A combination of factors explains the high incidence of diarrhoea Children aged 7 to 12 months experience very high levels of diarrhoea, as they learn to walk, they put many things into their mouths[20] Furthermore, diarrhoea and vomiting are disproportionately common in rural villages, possibly related to lower access to safe water and sanitation[21] Homes where the number of children under the age of five is high have been closely associated with high incidence of diarrhoea Above all, the level of literacy of the mothers and thus the ability to know the causes and management of diarrhoea is a key determinant of the occurrence of the disease and its severity [22] There have been several recommendations and programmes to bring down the rates of diarrhoea, including handwashing practices, availability of storage for drinking water and oral rehydration salts (ORS) advocation programmes

Acute Respiratory Infection (ARI)

ARI is the second leading cause of infant visits to health units and the third commonest cause of infant deaths responsible for approximately 8 2%[23] Main causes of ARI include poor ventilation and over-crowding, smoke and substances which cause allergies Symptoms include chronic cough, lethargy, rapid breathing and fever Awareness of ARI among mothers is not adequate, and this could be one of the main factors that promotes the disease Control of ARI would include improved housing and ventilation, increased awareness,and improved access to health units

Figure 6 4 Cases of guinea worm in Uganda 1992 - 1995



Source *UNICEF Guinea worm Eradication Programme Report*

6 8 3 Food Security, Nutrition and Health

Food security can be basically defined as the access by all the people in a given location to adequate food, both in quantity and quality at all times[24] Food security is analysed both at the household and national levels Food security has a bearing on human health although, in addition to availability, there must be quality too Even though some households are able to produce enough food for themselves and

for others, food availability can be met through purchases from elsewhere Supportive infrastructure such as storage, road network, marketing distribution systems and information can affect food availability Sometimes, however, food accessibility, even when food it is available, is made difficult because of lack of purchasing power Parts of the country are experiencing problems in accessing adequate food These include parts of north-eastern, northern, western and central Uganda The main causes of the poor food accessibility include poor social and economic infrastructure, low income levels and poor farm and district storage facilities Presently, pursuance of implementation of the food security policy and strategy in Uganda is still inadequate Under these circumstances, it is costly to deal with emergencies, such as occured in 1992-1993 when 16 districts in northern and north-eastern Uganda were hit by famine

According to the UNDP Human Development Reports of 1993 and 1995, the minimum per capita daily intake requirement for sub-Saharan Africa is 2419 calories According to WHO, even for those carrying out only light physical activity, the "critical" minimum intake should not be less than 2200 calories per person per day As for protein and fat, the FAO recommended minimum daily intake levels are 57 6g and 20 3g respectively[25]

Based on the present consumption pattern, the daily average intake on calories is about 2400, for protein and fat, it is 50g and 19g, respectively [26] As a result, the national calorie intake is 99% of the sub-Saharan African minimum requirements Compared to the WHO "critical" level, the national average calorie intake per person per day is about 109% In the case of protein and fat, the national average intake levels are 87% and 94% of the FAO minimum intake levels This clearly shows that the national average calorie intake is about equal to the SSA and higher than WHO "critical" minimum levels As for protein and fat, national intake levels are below the minimum recommended by FAO

There are, however, regional variations in nutritional intake These are given in **Table 6 9** In brief, failure to attain adequate food nutrient intake results in malnutrition and ill health in children, thereby reducing the ability of the population to develop optimally This directly affects the country's productivity and well-being

6 8 4 Malnutrition

Malnutrition is the most pervasive cause of ill health and a major contributor to the high death rate among infants and young children About 2% of the deaths in children under-five years of age are due to nutritionally-related causes The most common malnutrition diseases among the under-fives in Uganda are kwashiorkor, marasmus, stunted growth and under-weight According to the UGHS 1988-1989, 45% of children suffered from stunting Stunted growth reflects chronic under-nutrition, wasting reflects acute under-nutrition, under-weight reflects either chronic or acute under-nutrition Among sub-Saharan African countries sampled by the DHS, the level of stunting in Uganda's children is second only to Burundi[27] Almost twice as many children in rural areas are stunted (46 3%) as children in urban areas (25 3%)

The most disturbing aspect is that infant and child illness and malnutrition have a mutual cause and effect relationship A study in Mbarara district found that malnourished children have a significantly higher risk of death from malaria, diarrhoea and ARI Conversely, childhood infections like ARI, diarrhoea and measles predispose children to malnutrition due to malabsorption as well as loss of appetite and hence decreased food intake Intestinal worm infestation, which is common among Ugandan children, also affects the nutritional status of children

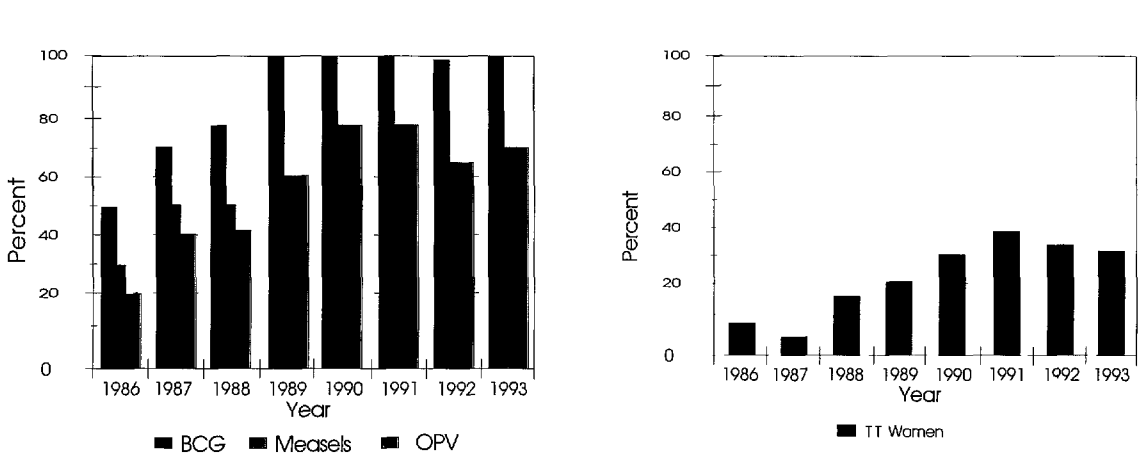
Generally, Ugandan children get a good nutritional start with almost universal breast-feeding at birth Soon after this, however, up to half of the children begin to show stunting, their growth in height is too slow for their age Multiple factors contribute to the stunting problem Food quantities are limited by poor household food security, inequitable household and cultural feeding practices, and the need for cash income in the homes Conflicting maternal responsibilities and negative food beliefs determine the quality of food within the household Intestinal parasites and other infant and child diseases affect the ability of children's bodies to use the food they eat All these determinants contribute to under-nutrition in infants, toddlers and children of school-going age

6 8 5 Immunisation

Most of the killer diseases of Ugandan children are preventable The Ministry of Health has, through the UNEPI (Uganda National Expanded Programme for Immunisation), immunised against the main diseases, namely tuberculosis, polio, measles, whooping cough, tetanus and diphtheria By the trends shown in **Figure 6 5**, Uganda has shown a lot of improvement It must, however, be cautioned that this coverage relates only to the hospitals from which statistics are consistently collected

There are some districts which are still lagging behind in responding to immunisation programmes and for which additional effort seems necessary The districts are shown **in Table 6 10** under each of the immunisable diseases together with the degree of coverage

Figure 6 5 (a) & (b) Reported immunisation coverage in Uganda for infants and women, 1986 -1993



Source *Ministry of Health/UNEPI 1994*

6 9 Transport and Communication Systems

6 9 1 The Interface between Transport and the Environment

The growth of transport is important for the development of the economy because it facilitates trade, tourism, mobility and cultural exchange While this is the case two important aspects need to be monitored first, the supply of and demand for transport services including the infrastructure, and second, the structural changes within the modes and types of transport and the implications they have for energy consumption, air and noise pollution, traffic accidents and jams economic productivity and social inequities that arise when the poor find transportation services increasingly unaffordable

Table 6 9 Average daily per capita nutritional intake by region 1995

Durable goods	Residence		
	Urban %	Rural %	Total %
Radio	67 2	32 8	37 5
Television	17 3	0 6	2 9
Telephone	2 4	0 1	0 4
Refrigerator	4 8	0 1	0 7
Bicycle	24 5	35 7	34 2
Motorcycle	1 7	0 6	0 7
Private Car	5 4	0 7	1 3
Non of the above	26 8	51	47 7

Source EPAU Food Security Framework 1995 Regional Food Requirements UNDP Human Development Report 1993 FAO Handbook on Human Nutritional Requirements 1994

Table 6 10 Districts with low immunisation coverage, 1994 *

TT (Women)	OPV (Children)	Measles (Children)	BCG (Children)
Uganda 59%			
1 Moroto, 31%	1 Kitgum, 28%	1 Kitgum, 35%	1 Kitgum, 53%
2 Apac, 37%	2 Apac, 32%	2 Apac, 41%	2 Moroto, 61%
3 Kabale, 38%	3 Kamuli, 42%	3 Pallisa 41%	3 Apac, 63%
4 Kisoro, 38%	4 Lira, 42%	4 Iganga, 42%	4 Mpigi, 66%
5 Kitgum, 40%	5 Iganga, 43%	5 Moroto, 42%	5 Iganga, 68%

* - Covers only 9 months, January - September 1994

Source Ministry of Health/UNEPI 1994

6 9 2 Modes of Transport

The modes of transport are road rail, air and water Of these, it is the road that is used by the majority of people Uganda has a total road network of 25,632km grouped in three classes (**Table 6 11**) All weather roads (tarmac) take up only 2276km or 8 9%, all weather roads (murram and gravel) take up 10,635km or 41 5%, while dry weather roads (dirt roads) cover 12,721 km or 49 6%[30], (**Figure 6 6**)

The Central region is better served by all classes of roads, making it a leader in trade and commerce The fact that almost 50% of the road network is made up of dry weather (dirt) roads, implies that during wet seasons some areas are inaccessible This results in a corresponding social and economic loss to the nation since this cuts off transport of goods and produce to and from rural areas, as well as denying people access to social services Recent steps to decentralise the maintenance of rural feeder roads has eased some of the transport problems due to the increased capital input into the exercise

The railway system is now mainly used for transportation of cargo Passenger traffic has fallen since 1987 and now accounts for a small percentage of the earnings by Uganda Railways Corporation Although the goods traffic has more than tripled since 1987, the railway line is increasingly becoming expensive to maintain

Lake Victoria, as a waterway, supports trade between Kenya, Tanzania and Uganda This mode of transport will gain more significance as more of the imports are channelled through Dar-es-Salaam The water hyacinth, however, is posing a big threat to this mode of transport Although Uganda has witnessed a rise in international airlines, only Entebbe Airport has been rehabilitated while the up-country airstrips are still in need of improvement Increased air traffic has been accompanied by a rise in noise levels A preliminary environmental impact assessment (EIA) of standards for noise at the airport has indicated that in some locations noise pollution is very high, particularly for the workers

6 9 3 Vehicle Stocks and Environmental Issues

Since the release of the SOER, 1994, the country has witnessed a drastic increase in the stock of vehicles and a continued structural shift in the composition of the vehicle stock In 1992, the stock of all categories of vehicles was 53,045 In 1995, this figure had shot up to 96,212 an increase of 81 4% in only three years This increase is accompanied by a number of important observations and characteristics

First, by 1991 the total stock of vehicles in Uganda had already exceeded the peak of 45,262 that had been attained in 1972 The consistent decline in vehicle numbers from the 1970s to mid-1980s reflects the then economic decline, breakdown in law and order and loss of respect for people's property The upward trend after 1986 is a result of government's commitment to both economic recovery and rule of law The current trend of vehicle growth has many implications for energy planning policy, infrastructure development, parking, particularly in urban areas and regulatory frameworks The trend is illustrated in **Figure 6 7**

The second observation is that there is a continued structural shift in the composition of vehicles, which began in the 1980s Pick-ups have increased much faster than heavy commercial vehicles,

Figure 6 6 Road network (map)

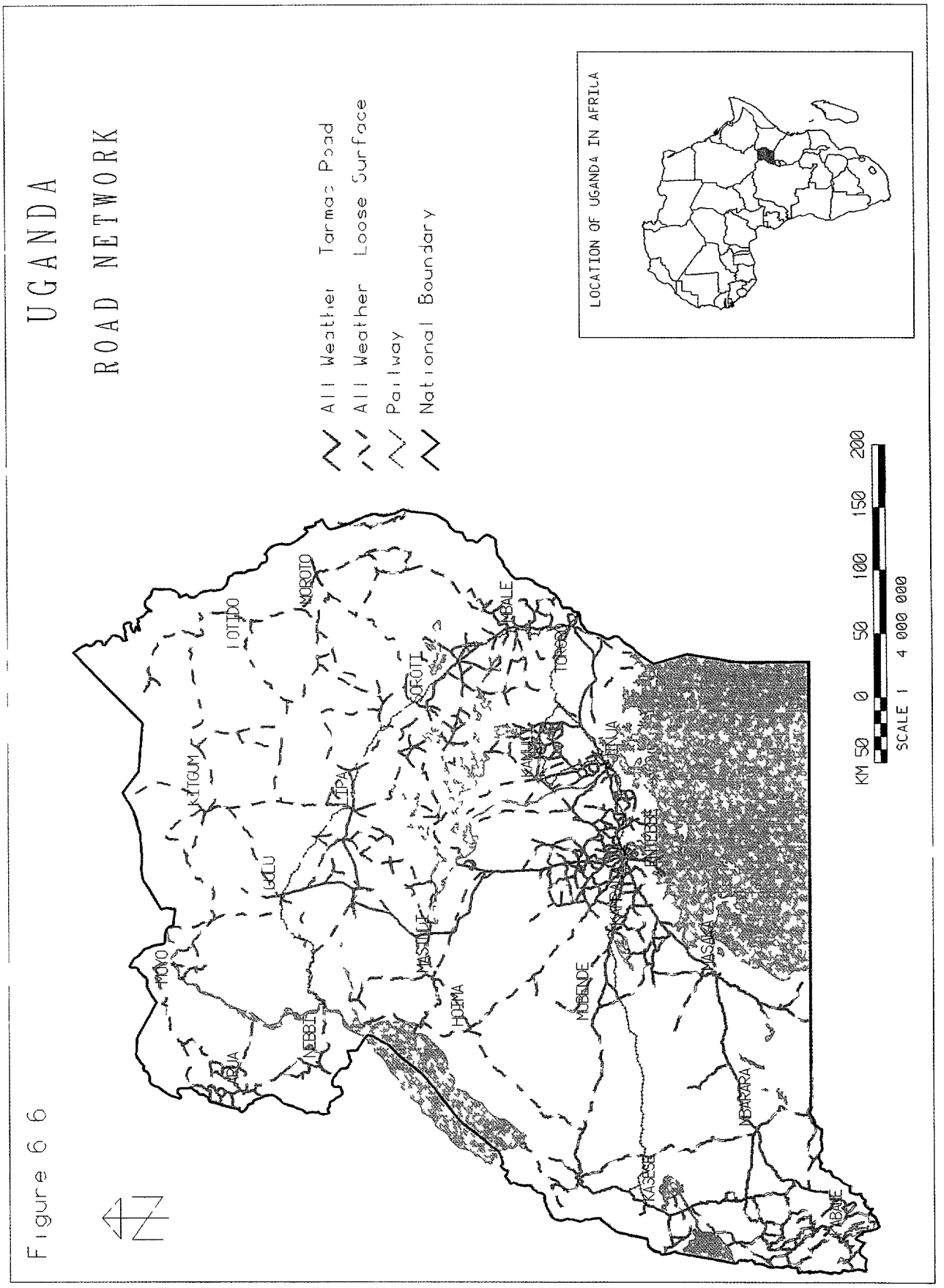


Table 6 11 Main road and railway network by region, 1996

	All weather (Tarmac) km	All weather (murram gavel) km	Dry weather (dirt road) km	Road Total km	Railway line km
Central	1009	2404	4136	7549	293
Eastern	565	2337	2288	5190	535
Northern	93	3700	3201	6994	258
Western	609	2194	3096	5899	142
Total	**2276**	**10635**	**12721**	**25632**	**1228**

Source *MFEP (1996) Statistical Abstract, 1996*

while mini-buses have greatly substituted buses Overall there has been a shift from large-sized commercial vehicles to smaller ones

Third, there has been a sudden increase in motorcycles This is mainly explained by the growing intermediate transport, informally known as "boda-boda" in many parts of Uganda This form of transport is attractive in areas where the roads are still too poorly developed for use by vehicles It is also attractive to customers who cannot afford more expensive means

Concomitant with the growth in vehicle numbers is the increase in road accidents These doubled between 1990 and 1995, from 5674 to 11,640 [31] Kampala alone accounts for the highest proportion of all road accidents in the country

Furthermore, although the drastic increase in the vehicle stocks reflects the economic growth in the country it has not yet been matched by a corresponding increase in the number and quality of roads The government has been preoccupied with rehabilitating the old road network rather than with opening up completely new roads The problem is more acute in Kampala and its surroundings where most vehicles are concentrated Traffic jams lasting 20 to 30 minutes during the peak hours are common, particularly around the junctions and city outskirts

In wet seasons, the flooding of some road junctions exacerbates the problem of traffic jams Much of Kampala lies in what used to be a swamp It was at one time an arm of Lake Victoria The unplanned use and conversion of the wetlands, coupled with clearing of the vegetation by developers, have increased the run-off This is proving to be costly Kampala City Council plans to spend US$ 5 million to widen Nakivubo channel to overcome current problems of flooding and traffic jams during wet seasons Jams cause the loss of time that could be put to productive economic activities and urgently need a solution

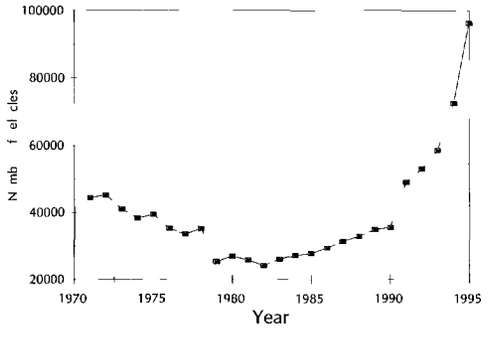
More than anything else, the stock of vehicles in Kampala is challenging the city authorities to come up with innovative and perhaps economic approaches to dealing with parking Public transport needs improvement With growth in both the population and bicycles, the city needs to be made more friendly to non-motorised vehicles and pedestrians

Institutionally, the government has divested itself from the Uganda Transport Company It still owns Uganda Airlines Corporation and Uganda Railways Corporation Currently, parking is free of charge

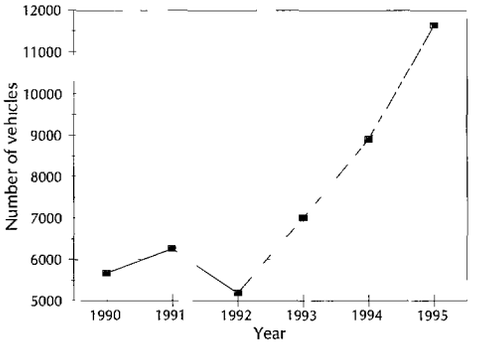
along the city's roads Plans are under way to privatise parking within the city The Road Safety Act, 1970, is weak compared to the emerging problems of accidents and congestion The growing intermediate (*boda-boda*) transport needs to be brought under a regulatory framework

Figure 6 7 Trends in stocks of vehicles, 1971-1995

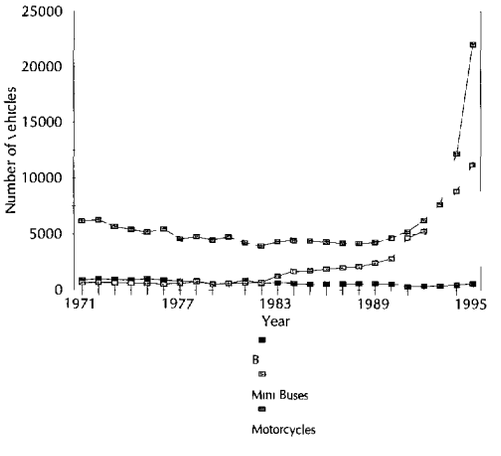
(A) Number of vehicles 1971-1995



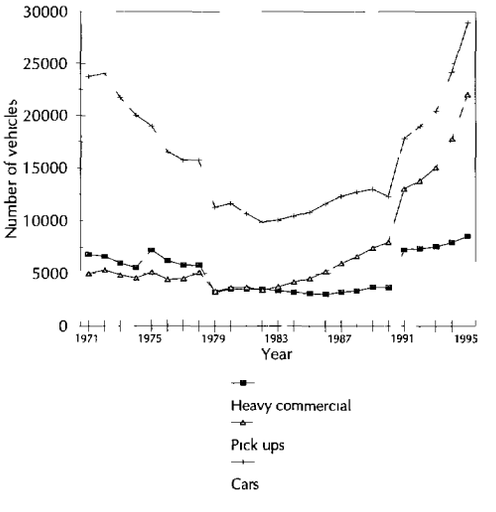
(B) Road accidents 1990-1995



(C) Structural shift and trend between buses mini-buses & motorcycles



(D) Structural shift & trend between pickups and heavy commercial vehicles 1971-1995



Source *MFEP* *Statistical Abstract 1996*

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CHAPTER SEVEN

7 0 TRADE, TOURISM, INDUSTRY AND MINING

7 1 Trade

7 1 1 Introduction

In an endeavour to improve the income of its citizens, its trading and balance of payments and to reduce dependency on aid, government has pursued policies aimed at stimulating regional and international trade Agenda 21 recognises that the development process will not gather momentum if the global economy lacks dynamism and stability and is beset with uncertainties Neither will it gather momentum if developing countries are weighed down by external indebtedness, if barriers restrict access to markets, and if commodity prices and terms of trade remain depressed as they were in the 1980s It is for this reason that Agenda 21 advocates a dynamic international economy and an open, equitable, secure, non-discriminatory and predictable multilateral trading system[1]

As more policies are put in place, one has to keep in mind that there is a considerable increase in interest in the linkage between trade and the environment How do changing trade regimes affect the environment? And how do stricter environmental regulations as well as an increase in environmental awareness affect trade? Some environmental regulations have come by way of treaties to which Uganda is signatory, including the Convention on Trade in Endangered Species (CITES), the Montreal Protocol on the Phase Out of Ozone Depleting Substances and the Convention on the Trans-boundary Movement of Hazardous Wastes It is against this background of developmental goals and environmental issues that the state of trade in Uganda is reviewed

7 1 2 Composition and Value of Traditional Cash Crop Exports

Exports are important because they help economies to earn foreign exchange to improve their balance of payments and finance imports Whether exports help a country to achieve these objectives depends on a number of factors, including the volume of exports, the unit and total values, the mix of exports and the relationship between the value of exports and imports, and the environmental consequences of producing goods for export

Until recently, the traditional cash crops of coffee, cotton, tea and tobacco dominated the exports Minerals of substantive value like copper ceased being exported in late 1970s Trends in the volume and value of exports from 1970 to 1995 are revealing First, the volume of Uganda's major export, coffee has remained relatively stable over the years and considerably more than that of cotton, tea or tobacco But the value shows great variations due to world price fluctuations Coffee seems to boom on a ten year cycle In 1997 as much as US$ 567 million was realised from coffee, in 1986 and 1995 coffee earned Uganda US$ 394 million and US$ 384 million, respectively The early 1990s, on the other hand, saw low earnings In 1992 coffee brought in a mere US$ 95 million and in 1993 only US$ 106 million These trends are shown in **Figure 7 1**

Second, both in quantity and value, cotton ranked second after coffee up to late 1970s The drastic fall both in volume and value since then is also shown in **Figure 7 1** Currently, the crop is attracting a new level of government and donor support Government's monopoly of trade through the Lint Marketing Board has been broken with liberalisation of cotton exports However, there is still a long way to go to

attain the 1970s' export volumes and value Like cotton, tea has not fully recovered to its 1970s' performance but it is improving faster than cotton Only tobacco has fared more impressively in the recent past than ever before

Third, the benefits derived from these fast-growing industries are not enough to compensate for the low earnings still being obtained in the tea and cotton sub-sectors The recovery of the traditional cash crops above must therefore be analysed in the context of changed farmer preferences, export diversification and incentives to the agricultural sector in general

7 1 3 Diversification of the Export Base

Coffee accounted for up to 96% of exports in the 1980s This was a time when the coffee prices were generally showing a downward trend and did not augur well for the government that inherited one of the poorest economies in the world Consequently, government after 1986 encouraged the diversification of exports into the non-traditional agricultural exports (NTAEs) These were mainly maize, beans and simsim, horticultural crops are also becoming popular Results have started to show First, the NTAEs fetched the country US$ 150 million in 1995, thereby improving the position of total export earnings[2] This has, accordingly, reduced coffee's dominance of foreign exchange earnings to 68% in 1995 Second, the current earnings from NTAEs far exceed those of the other traditional cash crops (cotton, tea and tobacco) combined as shown by **Figure 7 2** Finally, the opportunities for individual peasant farmers who grow NTAEs are widened, leading to improved income earning

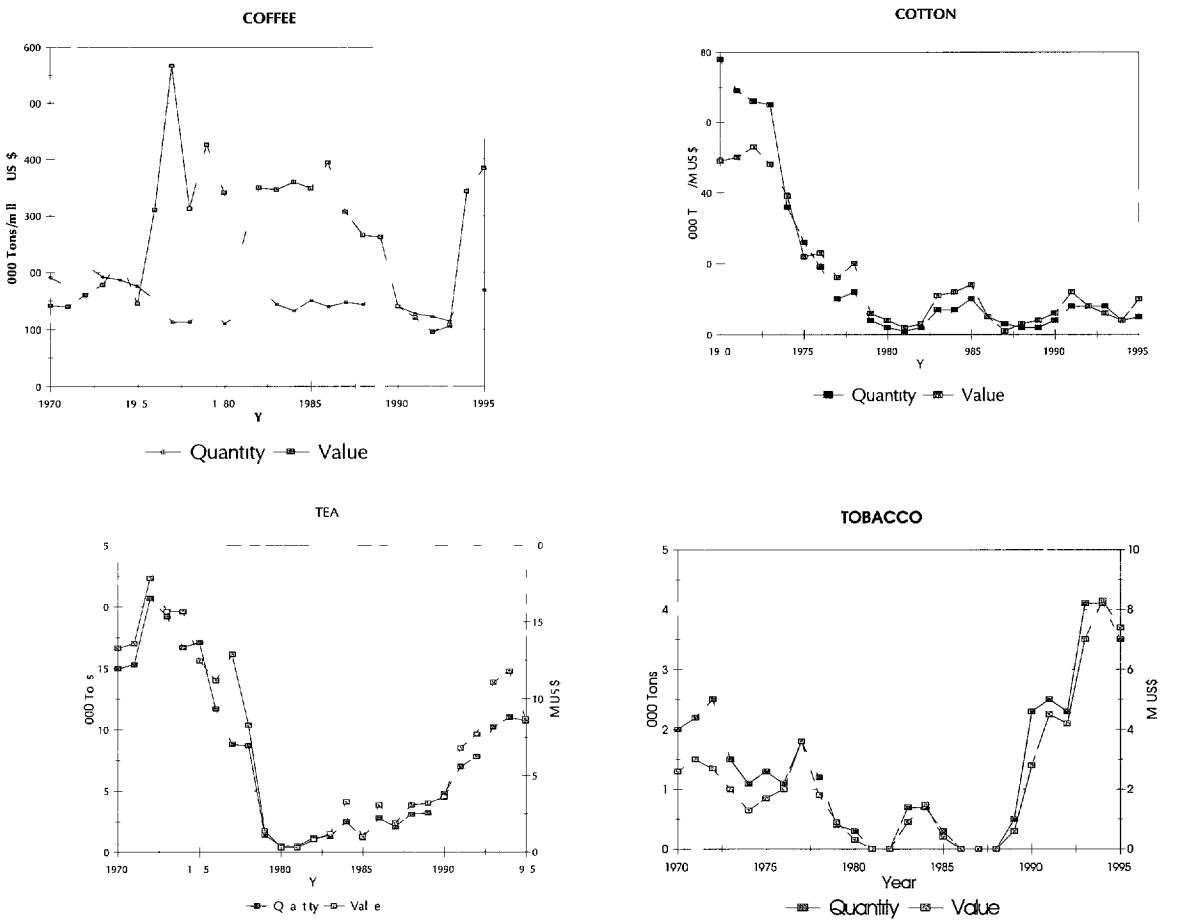
While the above diversification into NTAEs is financially and economically rewarding, these benefit must be off-set by environmental costs associated with them More than 100 different types of chemicals, many of them very toxic are used to address problems ranging from soil fertility to control of the numerous pests and diseases that attack flowers (NEIC/NTAE Report, 1995) The negative impacts of these chemicals on the soil, leakages into the water bodies, and accidental exposure of workers to the chemicals need to be carefully addressed

7 1 4 Other Exports

Exports of minerals (mainly copper), which used to account for 30% of foreign earnings, ceased by 1978 due to a halt in production Steps are being taken to revitalise production Other mineral exports were gold, tin, wolfram, bismuth, tantalum, beryl, columbite and phosphates In 1970, the mining sector accounted for 8 5% of Uganda's domestic exports, with the country accounting for up to 20% of the world production of beryl The value of mineral exports is now picking up with an increase of 237% in 1995-1996 due to liberalisation of the economy Currently the biggest contributor is gold It is also hoped that cobalt exports will account for 5% of the world's total output once production starts at Kasese

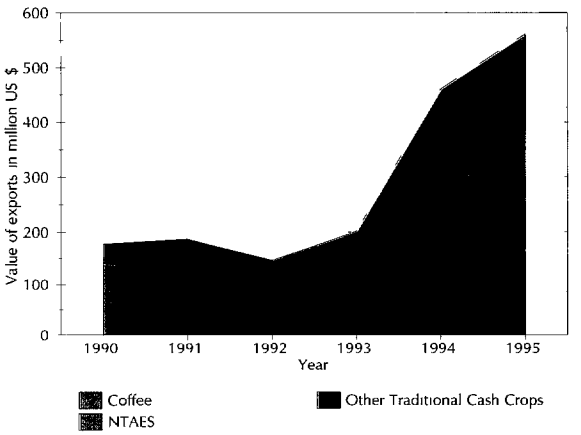
Of particular significance is the growth in exports of fish products, mostly from Lake Victoria and to a lesser extent Lake Kyoga Since the government is yet to establish the maximum sustainable yield (MSY) of the lakes, it has taken precautionary measures and allowed only a maximum of 60,000 tonnes a year for export The exports have risen from a mere 1664 tonnes in 1990, to 6138 tonnes in 1993, to 9279 in 1995 Likewise the value from exports has risen from US$ 1 366 million in 1990 to US$ 17 5 million in 1995, accounting for 3 2% of total exports Two important issues need to be ascertained if fish exports are to remain environmentally acceptable The first one is the maximum sustainable yield, especially of Lake Victoria, and the other is the mitigation of chemical use in the control of water hyacinth The trend in volume and value of fish exports is given in **Figure 7 3**

Figure 7 1 Trends in volume and value of traditional cash crop exports, 1970 to 1995



Source Background to the Budget (several years)

Figure 7 2 Composition and value of agricultural exports, 1995



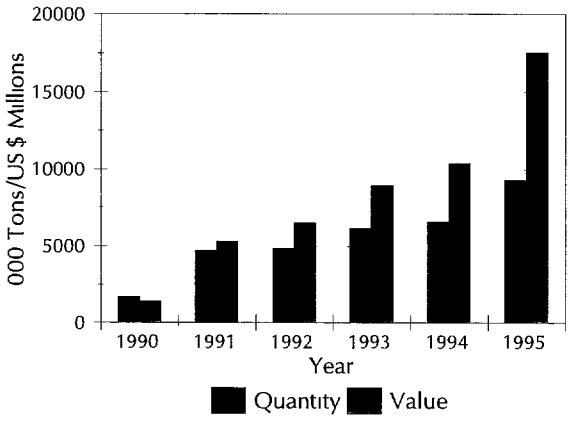
NTAEs Non-Traditional Agricultural Exports

Source MFEP (1996) Statistical Abstract 1996

7 1 5 Measures to Improve Trade

As part of the economy-wide policies embraced by government since 1987, measures have been put in place to generally stimulate exports and trade The foreign exchange regime was subjected to a series of devaluations so as to enable Uganda's exporters to compete on level terms in international markets The monopoly of marketing boards like the Coffee and Lint Marketing Boards and the Uganda Tea Authority were scrapped through liberalisation Dealing in foreign exchange was also liberalised in 1990, and infrastructural improvement has facilitated internal movement of produce With growing trade opportunities, the number of international airlines to Uganda has contributed to the country's revenue A uniform tariff system is also being fully explored by the Preferential Trade Area (PTA) countries

Figure 7 3 Exports of fish products, 1990 - 1995



Source *MFEP Statistical Abstract 1996*

7 1 6 Destination of Exports

An understanding of the destination of Uganda's exports is important in relation to packaging the products according to the preferences of consumers One factor now gaining significance is environmental awareness Uganda will need to continue monitoring this preference for environmentally-sound products by consumers and prescribe measures to help exporters maintain their competitiveness

The European Union is the dominant market for exports accounting for an average of 63% of the market share in 1992 The Preferential Trade Area (PTA), which in 1982 accounted for only 0 5% of the market share, has greatly improved since 1990 The PTA is now transformed into a common market known as the Common Market for Eastern and Southern Africa (COMESA) and ranked second after European Union, accounting for 13% of exports in 1992 This share is expected to be higher in 1996 North America, which was the second most important destination in 1982 with 34%, currently takes only 9 1% of Uganda's exports There is no doubt that with continued commitment to regional trade by governments within East Africa and COMESA regions, Uganda's exports to these markets will continue to grow Presently, the PTA region takes over 50% of Uganda's NTAEs, followed by Europe and the Middle East

7 1 7 Imports

Historically, Uganda's imports have been dominated by petroleum and chemicals which accounted for 71% of the total Non-oil imports grew by 4 6% in 1995-1996 while government imports grew by 14 3% in the same period As a percentage of GDP, total imports of goods and services were 28 3% of GDP in 1995-1996 as compared to 26 4% of GDP in 1994-1995 Generally, the demand for imports escalated from 1987 when government launched the reconstruction and development of the economy Of the total imports, 44% is taken up by consumer goods, 32% by capital goods and 24% by raw materials Since the economy started to recover, there has been a marked drop in imports of some commodities, particularly sugar, soap and cement, these are now produced locally

The pattern of Uganda's imports is characterised by a diversity of supplies A regional analysis reveals that the European Union, COMESA and Asia, respectively, have been the three most important sources of Uganda's imports since 1981 The share of imports from the EEC declined from 37% to 28% during the same period, while the share of imports from COMESA rose from 16% to 27%, probably due to the removal of import restrictions in the region

On a country basis, Kenya has long been a major source of Uganda's imports accounting for 37% of total imports in 1981 and 19% in 1988 Kenya's share of imports, however, has been declining it dropped to 3% in 1992 and is being taken over by other countries like the UK (10%), Japan (10%) and USA (5%) during the 1992 period

7 1 8 Trade Balance and Terms of Trade

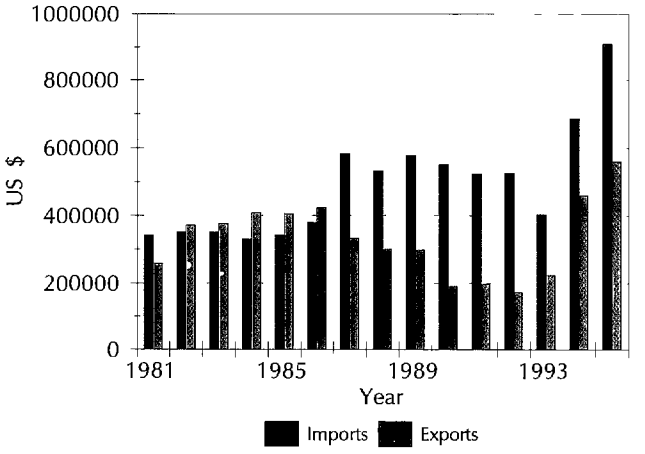
Trade balance is the difference between the value of imports and exports A positive trade balance indicates that the value of exports exceeds the value of imports This is the ideal Unfortunately, as shown in **Chapter 2**, the trade balance for Uganda has been negative since 1987 The value of imports has far surpassed that of exports (**Figure 7 4**) This has far reaching consequences for overall financing of the economy Trade balance is part of the current account in the balance of payments, the other account being the capital account With a negative trade balance, the overall balance of payments is reduced, sometimes itself becoming negative Under such circumstances, the economy is financed by external sources For Uganda's trade to contribute to economic stability, efforts will have to continue to be made to achieve a positive trade balance

The terms of trade and the net barter terms of trade measure the relative movement of export prices against that of import prices Calculated as the ratio of a country's index of average export prices to its average import price index, this indicator shows changes over a base year in the level of export prices as a percentage of import prices Ideally, the terms of trade should be above the base year index of 100, which would indicate higher export unit prices in comparison with those of imports

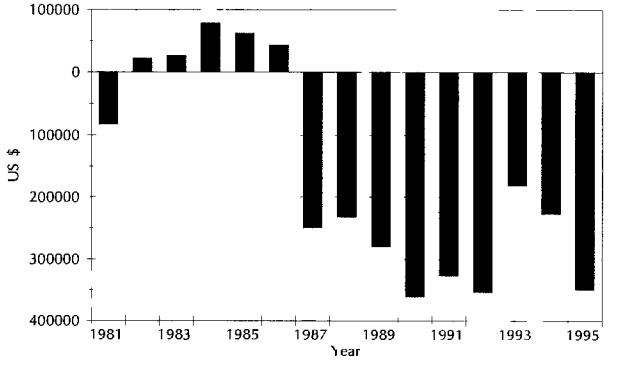
Unfortunately for Uganda, the terms of trade have been on the decline as seen in **Figure 7 4** Even if the country is able to produce and export more than before, the benefits are eroded by higher prices paid for imports This trend seems to have been consistent, and no major change is expected in the near future Uganda will need to either add value to its present products or improve its exports of manufactured goods Agricultural products have traditionally had the disadvantage of price fluctuations on the world markets

Figure 7 4 Key indicators of trade

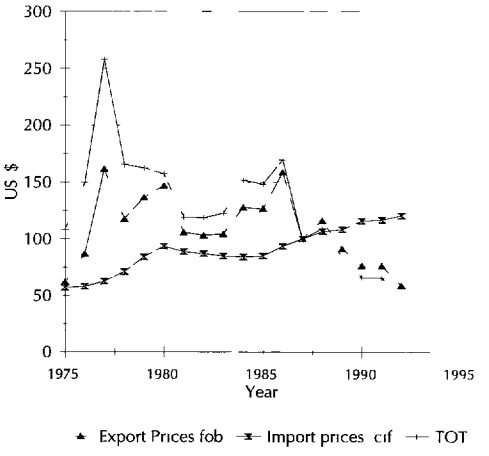
(A) Value of imports and exports



(B) Trade balance



(C) Exports and imports unit prices and terms of trade (TOT) index 1975-1992



Source MFEP (1997) Background to the Budget 1996-1997 and World Resource Institute (WRI) World Tables

7 1 9 Trade and Environment

Despite its benefits to the needs of a growing economy, trade is not always environmentally benign Consequently, it has to be monitored There are a number of ways trade has affected the environment First, with liberalisation of trade, the country has been able to import a wider range of products and from a wider range of countries With a weak surveillance system, some of this trade is causing harm to the environment Examples include continued importation of non-biodegradable polythene bags and second-hand refrigerators The latter contain substances which contribute to the depletion of the ozone layer

Many countries, Uganda inclusive, have liberalised trade to benefit from the international markets Whereas trade opens up a country's opportunities for earning foreign exchange and accessing imports, it takes effort to ensure that in the final analysis the value of exports exceeds that of imports, while at the same time ensuring adherence to environmental standards

From the environmental point of view, the country is being challenged to comply with the standards of importing countries, for instance, in connection with changes in ecosystems (lakes), packaging and waste disposal, and contaminated products such as processed fish On its part, Uganda is developing standards some of which will be used to regulate the manufacturing sector and imports

7 2 Tourism

7 2 1 Historic Perspective, Present Status and Future Prospects

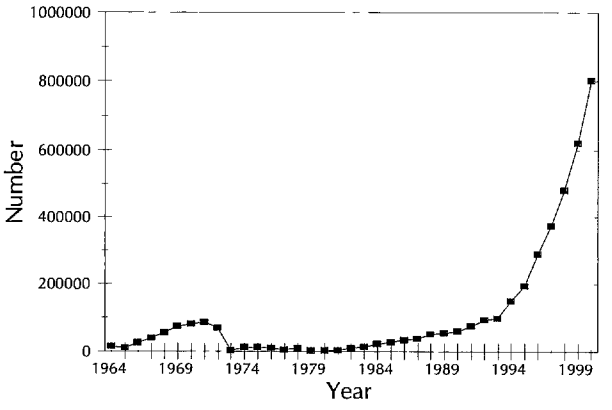
The 1996 theme for Tourism Day was *"Tourism a factor for tolerance and peace'* In the context of Uganda, the above theme is relevant because it correctly explains variations in the trends in the tourism sector over the years and the current choice of destinations within the country During the relatively stable period from independence in 1962 to 1971, the industry experienced a remarkable 34% annual growth rate The year 1970 recorded the highest earnings of Ushs 132 3 million (US$ 18 million), while 1971 recorded the highest number of tourist arrivals totalling, 85,000 people[3] At that time, average per capita spending was US$ 23057 and the industry was Uganda's third largest foreign exchange earner after coffee and cotton

Owing to the political turmoil and economic instability that characterised the period 1972 - 1978, the industry registered a 13 8% decline per annum with the lowest earnings of Ushs 7 2 million (US$ 0 120 million) being registered in 1977 With relatively stable conditions being restored between 1980 and 1996, the industry's growth rates and earnings have improved Much of the change was experienced after 1986 The Tourism Master Plan (1993) had projected that tourism would grow at a rate of 13% per annum, but it has recovered much faster, registering a 53% annual growth rate in 1996

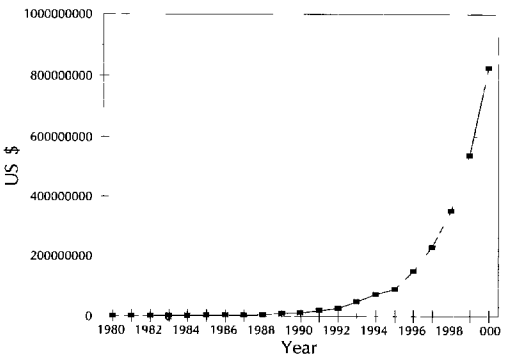
Compared to 1980, when only US$ 0 125 million was earned, the 1995 earnings had reached a level of US$ 90 million[5] If the current growth rate of 53% per annum is maintained in the short to medium term, the number of tourist arrivals will likely increase to over 800,600 by the year 2000 from the present level of 193,000 Likewise earnings will rise from US$ 90 million to US$ 823 million during the same period This will, however, be subject to improvement of the country's competitiveness in all aspects **Figure 7 5** depicts the tourist arrivals and earnings from 1964 to 1996 and provides projections to the year 2000, assuming continued stability and peace in the country

Figure 7 5 Summary of tourist arrivals and earnings, 1964 - 2000

(A) Number of tourist arrivals 1964-1996 with projections to the year 2000



(B) Earnings from tourists in (US$) 1989-1996 with projections to the year 2000



Source *Ministry of Tourism Wildlife and Antiquities (MWTA) (1996) PAMSU Project B Final Report*

7 2 2 Tourism's Significance to the Economy

Even though Uganda's tourism is small by international standards, it nevertheless makes a significant contribution to the recovery of the economy It contributes about 2% of GDP (**Table 7 1**)

Table 7 1 Tourism receipts as % of GDP, 1990-1995

	Total Receipts (US$ Million)					
Year	1990	1991	1992	1993	1994	1995
GDP (Markert Price)	4341	3355	2896	3285	4054	4450
International Tourism	26 6	32 7	45 4	56 7	73 1	90 1
% of GDP	0 6	1	1 5	1 7	1 8	2

Source *Ministry of Tourism Wildlife and Antiquities (1996) PAMSU Project B Final Report*

When the secondary impacts, generally referred to as the *multiplier process* are taken into account, the ultimate impact of tourism improves to between 2 5% and 3% of GDP[6] The trends in earnings have already been shown in **Figure 7 5** As there is lack of published data, use has been made of the tax incidence figure (26%) derived in the Integrated Tourism Master Plan (ITMP) as an indicator of government's overall tax "take" from tourism, to estimate the tax revenue as US$19 million This represents between 4% and 5% of total government revenue for that year

In terms of employment, the sector offers jobs to about 9000 people, of whom 7000 are in accommodation establishments, a further 1000 in tour operator/car rental companies and the balance in restaurants and other tourism facilities [7] Finally, given that the industry is characterised by the fact that the consumer comes to the product rather than the product to the consumer, it has benefits of reducing regional disequilibrium in wealth Local communities, such as those described in **Box 7 1,** also benefit from support to their social services This redresses poverty

Box 7 1
Local community participation in tourism a case study of Kibale Association for Rural and Environmental Development (KAFRED)

Inspired by a USA Peace Corps volunteer, KAFRED was formed as a community-based environmental organisation, intended to achieve social and economic development of the local communities through the wise use of natural resources Their main activity is eco-tourism centred around Magombe swamp, a wetland area found at the western edge of Kibale National Park

Magombe swamp is known to have a wide range of biodiversity, including species of primates (red colobus black and white colobus, grey checked mangabeys, red tail vervet, and blue monkeys, and baboons) About 138 bird species have been identified It also has a wide range of vegetation wild palms, polita figs, wild rubber trees and papyrus plants Mammals live in or visit the swamp from the neighbouring Kibale National Park

An income-generating project in the form of eco-tourism was started at Magombe Swamp to attract tourists who come to visit Kibale Forest National Park Tourists pay a fee to be guided around the swamp In the financial year 1994-1995, 1100 swamp tourists brought in an income of US$ 6137 The revenue from tourists is used to support community projects To date, the money has been used to support a community secondary school, a public library, and a board-walk to connect Bigodi trading centre and another village across the swamp The same board walk is used by tourists A raised pavilion (tree house) has been built for bird viewing, and construction of a visitors centre/ community hall has been started KAFRED fund supports community seminars on environmental education themes

The swamp has also been used by schools around the area as a nature studies laboratory Groups from different parts of Uganda have visited the swamp to learn from the experience of the KAFRED management committee

Financial support to KAFRED has come from the American Embassy This was a great incentive to KAFRED's start-up activities Technical support to KAFRED has come from IUCN, Uganda Wildlife Authority, (UWA), the National Wetlands Programme of the Ministry of Natural Resources, and Kibale Semliki Conservation Development Project Through Kibale National Park, UWA has trained KAFRED tourist guides and publicised Magombe swamp to tourists visiting the Park This has created confidence and good relations between UWA and the local community This initiative is a testimony that with modest technical assistance local communities can directly benefit from tourism enterprises and the process can conserve biodiversity and other natural resources

Source IUCN files and Consultant s observations

7 2 3 Tourism Product

The tourism product consists of a number of attractions and support services that continue to determine one's preference for a destination Uganda's tourism product is mainly centred around a network of 10 national parks, 29 wildlife reserves (formerly game reserves), sanctuaries and communal wildlife areas (formerly controlled hunting areas) covering about 56,000 sq km and approximately 14,900 sq km of gazetted forests There are also cultural sites The ITMP development concept was centred on a spatial strategy which defined some eight tourism zones, assessed to be sufficiently endowed with attractions to act as focal points of tourism activity Based on an assessment of the quality, variety, and concentration of their respective attractions, the zones were classified into primary, secondary and tertiary tourism zones

Table 7 2 Tourist zones

	Zone	Main Attraction	No of Visitors (1995)	Comment
	Primary 1 Rift Valley 2 Murchison Falls 3 Kidepo Valley	Rift valley Wildlife Park (Queen Elizabetb) Scenic areas (Rwenzori mountains and the crater lakes) Specific natural sights (Mount Stanley and Speke Kyambura Gorge) Forests (Kibale Semliki Maramagambo) and Game reserves (Toro Kibale Forest Corridor Kyambura Kigezi) Murchison Falls Wildlife Park (Murchison Falls National Park) Specific natural sights (Murchison Falls Karuma Falls) Forests (Budongo Forest Reserve Rabongo) and Game Reserves (Bugungu Karuma) Kidepo Valley Wildlife Park (Kidepo Valley National Park) Scenic areas (North East mountains) Forest Reserves (Zulia Morongole) Other areas (Lipan Communal Wildlife Area North Karamoja Communal Wildlife Area) and Culture (people of Karamoja)	32 187 (to Queen Elizabeth National Park 14 990 Kibale National Park 3 640 Semliki National Park 752 Murchison Falls National Park 11 039 and Kidepo National Park 1 766)	The rift valley zone has greater attraction and wider range of quality attractions than the other two zones Potential tourist activities include game viewing viewing of chimpanzees and other primates angling and boating and bird watching and other forms of eco tourism The Murchison Fall zone has a tremendous sense of wilderness undisturbed by Man which Queen Elizabeth N/Park does not have Apart from the stretch from Paraa to the Falls elsewhere the game is more thinly dispersed Potential is similar to that of the rift valley in addition to white water rafting Kidepo Valley is also the wildest of all Uganda s-parks and least tampered with by man Game viewing in the Narus Valley is considered the best in the country In addition to cultural visits other potential tourist activities are similar to those mentioned above with the exception of boating
	Secondary 4 Capital Area 5 South west Mountains	The Capital Area includes Kampala Entebbe and Jinja and area between them The attractions include Source of the Nile (Jinja) Bujagali Falls (Jinja) animal sanctuary (Jinja) Mabira Forest bird and animal santuary (Entebbe) and Lake Victoria South West Mountain National Parks (Bwindi Impenetrable Mgahinga Gorilla) Scenic areas (South west mountains as a whole) Specific natural sights (Sabinyo caves at Soko/Garuma/Ruhengo) and Lakes (Mutanda Bunyonyi)	NA4 068 (to Bwindi Impenetrable National Park 3 214 and Mgahinga Gorilla National Park 854)	This zone is essentially of secondary importance to the tourists and is based on the attractions of principle interest to holiday visitors Its attractions tend to be of an urban nature concentrated on entertainment and cultural facilities This zone is of remarkable contrasts and exceptional beauty Bwindi Forest bas a remarkable range of fuanal and floral environment (of which the mountain gorilla is prominent the only home to half of the world s surviving gorilla population) deriving from its antiquity ans survival during the last ice age It has a cross section of habitats ranging from swamps to lowlands and montane forest Mgahinga Park also home to the mountain gorillas Potential lies in gorilla and other primate viewing bird watching touring water recreation and mountain climbing
	Tertiary 6 Lake Mburo 7 Mount Elgon 8 Ssese Islands	Lake Mburo Game viewing and bird watching Mt Elgon The general scenery Specific natural attraction of Wagagai and Jackson s summit and Sipi Falls and Mt Elgon National Park Ssese Islands The principle charm of the Ssese Islands lies in the multiplicity of the islands and islets often thickly covered in rain forest their variation in size and their proximity	5 628 (to Lake Mburo 5 137 and Mount Elgon National Park 491) NA	Lake Mburo zone is unlikely to become a major tourist destination in itself but could be of value as a transit point on the way to other attractions/parks Potential activities include safari walks and boating on the lake Although there are some prospects for eco tourism on Mt Elgon the principle activities are likely to include camping mountain climbing and hill walking There is potential for eco tourism on the Ssese islands Suggestions have been made about developing a beach resort on these islands but is only possible if tourists are assured that the waters are free from bilharzia Development of the tourism potential of the islands will be a medium to long term proposition

Note - Number of visitors derived from UWA Annual Report Reports and Uganda Tourism Board Status Report, 1996

\- NA - Not available

Source *(Adapted fi om) Ministry of Tourism Wildlife and Antiquities Integrated Tourism Master Plan Final Report (1993) Vol 1 - National Structure Plan for Tourism*

(**Table 7 2**), this gave a preliminary indication of the priority to be accorded them for investment and promotion

First, Lake Mburo in the tertiary category has developed faster than the primary category Kidepo Valley National Park owing to relatively better security and infrastructure Secondly, the capital area is featured among the most frequented sites because the city is used as starting point and last-night-stay over location for visitors The main sites of interest in Kampala are the Kasubi Tombs, Bahai Temple and various craft markets Third, Murchison Falls National Park would have done better if it were not for rebel activities undermining security in the area The main limitation of the tourism product is that it is dominated by the mountain gorilla, which is a flag-ship of Uganda's tourism

Gorillas are found on the south-western mountain of Mgahinga and in Bwindi Impenetrable Forest This dominance is reflected in the earnings of the gorilla tracking as a percentage of Uganda Wildlife Authority's (UWA) total earnings In 1995, the gorilla tracking amounted to Ushs 411 million out of Ushs1124 million earned by UWA, or 36 5% Uganda will need to diversify its tourism product especially given that gorilla tracking has started to pick up in Rwanda and at a lower cost

7 2 4 Profile of International Tourists

Presently, the tourist profile is dominated by the business tourist category (32%) followed by holiday tourists (20%) and then visiting friends and relatives (VFR) (14%), other categories make up 34% Analysis of the 1994 data indicates that five source markets account for nearly 63% of holiday and VFR traffic to Uganda **Table 7 3** shows the percent distribution of tourists by the country of origin

There are certain characteristics of foreign tourists that limit benefits to the economy As many as 90% of holiday makers now make their own travel arrangements Relatively few purchase a "package" tour Furthermore, as much as 54% of tourists' nights are spent in non-commercial accommodation Only 35% of the bed-nights are spent in hotels and safari lodges Finally, most tourists visiting Uganda include at least on other country on their trip, the main other countries visited being Kenya and Tanzania Needless to say, therefore, the country's tourism strategy must recognise these characteristics The significance of the domestic tourist market is somewhat lower in Uganda than it is in other comparable countries Though there is lack of statistics on the domestic market, very few Ugandans take holidays in paid accommodation

Table 7 3 Percent distribution of tourists by main source markets (1994)

Source Market	No of Tourists	%
Kenya	14,200	53
U K	6100	23
U S	3100	12
Germany	1800	7
Tanzania	1600	5
Total	26,800	100

Source *MTWA/PAMSU Project B, Final Report 1996*

7 2 5 Tourists by Park Destination

Queen Elizabeth National Park has generally been the principal destination for tourists followed by Murchison Falls National Park and Lake Mburo National Park **(Table 7 4),** Mt Elgon National park in Eastern Uganda is the least visited The growth rate of tourism for Mt Rwenzori National Park has declined since 1993 because of administrative shortcomings within the Rwenzori Mountaineering Services - a local NGO with a concession for tourism development in the park Murchison Falls and Kipedo Valley National Parks would have done much better if it were not for security and infrastructual problems

Both Bwindi Impenetrable and Mgahinga National Parks are unique because of their gorillas However, the number of tourists to these destinations is limited by the carrying capacity of 12 visitors per day for gorilla-tracking Benefits from such tourists will not increase by varying that capacity, but rather by tourists willingness to pay higher fees Presently, a permit to track gorillas costs US$150 for non-resident foreign tourists, US$ 120 for resident foreign tourists and US$ 40 for nationals Still to be improved in the whole national park system is the quality of accommodation Concessioners in all the parks have yet to provide the appropriate accommodation facilities just as government is also yet to improve the road infrastructure

7 2 6 Tourism Image and National Competitiveness

Today, Uganda ranks as the twentieth destination for tourists in Africa[8] The growth trends are impressive The genuine friendliness of the people, the natural attractions and restoration of some stability are responsible for this recovery While that is the case, surveys in 1990 showed that the political instability in the country particularly between 1971 and the early 1980s earned the industry a negative image from 70% of the tour operators in Europe[9] Other causes of the negative image were a high incidence of disease, with risks of contracting AIDS, and a poor official exchange rate which gave the tourist dollar 50% less purchasing power than in other competing destinations

A more recent survey has indicated that Uganda's image continues to be overshadowed by the legacy of Idi Amin The country is still seen as having security problems and civil strife Kenya's international access by air surpasses that of Uganda, and Uganda's domestic flights are still poorly developed The road infrastructure, particularly in the rural areas, needs a lot of improvement Accommodation outside Kampala is still inadequate Unlike Kenya, Tanzania and South Africa, Uganda has no beach tourism, has less big game and lacks a professional service sector These factors reduce the country's competitiveness

The potential for recovery, however, is high with a strategy for quality tourism supported by liberalisation of foreign exchange and a deliberate marketing strategy The mountain gorilla is offering a unique but small market niche in tourism The limited permits allowed for mountain gorilla viewing amidst increased tourist arrivals dictate that the tourism product must be diversified to include other nature-based, social and cultural features The East African countries are being challenged to be more cooperative in the tourism industry, South Africa, with the abolition of apartheid, is a real competitor to all of them In any case, most tourists have a preference for multi-country destinations Steps are being taken by the three East African countries within the framework of regional co-operation to develop an East African Travel Market

7 2 7 District Initiatives in Tourism

The national parks, which are the greatest attractions to tourists, are centrally owned As such, revenue earned goes to the Uganda Wildlife Authority, because of this, districts and sub-counties, which are now planning units with power to raise and retain some of the revenue under the decentralisation policy, have had little incentive to develop revenue earning enterprises from tourism-related activities This is an area where districts with good vision and strategy should tap benefits from the tourism opportunities Presently, districts in which parks exist can benefit from the 20% revenue-sharing policy, some districts with some attractions are already charging entrance fees to their sites Jinja Municipal Council is charging entrance fees to the source of the Nile and Bujagali Falls

7 2 8 Community Initiatives in Tourism

Uganda has decided to leave as much as 80% of tourism-related activities to the private sector It is through government policy that accommodation facilities within the protected areas have been divested to the private sector An alternative way for communities to benefit is to initiate and operate small and medium enterprises in tourism-related services Although some of these exist, they still have problems of accessing credit, professional staff, training and skills in tourism management A few case studies such as that of KAFRED (**Box 7 1**) exist and if well developed could act as a model

7 2 9 Tourism and Environment

Two of the factors that will determine the benefits from tourism will be the enhancement of environmental quality and protection of wildlife and their habitats Poaching, encroachment and conversion of habitats into agriculture, bush-burning and pollution will need to be managed Some of these have been responsible for reduction in the big game The elephant, mountain gorilla and ostrich have become endangered, white and black rhino have become extinct Yet, most tourists are still attracted by big game The reduction in their numbers is presently responsible for low competitiveness Involvement of local communities must be instituted as a means of addressing some of these issues

A special aspect to be managed in Bwindi and Mgahinga National Parks is that of carrying capacity There are only two habituated groups of gorillas and only six visitors are allowed per group per day at a cost of US$ 150 per tourist's entry permit With eco-tourism, and in the framework of quality tourism, the carrying capacity will have to be managed strictly for ecologically-sensitive areas Likewise, litter and other pollution must be avoided and monitored Tourists should be advised of their responsibilities towards maintaining a litter-free wildlife environment Ecologically-fragile areas like Mt Rwenzori National Park need stringent measures

7 2 10 Policy and Institutional Framework for Tourism Development

It is the policy of the government to develop quality tourism, and the overall planning coordination and development of Uganda's tourism industry is the responsibility of the Ministry of Tourism, Wildlife and Antiquities (MTWA) It, however, collaborates with other government departments, parastatals and the private sector Key among such collaborating institutions are the Ministry of Natural Resources, especially the Forest Department, National Environmental Management Authority (NEMA), Uganda Tourist Board (UTB) and Uganda Wildlife Authority The UTB's main objectives in the sector are to promote the tourism industry of Uganda, both within and outside the country, and to liaise between the ministry responsible for tourism and the private sector

Table 7 4 Visitor statistics of national parks, 1990 - 1995

Year	QENP	MFNP	LMNP	KVNP	RMNP	BINP	KNP	SNP	MGNP	MENP	TOTAL
1990	4 973	6 456	1 213	251	865						13 758
1991	1 461	3 629	1 543	375	1 402				6		8 416
1992	11 627	8 903	2 501	1 067	1 531	112			47		25 788
1993	11 062	6 817	3 687	2 743	1 683	1 106	465	350	145	40	28 098
1994	12 982	7 041	3 962	1 489	1 030	2 461	1 890	488	404	280	32 027
1995	14 990	11 039	5 137	1 766	900	3 214	3 640	752	854	491	42 783
Total	57 095	43 885	18 043	7 691	7 411	6 893	5 995	1 588	1 456	811	150 864

QENP Queen Elizabeth NP
MFNP Murchison Falls NP
LMNP Lake Mburo NP
KVNP Kidepo Valley NP
RMNP Rwenzori Mountains NP
BINP Bwindi Impenetrable NP
KNP Kibale NP
SNP Semliki NP
MGNP Mgahinga NP
MENP Mt Elgon NP

Source *Compiled from UWA Annual Reports, and Uganda Tourism Board (UTB) Sector Status Report (1996)*

The private sector institutions with which the Ministry and UTB enjoy close working relationship include The Association of Uganda Tour Operators, Hotel and Catering Association, Association of Uganda Travel Agents, Association of Tourism Training Institutions, and The Board of Airline Representatives Established in 1994, the Hotel and Tourism Institute is mandated to organise and conduct courses in tourism, hotel management and catering Owing to poor funding mechanisms, the institute has not been able to operate effectively On the other hand, the Wildlife College offers training in wildlife-related disciplines The Uganda Institute of Ecology remains the research centre for the Uganda Wildlife Authority Finally, the Wildlife Education Centre in Entebbe will provide conservation education and *ex-situ* conservation

Needless to mention, there are many institutions servicing the tourism industry Inter-organisational cooperation, collaboration and joint planning are going to be fundamental in determining the country's competitiveness in the industry Establishment of standards, regulations and a code of ethics will also be vital Support to private sector institutions, which now assume 80% of responsibility for tourism development, will be equally important

7 3 Industry

7 3 1 Introduction

To an economy like Uganda's, industrialisation can create employment, foreign exchange earnings and savings, backward and forward linkages to the natural resource base and finally, support the fight against poverty As some countries developed, there was a structural shift of labour from agriculture to industry and services, a factor that reduced pressure on land In the endeavour to industrialise and tap the above benefits, the challenge is to ensure that society's benefits from the sector are not eroded by costs associated with the damage caused by industrial pollution The environmental laws, policies and institutions that have been put in place in the recent past should be used to ensure that both the sector and environment win

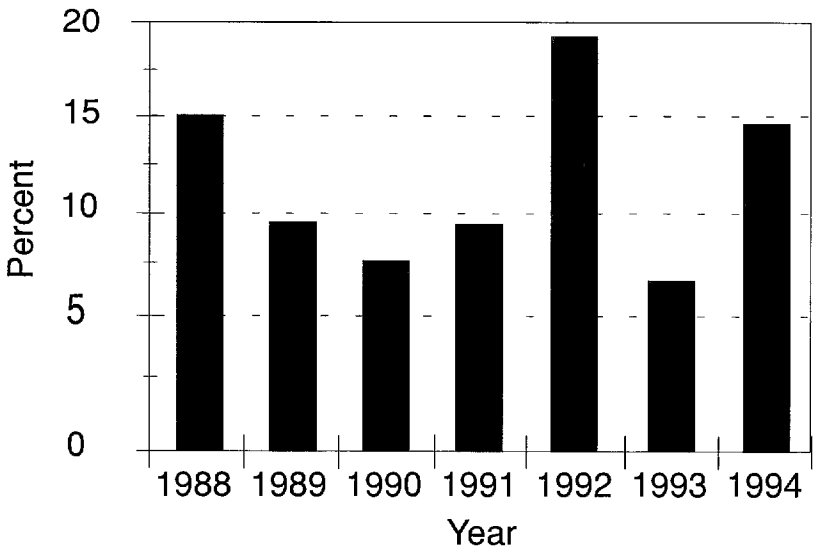
7 3 2 Industrial Growth Rate

Like other sectors, the industrial sector had severe setbacks prior to 1986 because of devastation, neglect, poor management and shortage of in puts With a new government in power since that time, the sector has improved at an average annual rate of almost 12% The consistent improvement is attributed to enhanced utilisation of idle capacity due to liberalisation of the foreign exchange rate and de-regulation of unnecessary controls on importation of raw materials and assets Currently, the manufacturing sector contributes 7 4% to GDP[1] See **Figure 7 6** for variations in industrial growth from 1988 to 1994

7 3 3 Indices of Industrial Production

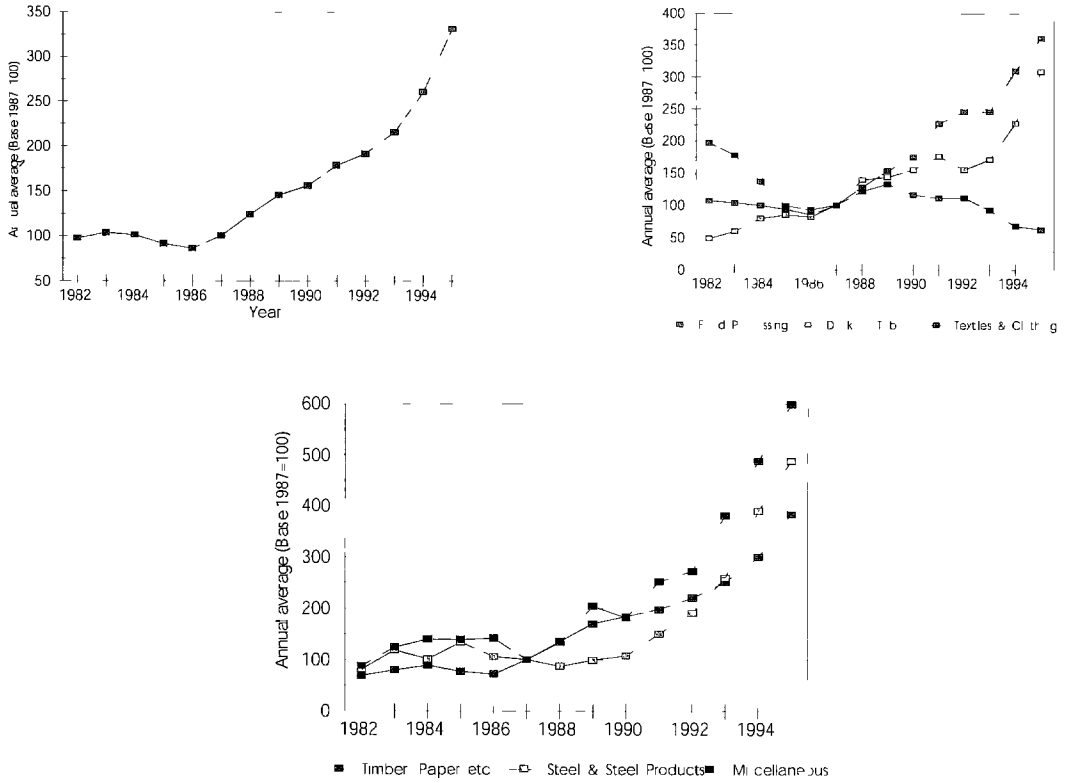
Despite significant recovery in the sector, there are major differences in performance among categories of industries They are observable in **Figure 7 7** Taking 1987 as the base year, the whole industrial sector has recorded improvement every year Some categories of establishments have grown faster than others The strong growth sectors are chemicals and paints (412% in 1995 from 1987 base year), steel and steel products (388% in 1995 from 1987), food processing (261% in 1995 from 1987), and timber, paper and printing (283% in 1995 from 1987) Drinks and tobacco also registered a consistent improvement, with 208% in 1995 as compared to 1987 The most evident decline is, however, noticed in textiles and clothes from an index of 100 in 1987 to only 62 in 1995, a decline of 38% The problem in the textile sub-sector is connected with technological obsolescence, inadequate capacity and the still unreliable supply of cotton lint Another category of industrial establishment that has more or less

Figure 7 6 Annual variations in industrial growth rate



Source MFEP 1996 Statistical Abstract 1996

Figure 7 7 Indices of industrial production, 1982-1995 (Base 1987=100%)



Source MFEP Statistical Abstract 1996 and MFEP (1993) Background to the Budget 1993/94 Pg 81

stagnated is leather and footwear

7 3 4 Levels and Trends in Capacity Utilisation

Most of the industries in Uganda were established just before or immediately after independence Hence, some of the machinery is 30-40 years old During the nationwide disturbances, establishments were vandalised, and most were poorly maintained Together with the difficulty of obtaining spare parts, this greatly reduces production and productivity Frequent breakdowns, low capacity utilisation and high costs of production are common in factories These scenarios have negative consequences First, absorption of labour into industries is curtailed Second, the value that the economy would otherwise obtain from its natural resources is reduced Third, there is continued reliance on imports, a factor that reduces the country's balance of payments accounts Finally, there is high wastage and pollution associated with old technology-based processes

7 3 5 Industrial Employment

According to the 1989 census of industrial establishments, the manufacturing sector employed a total of 53,902 people The sub-sector with the highest employment was coffee processing with 11,097 people, followed by textiles with 4378 people Of the total establishments, 698 employed between 5 and 9 people while 436 employed between 10 and 19 people Hence, 69% are small micro-enterprises (SMEs) which have an important role in job creation A regional analysis of the major employing industries shows that coffee processing, spinning and weaving, and cotton ginning are the major employing sub-sectors in central and western, eastern and northern regions, respectively

7 3 6 Linkages Between Industrial Sector and Natural Resource Base

The government's overall economic objective is "*building an independent, integrated and self-sustaining national economy*"[2] In essence, this would mean an economy which (i) is able to obtain domestically most of its requirements for production, consumption and capital formation, (ii) has its various sectors linked in a supplier-user manner, and, (iii) has its basic driving force as the production of goods and services to meet t' ⌄ demands of the population and for export, as well as the need to create new expanded productive capacities domestically

Despite the benefits to be derived from an integrated economy, Uganda still exports many unprocessed or semi-processed primary products The input-output data for the industrial sector in 1994 showed that most industries depend on imported raw materials and other in-puts, even when such raw materials can be produced from the very primary products being exported Good examples are cotton lint, hides and skins, and coffee beans

7 3 7 Industrial Waste and Pollution

The industrial process in Uganda produces hazardous wastes, which are harmful to the environment Hazardous waste is waste that has physical, chemical or biological characteristics which require special handling and disposal procedures to avoid risk to health and/or other adverse environmental effects There has been a general feeling that since the country is not industrialised, it is unlikely that there is a pollution problem similar to that in the industrialised counties With the current aggressive government industrialisation policy, the situation is changing very rapidly as is highlighted in the following sections

- ***Inorganic Hazardous Wastes***

This group of wastes includes the following acids and alkalis, cyanide wastes, heavy metal sludge and solutions, asbestos residues and other inorganic solid residues These are mainly generated by the following industries metal manufacture, of non-metal products, chemical and related industries, metal goods and engineering Acid and alkali wastes are, in addition, generated by industries involved in food production, textile, leather and timber industries, manufacture of paper, printing and publishing

There are inorganic wastes that require particular attention in this country, and they include heavy metal-contaminated wastes, asbestos wastes and toxic chemical-contaminated metallic containers

- ***Heavy Metal-contaminated Wastes***

Wastes of particular concern are those containing toxic metals such as arsenic, cadmium, hexavelant chromium, lead, mercury, nickel, zinc and copper These wastes are generated from a wide range of manufacturing processes which in Uganda include battery production, textiles, metal plating (electro-plating and galvanising) and leather tanning In addition, Uganda imports large quantities of dry cells, paints, electronic appliances, photographic materials and other products that contain heavy metals For example, in the 1994-1995 financial years, 13 million cells were imported These are thrown away after use and contribute significantly to pollution of the environment

- ***Asbestos Waste***

There is one factory in Tororo that used to produce asbestos products, especially roofing sheets which still cover a good number of houses in the country The factory has closed but there are indications that it may resume production in the near future There is another factory in Kampala, Zakaria Industries, which manufactures asbestos-based vehicle parts There are, however, brake pads on the world market which are not based on asbestos Apart from these factories, this type of waste normally arises from power stations and industrial manufacturing plants and may also arise from demolition of buildings

- ***Oily Wastes***

Oily wastes are generated primarily from the processing, use and storage of mineral oils In Uganda, oily wastes include those associated with lubricants and hydraulic fluids, bottom sludge from oil storage tanks, cutting oils, and filling station and motor vehicle repair shops Since Uganda, unlike many countries, still uses leaded fuels, wastes from these fuels are contaminated with toxic metals (such as sludge from leaded petrol storage tanks)

Disposal of oily wastes (with the exception of sludge from storage tanks which is said to be solidified by some oil companies) is not yet of particular concern in the country Every year several million litres of lubricating oil are imported and a major portion of it disappears into the environment There is evidence that some used lubricating oil is used to treat timber and poles while some is used as furnace oil in boilers and cement kilns How much oil is used in each case is yet to be established Motor vehicle repair garages, which are heavily oil contaminated indicate that the biggest portion of used oil is poured into the ground To avoid pollution, it is necessary that used oil undergoes proper refining before it can be used as a wood preservative, furnace oil or re-used again as a lubricant

It is important to note that once oil contaminates groundwater, it becomes a very big problem as it cannot be easily biodegraded and cleaning such water is very expensive There is no data in the country indicating the level of oil in underground and surface waters Reputable publications warn that one litre of oil can ruin one million litres of water because it is toxic

Organic Wastes

This group of wastes is different from organic matter which is decomposable Organic wastes include halogenated solvents (containing chlorine, bromine or fluorine), non-halogenated solvents, polychlorinated biphenyl wastes, paints and resins, biocides and other organic residues Organic wastes are very poorly known by the general public because hazards associated with them are not direct In most cases symptoms of these hazardous wastes appear after years of use and exposure Most of the wastes of this group are persistent in the environment, and they enter the food chain and accumulate in the bodies of humans and other animals

Other Solvent Wastes (non-halogenated)

This group of wastes includes a large number of hydrocarbons and oxygenated hydrocarbons, of which the most commonly used are white spirit, toluene, methanol, isopropanol and ethanol They find wide application throughout industry in the production of paints, inks, adhesives, resins, solvent-based wood preservatives, toiletries, food flavourings and cosmetics and for factory cleaning equipment They are also used as machine washing solvents in engineering industries as well as for the extraction of natural products from animal and vegetable sources Most of these solvents are used in Uganda The toxicity of these materials varies greatly, and in many cases the major hazard is flammability

Polychlorinated biphenyl (PCB) Wastes

PCBs are not manufactured in Uganda but they are used principally in electric equipment such as transformers, starters and capacitors Uganda Electricity Board (UEB) and Uganda Posts and Telecommunications Corporation (UP&TC), therefore, are the major sources of PCB wastes when their equipment is decommissioned There are no data to estimate the amounts of PCBs that have been discarded into the environment However, it is known that the equipment of these two institutions is getting old and, therefore, there is a potential problem of how to safely dispose of them UEB recycles its transformer oil, although leakages of this oil into the ground are a normal occurrence Scrap capacitors are still simply thrown away by UP&TC Another source of PCBs is the decommissioning of equipment which contains hydraulic and heat transfer fluids Many industries use both types of fluids Like oil from transformers and heat transfer fluids, hydraulic fluids are discarded into the environment in considerable amounts through leakages

The major concern about PCBs is their high persistence in the environment and bio-accumulation potential PCBs are, therefore, among the most dangerous chemical wastes

Paint and Resin Wastes

Paint and resin wastes are generated from a variety of sources, including formulation and other tertiary chemical processes, and also application of paints and resins to finished products They are typically

combinations of solvents and polymeric materials including, in some cases, toxic metals Lead compounds used in paints have non-toxic substitutes on the world market, so there is no reason to keep using lead-based paints in Uganda About four million litres of paints are produced annually by 10 factories and about 50 metric tons discarded as waste by the same factories Paint stripping in homes, institutions, commercial establishments, and so on accounts for the rest of the waste which is much more than that from paint manufacturers

There are two factories in the country which synthesise resins for use in paint, adhesive and ink industries, but not much waste, apart from contaminated containers, is generated

Pesticide Wastes

Wastes are generated both in the manufacture and formulation of pesticides, and in use of these compounds in agriculture, horticulture, households and a variety of other industries Uganda uses, mainly imported pesticides and, therefore, the major sources of this type of wastes are unused or expired pesticides Currently, there are over 40,000 litres of various expired pesticides which are said to be safely stored in various parts of the country, awaiting proper disposal The large amount of expired pesticides is a result of their accumulation over 30 years There is, however, evidence of misuse of pesticides during application as well as problems involving their containers, and this has grave consequences for the environment and public health Possible leakages are another risk from expired pesticides especially during storage

Containers Contaminated by Toxic Chemicals

Uganda imports toxic chemicals packed in both metallic and plastic containers of varying sizes These empty containers are sold off without being decontaminated Thousands of these containers continue to slowly poison the population since they are used to store water for domestic purposes Steps should be taken to start mass production of medium-size plastic containers and to set up a container decontamination centre in the country It is important to note that the big volume plastic containers presently made by two factories in Kampala are not affordable by the majority of the households in the country Alternatively, containers made from clay or cement should be encouraged although the latter type is more expensive than the plastic version of equal volume

Solvent Wastes containing chlorine, bromine or fluorine (halogenated solvents)

Halogenated solvent wastes are generated primarily from dry-cleaning operations, metal-cleaning in the engineering industry and to a small extent from machine-washing processes in the textile and leather industries The hazards caused by these wastes are a result of their toxicity, mobility and relatively high persistence in the environment Quantities of these halogenated solvent wastes need, therefore, to be determined and places where there are finally deposited need to be known Their chemical degradation in the environment need to be monitored as micro-organisms at times convert them into more dangerous pollutants An example is microbial transformation of trichloroethylene, perchloroethylene, and 1,1,1-trichloroethane, solvents used in Uganda industries, which can lead to the formation of vinyl chloride, a compound resistant to further breakdown and a proven carcinogen

Organic Chemical Residues

Organic chemical residues are generated from coal carbonization and by-products operations (at least one steel mill uses coal in Uganda), and from the manufacture of primary, secondary and tertiary chemical products Distillation residues and filter materials are common components For example, during recycling of transformer oil, filter materials are generated as waste but in Uganda they are simply thrown away, which should not be the case These waste streams are generated by a wide range of industries, including those involved in the manufacture of chemicals, dye stuffs, pharmaceutical products, plastics, rubber and resins

It is important to note that in Uganda, most of the above mentioned industries use refined raw materials (that is, products of primary and secondary chemical industries) and generate much less waste than in industrialised countries as they are tertiary industries This group of wastes, however, accounts for a considerable portion of solid wastes (hazardous) in the country, and its major source are households, commercial enterprises and institutions (like hospitals) with industry contributing to the waste stream mainly in form of packaging

High Volume/Low Hazard Wastes

High volume/low hazard wastes include wastes which, based on their intrinsic properties, present relatively low hazards, but may pose problems because of their high volumes In Uganda, an example of such type of waste is sludge from mining and purifying copper at Kilembe Mines While amounts of toxic copper in the waste are supposed to be minimal, the sludge contains other impurities that have affected the surrounding environment The accumulated waste, however, has commercially viable quantities of cobalt whose extraction is about to start Fly-ash from fossil fuel-fired power plants is another example In Uganda, these power generators are many but are of a small capacities A new, relatively big capacity thermal-power plant is expected to be put up in the country This plant will produce not only fly-ash but other toxic gaseous wastes Waste waters from soft-drink and beer-brewing industries as well as fish-processing factories are classified under this group of wastes

7 4 Mining

7 4 1 Introduction

Minerals are literally and commercially the foundation stones of development Mining in Uganda began as far back as 1907 and has contributed a great deal to Uganda's economy In 1970, mineral exports accounted for 8 5% of total export earnings At one time, copper ranked as the third foreign exchange earner after coffee and cotton An evaluation of the mineral potential of a country like Uganda should identify the basic raw material needs of industry, aid with efficient resource planning and management, help in the discovery of new deposits, and indicate how locally-produced materials can substitute for imports so as to save valuable foreign exchange The extraction and processing of mineral resources, however, can have a negative environmental impact on the long-term growth potential of the country even if immediate economic benefits may be gained by firms and individuals It is, therefore, important that mining should be carried out in a manner that minimises these deleterious impacts through careful planning, modern technologies, appropriate regulations and sensitive management

7 4 2 Minerals in Uganda

The geological framework of Uganda can be divided into five main categories crystalline basements, sedimentary cover sequences, carbonatite intrusives, volcanics, and quaternary sediments[1] For purposes of evaluating the mineral potential of Uganda, each of the five categories is considered as a distinct domain containing characteristic and predictable sites of minerals The actual occurrence of minerals in Uganda reveals high concentrations in the south-western, eastern and north-eastern parts of the country, less in the north and even less in central Uganda

The distribution is evidence of some of the earth movements associated with this part of East Africa, since minerals tend to occur in highlands and in rift valley areas Of particular importance are the limestone reserves estimated at 200 million tonnes and iron ore estimated at over 50 million tonnes on which the local industries could be based for the production of cement and iron and steel products There are also various and abundant construction materials like clay, silica sand, glass sand and volcanic ash

7 4 3 Current Exploitation of Minerals

Commercial mining started in Uganda in 1907 In spite of the wide range of mineral resources, their exploitation was limited to copper, phosphates and lime Other minerals such as tin, wolfram, gold, gypsum, asbestos, mica, kaoline, columbite, tantalite, beryl, quartz, iron and lead were exploited in small amounts, their extraction left considerable environmental degradation due to poor and inefficient methods and technologies The sector suffered dramatic decline during the period 1979-1985 and as a result most of the mines ceased production due mainly to lack of spares, technical know-how and an unfavourable political and economic environment that did not foster further exploration and investments of high risk capital into the sector

Since 1986, the recovery of the sector has been gradual, with growth improving from a rate of -17 1% in 1987 to a record 165 6% in 1990 and again rising from -4 8% in 1994 to 25 2% in 1995[2] **Table 7 5** shows the production levels of selected minerals for the years 1984 to 1995 Of particular importance is the marked improvement in the reported gold production due to the liberalised policy of government, under this policy producers do not pay royalty on gold The prospects for future exploitation of minerals in Uganda are promising and a number of minerals may reappear on the scene These include cobalt, copper, crude oil, gold and others

By December 1996, a total of 133 prospecting licences, 13 mining leases, and 58 location licences had been issued[3] Moreover, the area under exploration increased 16 fold from about 3910 sq km in 1994-1995 to 63,318 sq km in 1995-1996[4] Most of this increase is due to gold exploration The main problems in the sector are funding and inadequate technical staffing The increase in gold exploration also has a number of environmental problems associated with it Deep pits are afterwards left uncovered, at the same time toxic chemicals like mercury, which are used in the processing, are discarded carelessly

Copper/Cobalt

The copper mines stopped production in 1979 During the copper production, a huge tailing containing cobalt was stockpiled at Kasese (1 1 million tonnes containing 0 1% cobalt) This is due to be processed to recover cobalt when a cobalt bio-leaching plant is established by 1998 The industry is ex-

pected to use a lot of sulphuric acid and limestone, and there is need to monitor how waste is disposed of through the proposed systems The Kilembe underground copper mine has been under care and maintenance but now there are plans to reactivate mining with emphasis on cobalt rather than copper

Petroleum

Petroleum production has not been established in Uganda, but the hydrocarbon-generating capacity of its rift basins is evident[5] The main potentially productive area is the Albertine Graben, a stretch from the border with Sudan in the north to Lake Edward in the south, covering an area 570km long and 45km wide The Petroleum Exploration and Production Act, 1985, was enacted to regulate the exploration and possible production of oil in Uganda Possible environmental impacts have been anticipated, and the Petroleum (Exploration and Production and Conduct of Exploration Operations) Regulations, 1993, were put in place to control them

Lime

Lime, generated by the burning of limestone, is presently produced in Tororo, Hima, Muhokya (Kasese) and Kisoro Most of the kilns are inefficient and of poor quality, leading to massive consumption of fuel wood resulting in localised deforestation Attempts are being made to design and construct fuel efficient lime kilns that can also use alternative forms of energy like biogas, agricultural waste, used oil, and others

Gold

Gold mining started in 1933 on a small scale Techniques used included hand-panning, machinery and cyanidation At Tira, some kilometres north of Busia, at least 420 metres of reef carrying visible gold were discovered At Busia open-cast production started in August 1937, and in 1938 mining started 44 metres below the surface This industry declined until recently when liberalisation attracted large numbers of explorers, both local and foreign

Traces of gold have been found in alluvials in most parts of Uganda but none seem to be of significant economic value At present more areas of Uganda are under exploration, especially the Karamoja region which has been intensively investigated

Gold exploration activities by large companies such as Branch Energy in Kotido have had a significant negative impact on the environment Large gapping holes are left behind as well as huge tracts of land cleared of vegetation

Phosphates

Super phosphate fertilisers were being produced at Tororo until 1975 when the factory closed Estimated reserves of the order of 203 million tonnes have been proven A new company, Sukulu Mines, is in the process of looking for partners to restart operation in order to produce about 50,000 tonnes per year of single super phosphate (SSP) to supply both the local and foreign markets The reserves also contain limestone which could be used to produce cement

Tin concentrate

Tin mining started in 1926 and was mainly centred around Kikagati and Ruhama areas This industry also collapsed in 1979 partly due to war and unfavourable economic conditions Attempts are now being made to revive tin mining with small-scale miners presently operating

Wolfram

Wolfram mining is based on the Nyamulilo, Ruhija mines in Kabale and Kirwa wolfram and Bahati mines in Kisoro and Buyaga in Rakai District No large-scale operations are being carried out now but past operation resulted in environmental degradation due to open-cast mining and tailings disposal in the water system

Tantalite-Columbite/Beryl

These were mined on a small scale in south-western Uganda and have since declined due to low grade deposits, lack of finances and poor marketing strategies

Industrial Minerals

Apart from phosphate fertilizers, other industrial minerals produced on a small scale include

(a) Kaolin - at Mutaka in Bushenyi, Buwambo in Bombo and Namasera in Mpigi

(b) Feldspar - at Mutaka in Bushenyi, Lunya in Mukono

(c) Diatomite - at Pakwach in Nebbi

(d) Sand - along the shores of Lake Victoria and at other places countrywide

(e) Talc - at Kisinga in Kasese

(f) Mica - in various places in Gulu and Mbarara

(g) Clays - are mined and extensively used in the brick and tile industries, with the major productions at Kajjansi, including Uganda Clays, Gayaza road and Kisubi There are numerous small-scale clay works all over the country Most of these clay works are in wetlands and because of the haphazard nature of their operations, a lot of degradation is taking place At present clay mining and sand quarrying are not yet under the Mining Act Regulations, hence, control is very difficult

(h) Volcanic ashes - research into the use of volcanic ashes for the production of Pozzolanic cements has been completed The production will involve the mixing of lime and volcanic ash Large quantities of volcanic ashes exist in Kisoro and Bunyaruguru, and there is need to regulate their exploitation as they occur in sensitive areas susceptible to landslides

Table 7 5 The production of selected minerals, 1984-1995

Mineral	Unit	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Gold	Grams	1316 7	142 0	149 7		20 5	1700 0	75230 0	776 000	117 800	291 4	1627	1506 5
Tin ore	Tonnes	263 3	5 9	43 5	9 7	63 8	45 0	31 2	72 2	30 0	2 674	2 562	4 289
Wolfram	Tonnes	14 7	16 8	19 1	30 2	74 9	32 2	48 3	98 3	65 5	5 0	11 638	17 311
Tantalite/ columbite	Tonnes			7 7			5 4	2 7	0 055	5 0	0 452	0 435	1 824
Kaolin	Tonnes			400 0									
Feldspar	Tonnes			200 0									
Limestone 1	Tonnes							385 5	807 5	407 0	10024 6	162 5	969 6
Gypsum	Tonnes							43	43 1	651 0	308 38	201 7	1537 66
Phosphate	Tonnes							25 0	30 0				
Iron ore	Tonnes					11 1			86 71	132 0	23		7

Source *MFEP, Background to the Budget, 1993-1994, GSMD (1996)*

7 4 4 Export Values of Minerals and Economic Significance

The mining sector is an important source of tax revenue, employment and foreign exchange and is essential for the recovery of Uganda's economy Though Uganda is known to have substantial deposits of various minerals, the industry has not made much impact on GDP even with the liberalised investment climate The bulk of mineral output is exported to international markets but the proceeds still account for a small part of the monetary economy Mining's share fell from 5 4% in 1970 to less than 1% in 1988 At its peak in 1969, 16,500 tonnes of blister copper earned US$ 27 million In 1970, the sector accounted for 8 5% of Uganda's domestic exports, more important than tea at 5 5% Uganda accounted for up to 20% of the world production of beryl in the 1960s[6]

Due to negative factors like falling world prices for minerals such as copper, lack of spares and in puts, lack of technical know-how, political instability and plain mismanagement, the glory of the sector has gradually waned The mining and quarrying sector contributed 0 2% of GDP each year for 1983-1984, 0 1% each year for 1985-1989, 0 3% each year for 1990-1992, and remained stagnant at 0 32% for the 1992-1993 and 1993-1994 fiscal years[7] The value of minerals exported during 1995-1996 increased by 237% over that of 1994-1995 The biggest increase was in gold

Royalty collected on minerals during 1995-1996 was Ushs 21,267,500, a decrease of 0 05% over that collected in 1994-1995 (Ushs 21,278,125) This was mainly due to non-purchase of gypsum from Kibuku by Hima Cement Factory

In 1970 mining employed 7000 people This number fell to 4100 by 1976[8] and to 1597 by 1996[9] According to the Uganda National Household Budget Survey (1989-1990) mining and quarrying employed just 0 1% of the total employed household population in Uganda

7 4 5 Importation and Value of Mineral Products

Most industries in Uganda were set up for import substitution, a policy which could not be sustained due to dependency on imported raw materials Evidence from the input-output table for the industrial sector in 1994 shows that most industries rely on imported in-puts even when some of them are locally available This negates the very goal of building an independent, integrated and self-sustaining national economy **Table 7 6** shows the imports of mineral commodities, both as raw materials and final goods, into the country for 1995-1996, reflecting substantial expenditures of foreign exchange

Of particular importance are the volumetrically and monetarily high imports of cement products, salt, fertilizers, ceramics, glass and glassware, copper articles, and other mineral products for which their mineral ores occur in Uganda This reflects a poor linkage between the country's natural resource base and the industrial sector for which the economy pays dearly in terms of foreign exchange It should, however, be understood that in certain circumstances, it may be better to import if it makes economic sense than to do without or use over-priced domestic sources In 1992, 13,304 tonnes of cement worth US$ 14 7 million were imported

7 4 6 Mining and Environment

Mining is the extraction from earth of materials useful to humans Various tools, chemicals and processes are used to achieve this extraction depending on the nature of the mineral ore, its geological location and the scale of the undertaking Correspondingly, a variety of environmental impacts are experienced

Table 7 6 Imports of minerals and mineral products by quantity and value, 1995-1996

	Product	Quantity	Ug shs
1	Salt Sulphur Earth & Stone Plastering materials (e g Clays Marble Pebbles Granite)(Kg)	12 732 782	1 407 872 580
2	Common Salt (Kg)	59 400 541	9 934 540 224
3	Portland cement Aluminous Cement and Persulphate Cement (Kg)	194 707 488	35 667 383 779
4	Fertilisers (Kg)	2 729 738	3 670 428 112
5	Ceramic products (eg tiles bricks blocks sinks etc) (Kg)	4 516 030	3 924 313 600
6	Glass and Glass ware (Assorted items)	NA	5 121 420 610
7	Iron and Steel (Kg)	212 575 309	36 680 952 321
8	Copper and Articles thereof (Kg)	134 515	552 027 873
9	Nickel and Articles thereof (Kg)	759	1 995 393
10	Aluminium and articles thereof (Kg)	NA	8 858 145 068
11	Lead and Articles thereof (Kg)	212 836	283 908 654
12	Zinc and Articles thereof (Kg)	1 280 305	2 028 530 281
13	Tin and Articles thereof (Kg)	5 062	6 303 776
14	Precious stones and metals (e g Coins Gold Jewellery Diamonds and Pearls)	NA	53 699 624
15	Articles of Iron and Steel (Assorted items)	NA	17 284 600 774
16	Articles of Stone Plaster Cement,asbestos mica materials etc (Kg)	1 174 724	798 749 112
17	Base metals (Tungsten Magnesium Titanium vanadium) etc (Kg)	4 365 466	34 976 547
18	Articles of base metal (eg Tools Implements Cutlery Saws etc) (Nos)	5 226 595	6 336 727 411
19	Miscellaneous articles of base metal (e g locks safes belts keys etc)	131 193 330	4 436 249 488

* - The official (average) exchange rate for 1995 was 968 65 Ushs per US$
NA - Not available
CIF - Cost, insurance and freight

Source *Uganda Revenue Authority 1996 Trade statistical tables 1995-1996*

Mining activities in Uganda, notwithstanding their contribution to the economy, have contributed to the degradation of the environment through pollution and damage to the landscape The multitude of open ditches left behind by small-scale miners of gold, lime, clay, and sand, constitute landscape damage, a hazard to the public and to wildlife, an interference with water flow to streams (hence, with wetland ecology), and a threat to health since vectors breed in pools of water accumulated in these ditches These are common in Tororo, Bwindi in Kisoro district, and Busia Furthermore, the carelessness with which gold miners handle mercury, a toxic substance used in the recovery of gold, and thereafter dumped in streams from where it enters the food chain, is of great concern A serious deforestation problem has arisen in the limestone and clay extraction areas where the fuelwood is required to fire the brick and lime kilns

Perhaps the greatest damage done to the environment by mining has been the degradation of the cobaltiferous pyrite (by-product) stock piled at Kasese For over 20 years now, the heavy rains in Kasese (1900mm p a) have washed the pyrite down slope into River Nyamwamba and finally into Lake George where high concentrations of metals (iron, copper, zinc, cadmium, etc) have accumulated in water, plants and soil The River Nyamwamba and Lake George waters are consumed domestically by the local people Moreover, the economic importance of Lake George as a source of fish and tourism revenue is endangered These effects are considered to be serious and deserve urgent attention

As efforts are being made to revive the mining sector, there is need to anticipate environmental effects through environment impact assessments (EIAs) and prepare to prevent harm or provide financial means for mitigation In the past, development accrued without concern for the environment Current government policy demands that environmental concerns should be at the centre of every development

7 4 7 Policy and Institutional Framework for Mining

The two laws governing mining activities in Uganda are the Mining Act, 1964 (under revision), and the Petroleum (Exploration and Production) Act, 1985 The former provides for the ownership, prospecting and extraction of minerals It reserves rights over all minerals in Uganda to government and regulates the granting of permits, licences and leases The Act is still under review to include measures for waste disposal, EIA and use of environmentally-friendly technologies It is expected that the revision will also bring it into line with the Investment Code to encourage investment in the sector, and with the Constitution and the Environment Statute, 1995, which requires all mining activities to be subjected to the EIA process

The Petroleum Act, 1985, concentrates on rights, procedures, and control of licensing for exploration and production Furthermore, the Petroleum (Exploration and Production) Regulations, 1993, address environmental standards in the production and drilling activities, including off-shore operations, pollution prevention and control, explosives and environmental health and safety

All mining activities in Uganda are controlled by the Geological Surveys and Mines Department (GSMD) and the Petroleum Exploration and Production Department (DEPD) both under the Ministry of Natural Resources

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CHAPTER EIGHT

8 0 ENERGY AND CLIMATE CHANGE

8 1 Energy Resources

8 1 1 State of Energy Production and Use in Uganda

The energy sector plays a critical role in the development of the economy The sector is a major component of the country's infrastructure and supports economic and social development It contributes significantly to financing public expenditure For example, petroleum taxes provide about 30% of total fiscal revenues Electricity sales taxes contribute over 1% of total revenues, while commercial trade in woodfuel contributes over 2% to Uganda's economy and employs about 100,000 people (*Turyahikayo, et al 1995*) The sector, however, draws on the country's scarce hard currency resources especially in the importation of petroleum products and energy equipment and external debt servicing in relation to the power sub-sector which also uses a large portion of the project aid the country receives The oil import bill in 1994-1995 was about US$ 65 million or 15% of the value of earnings from exports The Energy Sector Investment in the Government's Rehabilitaion and Deveopment Programme (RDP) 1993-1996, is US$ 231 71 million or 14 6% of the total plan, of which US$ 215 5 million or 93% is donor funded

The major sources of energy in Uganda are biomass, petroleum and hydro-electricity These provide approximately 96 5%, 1 5% and 2%, respectively, of the total energy consumed in the country Other renewable (non-conventional) sources of energy contribute negligibly to the national energy balance Total energy consumption in Uganda is estimated at about 5 million tonnes of oil equivalent (TOE) About 90% of this is from biomass With an estimated population of 19 26 million in mid-1995 (MFED, 1995), Uganda's per capita total energy consumption (0 26 toe) is one of the lowest in the world The modern segment of the energy sector, electricity and petroleum, is also one of the lowest in sub-Saharan African (0 02 toe in 1989)

Despite Uganda's vast hydro-power potential (over 2000 MW), less than 10% of this potential is exploited Neglect of the energy sector, like all areas of infrastructure, is a legacy of nearly 20 years of political turmoil, civil strife and economic decline, which curtailed commercial energy supplies, depressed efficiency in energy production and use, restricted the choice of energy sources, led to a high import bill for petroleum, and an inadequate institutional framework for energy resource management The net result has been pressure on the natural resource base, mainly forests, leading to degradation

Meeting the energy demand of a growing economy on a sustainable and efficient basis and improving the living standards of the people is a priority of government The main challenge in the energy sector, therefore, is how to develop Uganda's considerable hydro-electric potential (and possibly its petroleum resources), simultaneously increase the biomass resource base, and use the present resources efficiently This challenge has been taken up by government as evidenced by strategies and policies that have been iecently developed The overall policy objective of Government for the energy sector, as stated in the ministry's policy statement for the 1996-1997 financial year, will be to continue to improve the quality and quantity of energy supplies at least cost to the national economy, while also promoting efficiency and conservation of energy resources (MNR, 1996)

A number of advances have been made in the recent past to ensure adequate and reliable supplies of energy to the economy A Hydropower Development Master Plan is almost concluded, the Electricity Act (1964) is being amended to remove restrictions on the participation of the private sector in power generation, and a long-term energy sector reform project is about to start Efforts to introduce stop-gap measures using thermal generation in order to reduce loadshedding are now underway

8 1 2 Biomass Energy and Deforestation

Biomass (primarily fuelwood) is the main source of energy in Uganda It accounts for thirty times as much final end-use energy as electricity and petroleum combined (**Table 8 1**) In industry it accounts for nearly four times the delivered energy as electricity and petroleum combined The household sector is the biggest consumer of energy (87 8%), of which 98 0% is biomass-based energy The consumption of biomass energy is expected to remain high because of the high cost of modern energy, inefficient use of woodfuel, a high population growth (2 5% per annum) and a general lack of awareness by the community about natural resource conservation This has contributed to deforestation of Uganda's forests and bushlands Currently almost 1 2% of the total area of Uganda is degraded forest (FD, 1996) The situation has been made worse by the inability of UEB to supply reliable and cheap electricity, resulting in excessive charcoal use

Table 8 1 Final energy demand (effectively utilised energy), 1994 (in giga joules GJ)

Sector	Biomass	Petroleum	Electricity	Total	Percent
Household					
- Urban households	3,338,098	122,016	852,930	4,313,044	3
- Rural households	130,685,199	305,040	94,770	131,085,009	85
Sub-total	134,023,297	427,056	947 700	135,398,053	88
Industrial	7,086,853	915,120	1 193,400	9,195,373	6
Commercial	4,340,730	508,400	596,700	5,445,830	4
Institutional	3,770,120	152,520	280,800	3,810,332	3
Transport	0	381,300	0	381,300	0
Total	148,827,892	2,384,396	3,018,600	154,230,888	100
Percent	97	2	2	100	

Source *Environmentally-sustainable Development (ESD) Study, 1995*

The high cost of rural electrification also means that the rural population will continue to rely on woodfuel for a long time to come Less than 6% of the population has access to electricity, which results in increased pressure on forests Large institutions, such as hotels, schools and hospitals, also consume large quantities of woodfuel (**Table 8 2**) Since 1986, there has been increased demand for fuelwood/biomass in industries Uganda's tea production has doubled over the past three years

The tea factories consume over 30,000 tonnes of woodfuel for drying and fermenting (World Bank/ UNDP, 1996) The construction industry has grown at an average rate of over 7% since 1990 Brick and lime production have doubled over the past six years and accounted for about 230,000 tonnes of wood consumption An average of 2kg of wood is used per kilogram of lime produced
This is very inefficient and makes lime production the main industrial consumer of wood, accounting for nearly 650,000 tonnes of wood in 1994 Furthermore, over 16,000 rural Ugandans cure tobacco, most of them using the energy-inefficient "flue" curing method The sugar industry consumes nearly 100,000 tonnes of wood annually, while an estimated 40% of all fish is smoked over open fires, consuming an estimated 130,000 tonnes of wood The estimated biomass consumption in industries is shown in **Table 8 3** below

Table 8 2 Institutional woodfuel use, 1994 ('000 tonnes)

Institution	Woodfuel Used ('000 tonnes)
Schools	71
Prisons	8
Hospitals	8
Total	87

Source *ESD Survey and estimates 1995*

Table 8 3 Fuelwood consumption in Ugandan industries 1994 ('000 tons and GJ)

Industry	Tons ('000)	GJ ('000)	% Total
Lime	646	9,696	54 7
Bricks and Tiles	230	3,443	19 4
Fish	134	2,004	11 3
Sugar/Jaggeries	95	1,426	8 0
Tobacco	63	938	5 3
Tea	31	210	1 2
Total	1,198	17,717	100 0

Source *World Bank/UNDP, 1996*

Similar pressure on forest resources is exerted by the commercial sector where wood and charcoal are widely used in hotels, restaurants, breweries and bakeries (**Table 8 4**)

Table 8 4 Estimated commercial woody biomass consumption in 1994 ('000 tonnes)

Commercial establishment	Charcoal	Wood
Hotels restaurants & bars	100	192
Bakeries	0	31
Breweries	0	74
Total	100	297

Source *World Bank/UNDP, 1996*

The estimated sustainable supply of biomass is almost twice the level of demand for Uganda as a whole (World Bank/UNDP, 1996) This indicates that there is no nationwide fuelwood crisis But fuelwood crises do exist on a localised level Fuelwood shortages are especially pronounced around highly-urbanised areas, in the neighborhood of wood-using industries, and areas with high population densities coupled with agricultural land expansion (for example, Southern Kigezi region) Country-wide using an estimated demand growth of 3% per year, a supply surplus should persist well into the next century (World Bank/UNDP, 1996) To improve fuelwood supply in the deficit areas and sustain its availability countrywide, it is necessary to strengthen policies and legislation in the biomass sector Otherwise, there is a danger of the situation eventually degenerating into a real national crisis

Government, NGOs and the private sector have responded to the shortages through a number of measures, more especially tree planting and dissemination of improved stoves The National Tree Planting Programme was launched in 1992 Furthermore, agro-forestry and peri-urban plantations have gone a long way towards alleviating the shortage of woodfuel in particular areas By April 1996, approxi-mately 1770 hectares had been established by the peri-urban plantation programme in Mbale, Arua, Mbarara, Tororo, Kampala and Jinja A further 1232 hectares are private woodlots The number of NGOs working in the field of energy in Uganda has also increased More especially, they are involved in public awareness, tree planting and efficiency in woodfuel use A recent Forest Department survey indicated that at least 100 schools and hospitals have installed energy efficient institutional stoves since 1991 (World Bank/UNDP 1996) With the new stoves, a 30-40% reduction of woodfuel use has been recorded (World Bank/UNDP 1996)

- **Emissions due to Biomass Combustion**

The combustion of biomass in households, industries and institutions, among others, is largely done using inefficient technologies In the household sub-sector, the three stone fire is almost exclusively used in the rural areas In urban areas, the most common stove is the inefficient traditional metal "sigiri" with an efficiency of approximately 24% Although biomass combustion contributes carbon dioxide to the atmosphere, the positive balance on sustainable biomass supply implies that the result-

ant net greenhouse gas effect is nil Biomass combustion in the traditional rural kitchen is a threat to the health of rural people, especially women and children who are responsible for cooking The traditional three stone fire makes the kitchen environment smoky The smoke contains toxic substances that can cause morbidity and sometimes mortality

Although no tests have been carried out in Uganda to quantify the extent of the impact of biomass combustion, studies carried out in other countries like Nepal, Zimbabwe, Gambia, Papua New Guinea and India have found a strong correlation between prolonged exposure to smoke and acute respiratory infection in children and chronic lung disease and cancer among women who have cooked on biomass stoves for many years Over the last few years the Department of Energy and several NGOs, have developed and implemented an improved rural stove dissemination strategy that is cost-effective for the rural population It is based on the training of trainers in user-built stoves with materials obtained from their own backyards The stoves have a chimney that minimises smoke presence in the kitchen environment

8 1 3 Electricity Generation, Transmission and Distribution

Hydropower constitutes Uganda's greatest energy resource for economic development Its potential, estimated at over 2000 MW, is concentrated along the River Nile Twenty-two small hydro sites (0 5 to 5MW) have also been identified elsewhere, especially in the hilly western parts of the country Currently Uganda depends on a single hydro-power source, the Owen Falls Power Station (OFPS), at the source of the Nile in Jinja The OFPS was opened in 1954 with an installed capacity of 150 MW The economic decline of the 1970s and early 1980s to a large extent destroyed the generation, transmission and distribution infrastructure The dam, powerhouse, generators and the transmission facilities have undergone intensive rehabilitation over the last few years The installed capacity has also been raised to 180 MW A second power plant, the Owen Falls Extension (OFE), with an installed capacity of 200 MW, is under construction, and the first two machines of 80 MW (2 machines x 40 MW) are to be commissioned in 1999 Most of the electricity is consumed by the residential and the service sectors In 1995 alone, residential consumption accounted for 55% of the total energy billed, commercial 25%, industrial 20%, and street lighting and others 1%

8 1 4 Major Sub-sector Issues

i) **Insufficient capacity to meet energy demand**

Despite the uprating of the OFPS, increased economic activity since 1991 has resulted in a significant shortfall of power in Uganda In the latter half of 1996 loads of up to 40 MW have been load-shed on a daily basis This occurs at peak time (6 - 10 p m) Recent studies (Kennedy and Donkin, Dec 1996) show that the commissioning of the OFE will only alleviate supply shortages, but will not eliminate the loadshedding problem The predicted best case growth is such that demand will continue to exceed generation capacity until the next hydropower station after the OFE

ii) **High System Losses**

Losses on the electricity network are high Technical losses are estimated at 25% of generation sent-out values, while non-technical losses (administration, meter losses, theft) are estimated at 10% (Kennedy and Donkin, Dec 1996) This situation is illustrated in **Table 8 5**

iii) **Poor Performance of Uganda Electricity Board (UEB)**

The performance of a utility is measured against the quality of service to its customers UEB's quality of service has been largely poor The main problems include inadequate metering, poor billing, low collection of revenue resulting into very high accounts receivable, poor customer data base, and a high personnel-to-customer ratio These problems have been manifested in UEB's poor financial situation, which has hampered its ability to meet its obligations, like repayments of debts, improvement of the utility's infrastructure and rural electrification Other problems include frequent outages and brown-outs, though these have been reduced due to the system rehabilitation that has been going on

iv) **Electricity Tariff**

Since the pricing of electricity in Uganda is based on the principle of long-run marginal cost (LRMC), which considers both the investment cost (into the OFE project) and the cost of electricity production (Ushs /kwh), the average tariff is high (about US$ 9 cents/kwh) There has been a general outcry about the tariff structure and its potential long-term impact on the environment, especially the increased use of charcoal for cooking

Interventions

The Government has recommended and instituted certain measures to ensure that there is adequate power to meet demand, and that the electricity supply is reliable and will meet future national needs These are

i) **Liberalisation** of the electric power sub-sector to allow entry of private sector developers The proposed amendment of the Electricity Act (1964) and the long-term regulatory and legislative reforms, which are to be embarked on with NORAD assistance, will be the framework for this liberalisation As a result, three independent power producers, Nile Independent Power (NIP), Arab International Construction (AIC) and NORPARK are at various stages in the preparation of the development of three hydropower stations, namely, Bujagali, Kalagala and Karuma, respectively along the R Nile

ii) **Reform of UEB**

Government is implementing measures to ensure viability of UEB These include

internal restructuring to improve both financial and management performance,

technical measures to improve energy losses and peak power demand, includ ing prepayment metres, ripple control, shift of hours of operation by industries, and customer registration,

proposal to unbundle UEB vertically to have separate profit centres for generation, transmission and distribution respectively,

proposal to put distribution either (a) under a management contract, or (b) com plete privatisation, and,

corporatisation of UEB with government having majority shareholding

Table 8 5 Transmission losses as percentage of total generation, 1987-1995

Year	Total Units Generated (GWH)	Transmission Losses* (GWH)	% loss
1987	611 2	96 9	15 9
1988	567 4	194 7	34 3
1989	660 9	227 3	34 4
1990	738 0	231 4	31 4
1991	785 0	115 7	14 7
1992	994 3	225 7	22 7
1993	977 3	238 4	24 4
1994	1057 4	268 2	26 3
1995	1057 4	342 3	32 4
1996	1098 1	na	

n a =Figures not available

Source *Adapted from Uganda Electricity Board (UEB) Records 1996*

iii) **Emergency thermal plant**
To meet the growing deficit and stop loadshedding, efforts are underway to install a thermal generating plant in Kampala as an interim measure before completion of the OFE

8 1 5 Environmental Implications of Power Sub-sector Development

Uganda's dependence on hydropower means that the generation of electricity is not accompanied by the emission of greenhouse gases and other noxious fumes, a common problem for countries that depend on thermal power generation Uganda is planning to construct large reservoir plants to meet growing energy demand along the River Nile In particular, private power developers have already earmarked the sites at Bujagali, Kalagala and Karuma (Kamdini) Other sites with huge potential are Murchison Falls and Ayago Environmental effects expected to be associated with these developments will include relocation of populations in inundated areas, destruction of biodiversity, impairment of fish migration, inundation of farmland, eutrophication of reservoirs, and reduced downstream water quality Mini and decentralised micro-hydro sites are also planned to meet mainly rural energy demand In their case accompanying impacts are usually minimal compared to the large dams

The construction of dams on sites like Murchison Falls, Ayago and Muzizi, which are in locations rich with wildlife, is likely to disrupt migratory routes of the wildlife as well as result in loss of habitat due to the inudation The small-scale schemes planned for Ishasha, Paidha and Muzizi are in areas which are heavily populated These developments may force the populations to relocate to upland areas There could also be an influx of people settling in the developed areas, thus reinforcing the population in the watershed areas This may result into watershed degradation and deforestation in the vicinity of the hydropower plants, thus increasing soil erosion and decline in land productivity

Excessive weed and algal growth may occur in reservoirs following the construction of dams, especially on the small schemes Weeds and algal mats can clog dam outflow and increase water loss through transpiration Also water released from turbines into downstream waters could be deficient in oxygen, contain hydrogen sulphide and have a lower pH These characteristics are common in below-surface waters of reservoirs with weeds and algal mats as a result of the vegetation collapsing, sinking and decaying on the reservoir bed

8 1 6 Petroleum Resources

Imports and Exploration

Uganda imports all the petroleum it needs, although efforts are underway to explore oil reserves Three main sedimentary basins have been identified in Western Uganda and others elsewhere in the country Only aeromagnetic, gravity and surface geological surveys have been done Seismic surveys and exploratory drilling in the Albertine Graben of the rift valley are to begin soon by a British Company, Heritage Oil

Petroleum products constitute approximately 4% of the total energy consumed in the country The transport sector accounts for approximately 76% of all petroleum products consumption Product share of the market is as follows petrol 43%, diesel 31%, kerosene 11%, aviation fuel, 8%, and fuel oil, 7% Liquid Paraffin Gas (LPG) and industrial diesel are negligible on the Ugandan market Petroleum imports have increased by approximately 61% over the last decade, despite the fact that taxes on the products were more than doubled in 1989 and have had an upward trend subsequently While high petroleum pump prices are a disincentive to high fuel consumption and, therefore, should encourage conservation, the high increase in consumption in the decade is an indicator of the increase in the vehicle fleet in the country

Environmental Impacts of Petroleum Consumption

The main environmental impacts of petroleum consumption in Uganda include air pollution from gaseous emissions of vehicles and aircraft exhausts, greenhouse gas (GHG) emissions and their contributions to global warming, ground and water pollution, and environmental disaster risks from unsafe storage of petroleum products (AEP, 1996)

GHG Emissions

GHG emissions are mainly generated by vehicles in Kampala where the main fleet is concentrated and traffic jams are a common feature, especially during morning, mid-day and evening rush hours Although there has been a drastic improvement in the condition of vehicles in recent years, the majority of imported vehicles are second hand, their efficiency is low and they are prone to above average emissions Vehicle maintenance culture in Uganda is still poor, thus the common sight of vehicles emitting dark smoke from incomplete combustion On a global scale, however, Uganda's contribution to global warming is negligible because of its small petroleum consumption, which is low even compared to that of developing countries

Ground level Pollution

Ground level pollution in Uganda results from oil spillage and improper disposal of waste fuel and lubricants In particular, rivers, water channels and streams which are adjacent to garages are often heavily polluted Some of the streams passing through Kampala City empty directly into Lake Victoria without any water treatment and contribute to the pollution of the lake

A few incidences of spillage during transportation on water ways, rail and roads have occurred creating pollution on water and land Examples include a derailed goods train that spilled over 200,000 litres of petrol near Kampala in 1995, a lorry tanker that overturned in Bunyaruguru, Bushenyi district spilling about 18,000 cubic metres of petrol and polluting a nearby river and its banks

8 1 7 Development of Alternative Energy Technologies (AETs)

Uganda is richly endowed with renewable energy resources including plentiful biomass (including agricultural residues), hydrological resources, and favourable solar conditions (World Bank/UNDP, 1996) Considerable government, donor, NGO and private sector interest has been shown over the past 15 years in developing Uganda's renewable and traditional energy sector Unfortunately, these efforts have been generally uncoordinated and *ad hoc* The development of AETs has, for long, been hampered by inadequate financing by government and other donor agencies, and the lack, on the part of the community, of knowledge and awareness about the existence and potential of such technologies AETs currently applied in Uganda include small (mini and micro) hydros, improved woodfuel stoves, biogas, solar Photo Voltaic (PV), solar thermal technologies (water heaters, driers and cookers) and wind water pumps

The major issues in the development of AETs include

- lack of baseline data on renewable energy sources,
- lack of an integrated national energy policy that identifies the feasible niches for the development of AETs,
- low level of renewable energy technical and maintenance skills, and,
- inadequate dissemination and commercialisation strategies

8 1 8 Biomass Technologies

Improved Cook Stoves

At least 18 separate projects have been undertaken involving improved cook stoves since 1984

Unfortunately few concrete or long-term benefits have resulted from these efforts (MNR, 1994) It is reported that about 15% of homes in Kampala and 10% outside Kampala use improved charcoal stoves (World Bank/UNDP, 1996) The slow dissemination is attributed to lack of a uniform or organised strategy for marketing improved stoves at household level There are no awareness programmes for customers and no organised retailer outlets The producers depend on customers coming to them, yet, there is competition from the cheaper traditional stoves Moreover, there is lack of funding for improved stove production and dissemination (Turyahikayo, et el 1995)

Biogas Technology

Three biogas programmes have been undertaken since the early 1980s Several individual initiatives by local biogas technicians have been made, for example, four small demonstration biogas digesters were installed in Karamoja in 1991-1992 There is no inventory of these initiatives, but it is evident that performance of biogas technology has been very poor The main hinderance to wider dissemination is the high capital and maintenance costs and competition from cheaper wood and electricity

Biomass Briquetting Technology

Three major attempts at briquetting have been made by Falcon Industries, Black Power and Busoga Growers Cooperative Union since 1984 Dissemination has been hampered by high production costs and, therefore, competition from cheaper wood-derived charcoal, and lack of technical and marketing expertise However, simpler technologies mainly by NGOs like the Uganda Small Scale Industries Association (USSIA) and womens groups like Young Womens Christian Association (YWCA) are doing reasonably well

8 1 9 Solar Energy Technologies

The dissemination of solar PV technology over the decade 1982-1992 was very low, especially for private users Most of the systems disseminated were for institutional use through government projects, as indicated in **Table 8 6**

Photovoltaic (PV) rural lighting has had very slow progress, standing at 105 units by 1992, compared to Kenya, which had disseminated over 10,000 domestic lighting kits However, there have been encouraging developments in the dissemination of PV systems since 1992 for solar home systems with two projects by Habitat International in Kasese and the Uganda Rural Development and Training (URDT) in Kibale In recent years NGOs and private companies have in general been more vigorous than government in exciting the market The tourism sector is also expanding the use of PV in and around national parks

The Department of Energy is to start implementing a solar PV project, the Uganda PV Project for Rural Electrification (UPPPRE), which aims to develop a sustainable market for solar PV systems using innovative financing mechanisms that would make the technology more affordable There are no data available on the local manufacture of solar ovens and water heaters *(Turyahikayo et al, 1995)* There is also a lack of awareness on their merits and availability due to lack of funds for demonstration and extension This is coupled with lack of legislation to encourage use of solar energy technologies

8 1 10 Wind Energy

The use of wind energy has been virtually restricted to the remote and dry region of Karamoja where 12 wind waterpumps are installed However, their proper functioning and the dissemination of the advantages of wind energy suffer from lack of skilled labour, basic data and significant efforts by government and the private sector to develop the resource

8 1 11 Environmental Impacts of Renewable Energy

Renewable energy technologies (RETs) are environmentally benign Worldwide they are receiving intense interest In Uganda, the main renewable energy technologies that have received appreciable focus in Uganda are solar, biogas and woodfuel stove technologies All them promise positive environmental benefits

Table 8 6 Solar photovoltaic (PV) applications in Uganda (1982 - 1992)

	Lighting	Water Pumping	Communications	Refrigeration	AnnualTotals	Cumulative totals	Annual (KW)	Cumulative (KW)
1982								
1983			2		2	2	1 780	
1984			4		4	6	4 576	6 356
1985						6		6 356
1986			10	21	31	37	5 020	11 376
1987			25	50	75	112	22 880	34 256
1988	1		13		14	126	3 110	37 366
1989	4		24	67	95	221	20 270	57 636
1990	13		30	53	96	317	18 854	76 490
1991	14	1	26	2	43	360	9 622	86 112
1992	73	1	59	45	178	538	64 400	150 51
Total	105	2	193	238	538	538	150 51	

Source *Division of NRSE, Department of Energy, MNR (1995)*

Solar Energy

In Uganda, government is making efforts to expand rural electrification using solar PV technology to replace kerosene and diesel engines Since solar energy use produces no emissions, its contribution to GHG build-up in the atmosphere is nil Also the users' quality of life is improved due to the removal of smoky lanterns and candles For example, an 8 Wp PV lantern used in place of a kerosene lantern operating 1600 hours per year (about 4° hours per day) at 0 08 litres per hour reduces carbon dioxide emissions by 320kg per year Widespread use of solar water heaters in homes and institutions could also reduce the need for more capacity development for electric power generation, thus reducing impacts associated with increased large scale hydropower stations, and also cut down on the amount of woodfuel for boiling water in rural and urban poor households

Biogas

Biogas technology has the potential to reduce methane (the volatile component of biogas which is a GHG) emissions and improve sanitation problems Uganda has a wide range of feedstocks for biogas generation, including domestic animals (cattle, goats, sheep, pigs, chicken), human waste, domestic wastes (such as banana peelings), industrial waste (for example waste water and solids like molasses), and municipal wastes All these decompose and produce methane as well as posing disposal problems Several programmes for biogas development have been attempted with negligible success A feasibility study for a pilot project to produce biogas from molasses at Kakira Sugar Works has been completed and looks promising

Problems that have hampered the development of biogas in Uganda include the following

- Free ranching is not conducive to biogas production because of the labour needed to gather the required amount of feedstock (dung) Zero-grazing is the most convenient method, though it is still practiced on a very small scale

- Socio-cultural beliefs While human faeces form a good biogas feedstock, there are cultural barriers to feeling comfortable cooking with gas generated from human waste

- High investment costs

- High sensitivity of the benefit/cost ratio of using biogas to the cost of fuelwood, which is virtually free in the rural areas

- ***Woodfuel Stoves***

The dissemination of improved woodfuel stoves has three main impacts

i) conservation of forests/biomass resources,
ii) improvement in the health of rural women and children, and,
iii) reduction in the build up of carbon dioxide in the atmosphere

8 1 12 Energy Conservation

In a developing country like Uganda, which depends heavily on biomass fuels, imported petroleum products, and loans for energy investments, the desired energy conservation policy objectives must include the following

- reduction of balance of payments deficit by minimising energy investment costs and reduction in energy imports,

- conserving forests/biomass resources and minimising environmental degradation,

- minimising local and regional pollution, and,

- improving the socio-economic welfare of the population

In Uganda, the dominance of the residential sector in energy consumption (about 55% of total electricity consumed) makes it the first candidate for energy conservation measures There have been improvements in the electric power system due to the on-going rehabilitation under UEB's Second and Third Power Projects and a more concerted vigilance by UEB on the distribution system to flush out illegal users Nevertheless, there is a need for a comprehensive demand-side management strategy to reduce wastage in consumption This strategy would include efficient metering and billing to discourage irrational use of electricity, introduction of more efficient end-use appliances (for example, replacing incandescent bulbs with fluorescent lights), and dissemination of energy conservation information through the electronic and print media If a conservation strategy covering residential, commercial and industrial sub-sectors can be instituted soon enough, the outcome could be a saving that would be an

obvious alternative to increased generation As stated above, a thermal generator is planned to reduce loadshedding in Kampala

Continued emphasis on energy efficiency ultimately reduces requirements for further investments Energy conservation in the biomass sub-sector has concentrated on the dissemination of commercial stoves by NGOs and small enterprises, with more results in institutions than in households There have also been some efforts to sensitise and train rural women in matters of woodfuel production and utilisation, including the production of low-cost mud stoves For instance, the Department of Energy has conducted training workshops in the five districts of Hoima, Kabale, Rakai, Kamuli and Soroti for over 200 women, youths and district extension officers Notable achievements have been the improvement in the kitchen environment by reducing smoke, the savings in woodfuel quantities, and less time spent on cooking and associated activities This has contributed to improved welfare of the rural people

Woodfuel is the main source of energy for Uganda's industries and commercial activities This is another sector that needs particular attention Lime production is the second biggest cause of forest depletion next to charcoal (World Bank/ESMAP, 1996) The Department of Energy has carried out preliminary studies on energy consumption in lime kilns in Tororo The lime production process has been found to be inefficient mainly because of poor kiln design, use of wood with a high wet basis and generally poor operational practices

Tobacco curing creates local woodfuel scarcities in the areas surrounding the industrial locations Following encouraging results of a pilot project in the late 1980's to improve the efficiency of tobacco curing barns, the British American Tobacco Company (BAT) has disseminated a number of improved barns and encouraged the planting of woodlots by the tobacco producers Other industries that utilise biomass energy, but where almost no efforts have been made to improve energy efficiency, include brick and tile, tea drying, fish smoking, and sugar production

8 2 CLIMATE CHANGE

8 2 1 Climate Change in Uganda

Climate change refers to the long-term change of one or more climatic elements from a previously accepted long-term mean value Global changes in climate are expected to have major impacts on health, socio-economic development and the environment

This SOER examines climate change in terms of the following issues climate variability, global warming and ozone layer depletion

8 2 2 Climate Variability

One important aspect of climate change is climate variability, a phenomenon that can be devastating in the short term Climate variability is the sharp, short-term variations of meterological events as compared to their long-term mean The 1994 drought that affected 16 of the 39 districts in the country was a result of climate variability Uganda's rangelands and dryland are particularly prone to severe climatic events

Persistent droughts resulting from prolonged dry seasons and the general increase in surface regime temperatures, and often mistaken to be indicators of global warming, but are actually mere infant manifestations of climate variability Other climate anomalies such as flooding due to flash storms, cases of hailstorms, and shifts in seasons are of growing concern particularly for Uganda s agriculture

In Uganda aspects of climate that are of particular concern are the amount, incidence and duration of rainfall In some years, monthly rainfall amounts are below normal, leading to drought In others, monthly averages exceed the long-term average values leading to excessive water supply, resulting in floods, landslides, the washing away of roads and bridges, soil erosion and silting of dams and reservoirs While the absolute quantity of rainfall is important, of equal concern is the ability of soils to retain moisture which in turn is governed by potential evapo-transpiration (PET) Where PET exceeds the amount of rainfall received by an area, the soils experience moisture deficit This has been the cause of the high incidence of recurrent drought which has had severe impacts, particularly in the area known as the "cattle corridor" Drought occurrence is also known to extend westwards as far as the districts of Kabarole and Kibale and sometimes Kasese, Hoima, Masindi, Lira, Soroti and Kumi districts

The climate of Uganda is influenced by local moisture convergence zones that combine with surface temperatures to produce rainfall As the Inter Tropical Convergence Zone (ITCZ) shifts eastwards ,the western parts of Uganda are known to experience severe droughts The converse is true for the eastern parts of the country The dry areas of the Sudano-Sahelian region which extend to the north-eastern parts of Uganda, are characterised by limited and irregular rainfall These drylands areas have unpredictable rainfall and at times severe drought

Uganda has responded to climate variability in a variety of ways Some of the key responses include

National Study on Drought and Desertification as part of the Inter-governmental Negotiating Committee on Drought and Desertification (INCD) process which culminated in the formulation of a specific convention to combat drought and desertification This process examined the physical, climatic and socio-economic features of drylands areas
National Action Plan to Combat Drought and Desertification is currently being formulated as a follow up to the case study

Capacity-building in the Department of Meteorology to improve the early warning capability of the country

8.2 3 Global warming

Global climate warming is largely the result of the capacity of certain long-lived industrially and agriculturally-generated atmospheric trace gases (CO_2, CFCs, halons, CH_4, N_2O, and tropospheric ozone) to absorb some of the terrestrial radiation[1] Globally, rapid socio-economic development has led to an increase in the demand for fuel for energy, transport, industry, and to run institutions and homes Since the industrial revolution, the release of greenhouse gases (GHGs) and suspended particulate matter (SPM) into the atmosphere has tremendously increased with dire impacts on human health and the environment Combustion of woodfuel, charcoal and petroleum products releases

carbon dioxide (CO_2), carbonmonoxide (CO), sulphurdioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOCs), and water vapour into the atmosphere In addition, organic combustion

releases SPMs which range in size between 0 005µm and 100µm Their effects on health depend both on the depth of penetration (inhalation), deposition and retention in the lungs[2] SPMs include smoke, soot and dust particles They are extremely toxic if they contain heavy metals or hydrocarbons

GHGs are responsible for global warming (GW) in that they absorb long-wave terrestrial radiation reflected during the day from the earth's surface This brings about an increase in "sensible heat" energy within the atmosphere, with the net effect of raising atmospheric regime temperatures, particularly if they are not dispersed by wind SPMs in large concentrations within the atmosphere are responsible for blocking out the sun's rays and trapping heat in the lower atmosphere This is most evident during relatively cool days or evenings, particularly in regions surrounded by hills, where they appear as smog

8 2 4 Issues pertaining to GHG emission

The main issues related to GHG emissions are

inefficient utilisation of fuels Poorly-planned modes of transport, poorly-serviced motor vehicles, inefficient cook stoves and fire places, and rudimentary kilns and stoves in industries contribute to GHG emissions During charcoal production, significant amounts of carbon dioxide and other trace GHGs (SO_2,NO_x CO, N_2 O and various hydrocarbons) are released into the atmosphere in smoke and fumes The emissions released depend on the biomass type, amount consumed in the combustion process, carbon content and burning efficiency

massive deforestation and general biomass removal is still widespread, reducing natural carbon dioxide sinks and increasing GHG emissions through decomposition Conversion of forested lands and grassland areas to cropland releases carbon dioxide and GHGs through vegetation loss Methane (CH_4) uptake by the soil is reduced, while emissions of carbon dioxide, methane, nitrous oxide and carbon monoxide are increased

Change in vegetation cover affects land surface albedo, altering radiation balance and microclimates Lowering the albedo results in increased terrestrial radiation which increases atmospheric temperatures during daytime

widespread bush burning in Uganda contributes to carbon dioxide emissions seasonally Annual emissions are, however, considered to be negligible as new growth of biomass acts as a sink Such agricultural practices as the slash-and-burn method used to clear land in the rural and peri-urban areas and during the planting season marking the end of the dry season are common

Lack of data on emissions due to inadequate funds to carry out studies of current emissions and estimate past levels

Lack of atmospheric pollution monitoring stations rendering it impossible to monitor both current and background GHG/CFC emissions

GHG emissions for biomass burning are determined through the total carbon released and the emission ratios for the trace GHGs (CH_4, CO, N_2O, and NOx) to carbon dioxide in the smoke[3] Methane (CH_4)

is released by ruminant livestock (e g cattle, goats, sheep, pigs and poultry) and other wood-consuming organisms (e g termites) Bacterial fermentation of livestock manure and anaerobic activities occurring in wetlands and rice paddies are another source of CH_4

Uganda is considered a net sink for GHGs due to its vast biomass resources However, the loss of forest cover and other vegetation as well as wetland drainage are a real threat to these natural sinks Although "The Prohibition of Burning of Grass Decree No 4, 1974" is still in force, regulations and bye-laws need to be enacted and enforced by local governments Public awareness efforts also need to be enhanced

8 2 5 Uganda's response to Climate Change issues

In response to climate change issues, the following actions have been taken

- Uganda is implementing the United Nations Framework Convention on Climate Change (UNFCCC) signed on June 13, 1992 and ratified on September 8, 1993 The Convention came into force on March 21, 1994

- The Greenhouse Gas Inventory was completed under UNEP-GEF funding

- The United States Country Study Programme has supported the development of "Uganda Climate Change Country Study" which addresses the issues of vulnerability assessments in the agriculture, forestry and water resources sectors and the identification of mitigation and adaptation options to respond to climate change This study is on-going

- The implementation of Activities Implemented Jointly (AIJ) is planned This covers afforestation, agro-forestry, power plants, energy-saving mechanisms at rural levels and assistance to industry to mitigate release of carbon dioxide AIJ is expected to provide an excellent opportunity and entry point to implement priority environment protection activities The Ministry of Natural Resources is the focal point for AIJ in Uganda

8 2 6 Protection of the Stratospheric Ozone Layer

Ozone is a naturally-occurring gas found in the stratosphere (between 10 and 50km above the earth's surface) Ozone is produced photochemically by the dissociation of oxygen molecules by the intense ultra-violet radiation from the sun Single oxygen atoms (O) combine with other oxygen molecules (O_2) to form ozone (O_3) Ozone absorbs short-wave ultraviolet-B (UV-B) radiation, in the process of which the ozone molecule is broken down (dissociated) again to O and O_2 In this way, an equilibrium is achieved between the rates of ozone creation and destruction Under normal circumstances, there is a natural balance between the ozone's production and its destruction with a net ozone surplus sufficient to absorb most of the solar ultraviolet-B radiation

Most of stratospheric ozone layer is at present between 17 and 25km Introduction of chemicals that increase the rate of conversion of O_3 back to O_2 allows the UV-B to penetrate the atmosphere and reach the earth's surface The stratospheric layer has an important protective role against the incoming solar ultraviolet radiation through the absorption process UV-B radiation, despite some positive influences on the human body, can also cause sunburn, eye cataracts, skin ageing and other skin problems

It can suppress the body's immune defences against diseases and also adversely affect plant growth and plankton formation

Substances such as chloroflourocarbons (CFCs), halons, methyl chloroform, carbon tetrachloride and methyl bromide destroy ozone Some ozone-depleting substances have long atmospheric life times Some of them, such as CFC-12 and Halon 1301, are able to stay in the atmosphere for more than 100 years

The term "**ozone depletion**" refers to destruction of ozone by substances originating from anthropogenic sources Measurements of the total ozone concentration confirm that ozone layer depletion has increased with increasing consumption, use and production of the above substances

8 2 7 Uses of Ozone-depleting Substances in Uganda

The current consumption of controlled substances is estimated at 26 6 tonnes Total consumption is estimated to increase from about 14 8 tonnes in 1991 to about 37 4 tonnes by the year 2010 Much of the increase is expected to be in the consumption of CFC-12

Refrigeration and Air Conditioning Sector

Uganda does not produce any controlled substances but imports CFC-12, CFC-115 and negligible amounts of CFC-11 as well as refrigerators using these substances All the CFC-12 imported is for use in servicing refrigeration and air conditioning equipment CFC-11 is mainly imported for servicing of central air-conditioning systems

Industrial Refrigeration Systems

All the CFC-115 imported is part of refrigerant R-502 which is used in some industrial refrigeration systems Industrial refrigeration systems include cold rooms and stores (using CFC-12, HCFC-22 and R-502) Milk coolers (using HCFC-22 and CFC-12), ice plants (soft drink/beer bottling industries) and fisheries have various types of ice makers, ice banks and ice water plants All this equipment uses HCFC-22 or ammonia as the refrigerant Soft drink bottling industries have carbon dioxide coolers which use R-502 or HCFC-22, air driers use HCFC22, and chillers use HCFC-22 There are a number of cold rooms, fish-freezing plants and milk coolers, as well as some large central air-conditioning systems that are currently not in operation, but are expected to be reinstalled as the economy improves This equipment contains a lot of refrigerants, and there is a high possibility that these leak into the atmosphere as the equipment is not routinely maintained

Aerosols Sector

All aerosol sprays are imported Most of the sprays are not labelled to show the propellants used While some sprays may have hydrocarbons, a lot more may have CFCs as propellants

Solvents Sector

Small quantities (less than 1 tonne annually) of carbon tetrachloride are imported and used mainly as laboratory solvents The main users include universities, schools and textile industries There are several dry cleaning companies in Uganda but none uses controlled substances The common dry cleaning agent is perchloroethylene Apparently no methyl chloroform is used

Halons Sector

Only a negligible amount of halons is imported as bulk chemicals for refilling halon fire extinguishers,

but there are considerable amounts of halons contained in portable fire extinguishers in the country There are also fixed systems of halon fire extinguishers, especially in hotels Several companies deal in servicing, refilling, importing and selling portable halon fire extinguishers

Foams Sector

There are ten foam factories manufacture flexible polyurethane foam All use water as the sole blowing agent

8 2 8 Uganda's Response to Control of Ozone-depleting Substances

In meeting the requirements for a step-wise phase-out of controlled substances by the year 2010 as required by the Montreal Protocol, the consumption of controlled substances will have to decrease from 14 8 tonnes in 1991 to zero consumption by 2010 Highlight of the protocal give in Box 8 1 The responsibility for implementating the international agreements is assigned to the National Environment Management Authority Over the years, Uganda has actively participated in the various fora of the Convention and Protocol as follows

At international level, Uganda was elected as member of the Implementation Committee under the Non-Compliance Procedure for the Montreal Protocol for two consecutive terms (each term is for a duration of two years), the first term as Vice-Chair and Rapporteur

Uganda also served as Vice-President of the Bureau of the Seventh Meeting of Parties to the Montreal Protocol representing the Africa Region on the Bureau in 1995-1996

Uganda is currently a Co-opted Member of the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol and will become a full member of the Committee in 1998-1999

At regional level, the country is an active member of the Network of ODS Officers for English-speaking African countries (ODSONET AF/E)

Uganda in 1996 participated in the UNDP Regional Survey on Methyl Bromide in Africa

The Uganda Country Programme for the Phase-out of Ozone-depleting Substances under the Montreal Protocol was prepared in the period February 1992 to June 1994 and implementation is on-going and is highlighted in **Box 8 2**

A Project on Institutional Strengthening for the Implementation of the Montreal Protocol in Uganda is being implemented through UNEP

A Project on the Implementation of a National Programme for Recovery and Recycling of Refrigerant has been approved and is to be implemented through UNDP

Box 8 1
Global action to reduce ozone depletion

Global action to reduce ozone depletion began in 1977 when the World Plan of Action on the Ozone Layer, a programme of international cooperation in research on atmospheric chemistry and modelling, ozone and radiation trends, health and environmental effects, and emission trends of ozone-depleting substances began

In March 1985, the Vienna Convention for the Protection of the Ozone Layer was adopted and came into force on 22 September 1985 The Convention underscored the urgency of taking measures to protect human health and the environment from the harmful effects of ozone layer depletion and also identified the main areas for further scientific research and cooperation as well as information exchange Under it, Protocols covering the regulatory and further actions would be adopted Uganda acceded to the Convention on 24 June 1988, and it entered into force for Uganda on 29 September 1988

The Montreal Protocol on Substances that Deplete the Ozone Layer was adopted in September 1987 and came into force in January 1989 The provisions of the Protocol were intended to directly reduce and/or phase-out following a timetable, the export, import production consumption and use of ozone depleting substances (ODSs) The Protocol required the production and consumption of CFCs -11 -12 -113 -114 and -115 to be frozen at 1986 levels and ultimately reduced to 50% of 1986 levels by 1998 Production and consumption of Halons 1211, 1301 and 2402 were to be restricted to 1986 levels Substances controlled under the Protocol are used in refrigeration air conditioning and heat pumps rigid and flexible foam, solvent cleaning, aerosol products, sterilisation fire fighting and a number of other miscellaneous uses, including use in tobacco expansion, leak detection, graphite purification as a dielectric fluid in linear accelerators for cancer treatment thermostats/thermometers and solar tracking systems The provisions in the Protocol recognise the special situation of developing countries These include a ten (10) year grace period in implementing the control measures contained in the Protocol and the provision of technical and financial assistance to achieve phase out Such countries are referred to as "Parties operating under Paragraph 1 of Article 5" of the Protocol To qualify, they must be developing countries, be Parties to the Protocol, and have an annual per capita consumption of CFCs and halons below 0 3 kilogrammes

Uganda acceded to the Montreal Protocol on 15 September 1988 and it entered into force for Uganda on 1 January 1989 Uganda operates under Article 5 of the Protocol In 1990 the London Adjustments and Amendments to the Protocol were adopted to expedite implementation The control measures were adjusted to provide for the phase out of CFC and halon production and consumption (but not use) by the year 2000 with some exemptions for production of halons for "essential ' uses An intermediate cut of 50% of 1986 levels by 1995 was also agreed for CFCs and halons together with an 85% cut (for CFCs but not halons) by 1997 These adjustments entered into force early 1991 In addition the list of controlled substances was extended and a timetable for their phase out given Carbon tetrachloride was to be phased out by the end of the century with an intermediate cut of 85% of 1989 levels by 1995 1 1 1 trichloroethane (methyl chloroform) to be frozen at 1989 levels from 1993 30% cut by 1995 and 70% reduction by 2000, and complete phase-out by 2005 Uganda ratified the London Amendment to the Protocol on 20 January 1994, and it entered into force on 20 April 1994

Box 8 2
The Country Programme for the Phase out of Ozone Depleting Substances

The programme surveyed the consumption and use of ozone depleting substances in Uganda existing policies and regulations which affect their consumption and use and future strategies and policies to reduce or phase out completely the use of the substances controlled under the Montreal Protocol

To implement the country programme a Project on Institutional Strengthening for the Implementation of the Montreal Protocol in Uganda was initiated in 1995 This is a three-year project funded under the financial mechanism of the Multilateral Fund and implemented jointly by UNEP/Industry and Environment and supervised by NEMA

Under the project, a National ODS Unit has been established to facilitate the expeditious implementation of activities under the country programme as well as of projects for speedy and effective phase out of controlled substances and to ensure effective liaisons with relevant institutions The ODS Unit also routinely monitors industries and collects data on consumption and use of ODSs in Uganda In addition the ODS Unit undertakes public awareness and information exchange programmes on ODSs, their substitutes and alternatives as well as on international assistance and cooperation

To assist and guide the implementation of the activities of the country programme and the operations of the ODS Unit an inter-disciplinary and multi-sectoral National Steering Committee for the Protection of the Ozone Layer was established Membership of the Steering Committee consists of line and sectoral ministries departments and institutions trade and industry associations as well as representatives from the Multilateral Fund's Implementing Agencies (UNDP, UNIDO and World Bank)

Another element is the formation of an association of professionals and institutions in the field of refrigeration and air conditioning with the broad objective of assisting in the smooth phase out of ODSs in the refrigeration and air conditioning sector The ODS Unit initiated in collaboration with UNDP in May 1995 the formulation of a project on recovery and recycling of refrigerants in Uganda to be funded by the Multilateral Fund

A Project on Implementation of a National Programme for Recovery and Recycling of Refrigerants in Uganda was formulated and is to be implemented from 1997 The following course of action is pertinent to ensure that the sectors which depend on refrigeration and air conditioning are not adversely affected by unavailability of refrigerants

a) to maintain systems in proper operating condition including tightening up of systems by finding and repairing leaks
b) to recover and recycle refrigerants and thereby clean them to new product specifications for re use before servicing the systems, as well as training on recovery and recycling
c) to select non-ozone depleting refrigerants and technologies for new systems being installed as the cost of CFC equipment is expected to rise as world wide CFCs production falls off rapidly and
d) to enhance public awareness and education programmes to bring about better refrigeration conservation programmes

Both technical and economic feasibility to phase out many applications of controlled substances in Uganda, like in all other developing countries will be contingent upon and demand adequate financial and technical assistance Additional time as well as information training and infrastructural change will be required It may also be necessary to preserve the useful life of capital investments still dependent on ODSs For example refrigeration and air conditioning systems are expensive capital investments with long product lives (of about 20 years) To ensure that these continue to function there is need to ensure continued supply of refrigerants This can only be done by recovery and recycling

8 1 Energy

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CHAPTER NINE

9 0 LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK AND ENVIRONMENT INFORMATION

9 1 Legal and Policy Framework

9 1 1 The Need for Reforms

Policy, institutional and administrative failures have the effect of reducing the value of environmental resources to society through wastage, poor pricing and outright lack of means of conservation These failures have existed in the past, and some may still exist However, faced with environmental problems and challenges for sustainable development, the government, private institutions, NGOs, donor agencies and individuals are each responding differently and within their means to address them The responses are many forms including

(i) legal and policy reforms,
(ii) institutional reforms and reorganisation,
(iii) empowerment through education, public awareness, information exchange and networking,
(iv) research
(v) application of incentives and disincentives, and,
(vi) international and bilateral cooperation

9 1 2 Historical and Legal Perspective

With the attainment of independence in 1962, Uganda adopted wholesale the colonial policies and laws governing environmental resources Resources which had once been communally owned became government property Most laws were geared towards specific resource uses, and the inter-relationship among them was not strongly emphasised In addition, at that time there was no attention paid to Biodiversity, EIAs, wetlands and community participation, either nationally or globally The constitutional backing was also weak And there was too much reliance on command and regulation and not enough on economic instruments, compliance was therefore poor

Realising the above problems, the present government adopted a participatory approach and ensured wide consultation nationally and, to an extent, internationally in the development of some recent laws Of particular note are the Constitution of 1995, the National Environment Statute, 1995, the Water Statute, 1995, and the Wildlife Statute, 1996 The latter two borrow much from the National Environment Statute, 1995, and are a testimony to the advantages of having such a comprehensive piece of environmental legislation

9 1 3 Constitutional Reform

Following wide-ranging consultations with all sectors of society since 1992, the government promulgated a new Constitution in 1995 Under this Constitution, the State has, under the National Objectives and Directive Principle of State Policy, a mandatory duty to promote sustainable development and public awareness of the need to manage land, air and water resources in a balanced and sustainable manner for the present and future generations In addition, the State also has a mandatory duty to protect important natural resources, including land, water, wetlands, minerals, oil, fauna and flora on behalf of the people

of Uganda Above all, the Constitution has secured a place for the environment among the fundamental rights and freedoms of all people by providing that every Ugandan has a right to a clean and healthy environment [1] The right is now inherent and guaranteed by the state Other important landmarks in the Constitution include involvement of people in the formulation and implementation of development plans and programmes that affect them, conservation of Bio-diversity and wetlands, and an enactment of laws to promote environmental awareness and preserve the environment from abuse, pollution and degradation In relation to the international treaties and conventions, the Constitution allows the President or any other person authorised by him to enter into any bilateral or multi-lateral agreement in respect of any matter It also empowers parliament to make laws to govern their ratification

As the supreme law of the country, the Constitution has caused some fundamental inconsistencies in some laws passed in the recent past For example, under the National Environment Statute 1995, the powers to bring legal action against anyone degrading or polluting the environment is vested in NEMA or local environment committees[2] The Constitution vests that power in every Ugandan Second, the Statute decentralised management of natural resources by vesting the same in district, technical and local environmental committees The Constitution, on the other hand, generally centralised all powers of management in the government This is perhaps understandable given the still limited perception of the range of values of natural resources and lack of capacity to handle the management issues under decentralisation Although it is still too early to assess the impact of the 1995 Constitution on environmental management, it is clear that it backs environmental management more strongly than previous constitutions

9 1 4 National Environment Statute, 1995

One of the important outcomes of the extensive consultation under the NEAP process was the enactment of comprehensive environmental framework legislation, the National Environment Statute, 1995 (Statute No 4 of 1995) This law, enacted to address the constraints and problems affecting environmental management as identified during the NEAP process, some of which are highlighted in **Section 9 1 2**, creates an enabling power which allows for thorough and holistic amendment to sectoral laws on environmental matters

The National Environment Statute, as is the case with the Bio-diversity Convention, addresses all aspects of biological diversity conservation and brings together all the sectoral environmental agencies involved in the management of the environment under one forum to take collective decisions on environmental matters This forum was created through the establishment of a Policy Committee on the environment whose function is, *inter alia*, to provide policy guidelines and formulate and coordinate environmental policies for the National Environment Management Authority (NEMA) NEMA, under the Statute, is mandated to supervise all matters related to the environment

The other important outcome of the NEAP process and the novelty of the National Environment Statute, 1995, is the focus on wetlands The law for the first time clearly addresses and provides for the management of wetlands (Section 38) It provides for restrictions on the use of wetlands (Section 37) and prescribes the penalty for default (Section 103) It empowers NEMA to set standards for the management of wetlands And it also provides for the issuing of guidelines and prescribing of measures for the conservation of biological resources both *in situ* and *ex situ*

The Statute provides other tools of environmental management which had hitherto not been employed One of these is the environmental impact assessment The Statute imposes a mandatory duty on a

project developer to have an environmental impact assessment (EIA) conducted before embarking on the project Provision is also made for an environmental impact statement or an environmental audit as tool for management

The Statute moves away from formative sanctions and promotes other methods, including the polluter pays principle and the issuance of an environmental restoration order against an offender The need for environmental assessments and freedom of access to any information relating to the Statute or the environment is also given legal recognition

In fulfilling its duty to promote public awareness as required by the Statute (Section7(1) (g)), NEMA is legally required to produce the State of the Environment Report biennially, districts are required to do so annually

Subject to article 286 of the Constitution, the Minister may give legal effect to a convention or treaty which Uganda has signed or ratified through Statutory order made with the approval of the legislature (Section 10) The section also empowers the Minister to amend, by Statutory order, any enactment, other than the Constitution in order to give effect to the Convention or treaty (Section 107 (1) (c)) With respect to principal legislation, this is a vital move, normally, principal legislations, that is, Acts or Statutes, are amended by an amending Act or Statute but rarely by a subsidiary law This is another novelty of the National Environment Statute, 1995, which further portrays its comprehensiveness in that it did not only cover the concerns of the Bio-diversity Convention in giving legal effect to that convention, but also covered other conventions as well It is hoped that this novelty will be maintained under the proposed Bill on the ratification of treaties and convention made under Article 123(2) of the Constitution

One such convention is the Montreal Protocol on Substances that Deplete the Ozone Layer (and its subsequent protocols) The Statute provides for the making of regulations, the issuance of guidelines and institution of programmes to eliminate substances that deplete the ozone lawyer The government of Uganda fully supports this Protocol in the Statute, creating an enabling power to make regulation to give legal effect to the protection of the ozone layers (Sections 51 and 52) The Statute provides for the issuing of guidelines and the institution of programmes intended to eliminate substances that deplete the ozone layer

Needless to mention, it would be difficult for all Ugandans to benefit from the National Environment Statute if there were not sufficient empowerment of ordinary citizens The Statute is innovative in that it empowers various categories of people and the general public For example, it is a legal requirement to incorporate environmental education into the school curriculum Steps are already being taken with the National Curriculum Development Centre to implement this Realising that much of the population is illiterate, both the Statute and the Constitution call for general environmental awareness programmes While the awareness strategies are being developed and implemented, the right of all categories of people to a healthy environment is guaranteed through the provision which empowers NEMA or a local environment committee to bring action on behalf of any other person whether that person has *locus standi* or not A general legal principle is that a person cannot bring action unless the action complained of has caused him or her personal injury This is another novelty of this Statute and greatly protects those who are not aware of their rights in such cases

Access to environmental information is guaranteed Statutory provisions seem to be necessary,

however, to define more specifically what information may be granted to any citizen and the procedures for obtaining it Greater participation is also ensured by the institutional design created by the Statute By providing for the establishment of a local environment committee as well as a district environment committee, a bottom-up approach from even the lowest level of the Local Council system is assured in the environmental decision-making process and implementation (Sections 16 and 17)

9 1 5 Effects and Implications of the National Environment Statute,1995

The NEMA Statute, as a framework umbrella law, was intended to bring about holistic and harmonised amendments to the existing sectoral legislation so as to address problems identified under the NEAP process with respect to environmental laws and policies Provision is therefore made in the Statute that any *"law existing immediately before the coming into force of this Statute relating to the environment shall have effect subject to such modifications as may be necessary to give effect to this Statute, and where any such law conflicts with this Statute the provisions of this Statute shall prevail"*

The Constitution, as the supreme law is not subject to this provision Also, a loophole which has already been exploited by the Water Statute, 1995, is that the provision did not expressly cover any law made after the NEMA Statute came into force In law, in case of conflict, a latter law is taken to have been made with full knowledge of existing laws and as such, any conflict means that the latter law has amended the earlier law There is an urgent need to plug this loophole before it is further abused

Barely two years old, the National Environment Statute has had the effect of providing a basis for the formulation of the Water Statute 1995, and the Wildlife Statute, 1996 These laws are detailed in **Section 9 1 8** It is important to note that a consultative approach, which will build on the experience of the NEAP process, was used in the making of these two laws The overall lesson emerging is that a well-thought out and comprehensive law on the environment is good for the country because it defines, in broad terms, the key environmental considerations that need to be integrated in subsidiary or sectoral laws From that point of view, the benefits of the NEAP process are already being felt in Uganda

However, the National Environment Statute and the population's growing awareness of environmental issues are creating new challenges for capacity building Threats of legal actions and legal cases concerning environmental issues are regularly reported by the media The courts are confronted with challenges to administer justice on a subject that has not been familiar to them Furthermore, the requirements for EIAs, environmental audits and monitoring, the state of the environment reports, environment action plans, and integration of environmental considerations in the development planning process imply capacity-building needs for NEMA staff, those of lead agencies, the judiciary, local government planning levels, NGOs and the private sector Perhaps the greatest threat of all to the effectiveness of the National Environment Statute is the change in government policy This favours investors and, hence, the balance between conservation and sustainable development at times swings in favour of the investor The lack of supportive regulations and sectoral support is another threat which needs to be addressed Sectoral managers are still reluctant to surrender their powers for collective efforts in conservation

The Statute provides that every person shall have freedom of access to any information relating to the implementation of the Statute Besides, it stipulates that the environmental impact statements shall be public documents and may be inspected at any reasonable hour by any person These provisions are calling for administrative guidelines on how people's rights to such information may be exercised These need to be developed and adopted, either through legislation or administratively

The government is now encouraging investors It is possible that some of them are or will be insured under the Multilateral Investment Guarantee Agency (MIGA) MIGA was established in 1985 to cater for the interest of capital exporting and importing countries It is controlled by both home and the host states, developed and developing countries As part of government policy to boost and attract foreign investment, Uganda became a member of MIGA in 1992 MIGA insures risks which include expropriation, currency transfers, breach of contract and civil strife

MIGA acts as an insurance arrangement internationally for foreign investors The concern is that when an investor breaches the EIA contract with NEMA or any lead agency or when Uganda seeks to ban the dumping of environmentally-unfriendly technologies in the country, MIGA can exercise financial and political sanctions against Uganda as it seeks to exact penalties on the foreign investor Such a situation must be avoided

9 1 6 Regional Conventions

Uganda is party to a number of regional conventions First among these is the Lake Victoria Fisheries Convention of 1994 The purpose of this is to regulate and enhance fisheries on Lake Victoria through the establishment of the Lake Victoria Fisheries Organisation Second, there is the agreement under the Lake Victoria Environment Management Programme, 1994 This establishes a regional programme for the management of the environment in the Lake Victoria region and is especially designed to address issues of water quality, land use, wetlands, fisheries and the control of water hyacinth The first phase, to identify crucial areas of common management concerns to Kenya, Tanzania and Uganda, has been completed The second phase, which largely involves implementation, is now underway

Third, there is the Kagera Basin Agreement of 1977, which established the Kagera Basin Organisation as a forum of cooperation between the Kagera Basin States of Uganda, Tanzania, Rwanda and Burundi This agreement aims to ensure that environmental considerations are taken into account in development projects Fourth, there is the Technical Cooperation Committee for the Promotion of the Development and Environmental Protection of the Nile Basin (TECCONILE), the objective of which is to promote basin-wide cooperation for the integrated and just development, conservation and use of the Nile Basin water resources, and to determine the equitable entitlement of each riparian state to the use of the Nile waters One of the major projects currently being implemented is the Nile Basin Cooperation Framework which aims at establishing an institutional and legal framework for equitable utilisation and rational use of the Nile waters

Fifth is the Lusaka Agreement of 1996 on Cooperative Enforcement Operations directed at Illegal Trade in Wild Fauna and Flora (also known as the Lusaka Agreement), 1996 Sixth, there is the Convention to Combat Desertification (CCD) A final regional convention is the East African Co-operation Agreement to which Uganda, Kenya and Tanzania are party states This agreement, *inter alia*, stresses the need for sustainable environmental management in the region

9 1 7 Uganda's Response to Global Conventions

Globally Uganda has faced environmental challenges by supporting various international conventions and treaties Uganda is a party to the following international conventions and treaties, some of which are also highlighted in section 5 4 4

1 Convention on the Continental Shelf, (1958)

2 Convention on Fishing and Conservation of the Living Resources on the High Seas, (1958)

3 Convention on the High Seas, 1958

4 Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water, (1963)

5 Treaty of Principle Governing the Activities of States in the Exploration and Use of Outer Space including the Moon and other Celestial Bodies, (1967)

6 African Convention on the Conservation of Nature and Natural Resources, (1968)

7 Convention on Wetlands of International Importance Especially as Waterfowl Habitat, (1971)

8 Convention Concerning the Protection of the World Cultural and Natural Heritage, (1972)

9 Convention on the International Trade in Endangered Species of Wild Fauna and Flora, (1973)

10 Vienna Convention for the Protection of the Ozone Layer, (1987)

11 Montreal Protocol on Substances that Deplete the Ozone Layer, (1987)

12 Convention Concerning Safety in the Use of Asbestos, (1986)

13 United Nations Framework Convention on Climate Change, (1992)

14 Convention on Biological Diversity, (1992)

9 1 8 Environmental Policy Reforms

The National Environment Management Policy

The above policy, endorsed by the government in 1994, is the first of its kind in Uganda's history It is one of the landmarks of the NEAP process The overall policy goal is "sustainable social and economic development which maintains or enhances environmental quality and resource productivity on a long-term basis, that meets the needs of the present generations without compromising the ability of future generations to meet their own needs"[3] The policy sets out the objectives and key principles of environmental management and provides a broad framework for harmonisation of sectoral and cross-sectoral policy objectives It was on the basis of this policy that the comprehensive environmental legal and institutional framework was designed There is no doubt that it sets a benchmark for future monitoring and evaluation of the country's quest for sustainable development

To benefit from this policy will require, among others, that consistent efforts are made to ensure that the populace is aware of it, in addition to seeing through the implementation of its strategies Like the

National Environment Statute, the policy creates new capacity-building needs in environmental planning, information generation and dissemination, and the use of environmental tools in managing the environment, to mention but a few

National Policy for the Conservation and Management of Wetland Resources

Wetlands cover about 10% of Uganda's total land surface and provide a wide variety of values These include use, ecological and hydrological functions Due to a lack of understanding of these environmental values, society tended in the past to exploit them mainly for agriculture, food, medicinal items and raw materials for craft, construction and building This jeopardised other non-use values like hydrological functions and micro-climate support

In 1986, government issued administrative guidelines to curtail the devastation of the wetlands until a more scientifically-sound and socially-harmonious Wetland Policy was put in place Consultations for the formulation of the policy began in 1990 and culminated in the National Policy for Conservation and Management of Wetlands Resources Uganda becomes the second country in the world after Canada to adopt such a policy

In brief, the policy calls for (i) an end to the drainage of wetlands unless more important environmental management requirements supersede, (ii) sustainable use to ensure that benefits of wetlands are maintained for the foreseeable future, (iii) environmental management including the application of EIAs for all activities to be carried out in a wetland, and, finally (iv) equitable distribution of wetland benefits[4]

As mentioned in **Sections 9 1 3** and **9 1 4,** the Constitution and the National Environment Statute, 1995, create an enabling power for the conservation and protection of wetlands The enabling powers can only be effective when the regulations and bye-laws to guide public behaviour in the use of this resource are put in place In the meantime, steps are already underway under the Wetlands Programme to operationalise the policy The institutional framework for the management of wetlands, however, still needs to be clearly defined At present the management of wetlands still falls under NEMA It is questionable as to whether given NEMA's coordinating, monitoring and supervisory role, the implementation of the policy and legal requirements will be effectively handled

Water Policy

The Water Policy, the Water Action Plan, 1995, and the Water Statute, 1995, now form a coherent framework for the management, protection and use of the nation's vital water resources *The overall Water Policy objective is "to manage and develop the water resources of Uganda in an integrated and sustainable manner, so as to secure and provide water of adequate quantity and quality for all social and economic needs with the full participation of all stakeholders so as not to leave the future generations any worse off than ourselves"*[5]

The policy introduces an integrated, multi-sectoral approach in water resources management in the prevailing socio-economic context It emphasises the importance of (i) treating water as an economic, social and environmental good, (ii) relying on markets and pricing to determine water allocation among various sectors and user groups, (iii) involving the beneficiaries and the private sector in managing water at the lowest appropriate level, and, (iv) recognising that water is a finite resource that contributes

to economic development and supports natural ecosystems Based on government's overall policy of good neighbourliness and promotion of regional co-operation for optimal resource use, the policy principles adhered, in the regional context, to the accepted principles of international law on the use of shared water resources, without causing appreciable harm to other users

Uganda Wildlife Policy

The Uganda Wildlife Policy is another policy that is a result of wide consultation The Policy formed the basis for the enactment of the Wildlife Statue, 1996, and the establishment of the Uganda Wildlife Authority (UWA) Prior to this Statute, the basic laws relating to the protection and management of wildlife were the National Parks Act (Cap 227), the Game (Preservation and Control) Act (Cap 228) and the Forest Act (Cap 246) Common limitations had been inherent in these laws By taking a sectoral approach, each excluded certain species from the benefit of protection through the respective law For example, crocodiles were covered under a different law, that is, the Fish and Crocodiles Act, (Cap 228) This act focused more on the use of these resources than conservation, in contrast to the National Parks Act, which provided for strict protection, or the Game (Preservation and Control) Act, which provided for sustainable use The Uganda Wildlife Statute, 1996, removes crocodiles from the application of the Fish and Crocodile Act and places its management under the Wildlife Statute to enhance their conservation Also of concern was the fact that under the Game (Preservation and Control) Act, emphasis was placed on the conservation of big mammals and birds (First schedule to the Act) as opposed to species or living organisms as required by the Biodiversity Convention

Based on that past experience, the new Wildlife Policy has brought some innovations It has merged the former Game Department and Uganda National Parks to form Uganda Wildlife Authority Another innovation is the intention to involve Ugandans as widely as possible in the conservation of the nation's wildlife The management of wildlife, especially the wild animals which are not confined to protected areas, was and is still a problem for the relevant authorities Under the Game (Preservation and Control) Act under which the management of wildlife outside national parks formerly fell, an attempt to solve this management issue was made through the provision for animal sanctuaries and controlled hunting areas The UWA Statute provides for wildlife management areas In these areas, permissive activities (as shown in **Table 9 1** and also highlighted in **Box 3 5 in Chapter 3**)) were allowed, and the land use pattern was controlled by the then Game Department

The gazettement of an animal sanctuary (an aspect of a wildlife management area) or a controlled hunting area (now community wildlife area) only affected the land use in order to ensure that activities that were incompatible with the existence of wildlife in a given area were not permitted in that area Management plans were drawn up for this As can be seen from **Table 9 1**, this method of management allowed not only for community participation and benefit in wildlife management but also protection of wildlife This concept has been further developed and strengthened under the Uganda Wildlife Policy and the Uganda Wildlife Statute, 1996

The Uganda Wildlife Statute provides for greater protection of wildlife outside protected areas by encouraging greater participation by the local community in their management through the introduction of wildlife use-rights Once this arrangement is properly handled, it will be possible for an individual to manage the wildlife on his land and derive benefits from it in a sustainable manner This is a departure from the earlier arrangement where the community mostly suffered from having wildlife on their land, for example, through the destruction of their crops, other properties and threat to life of

Table 9 1 Categories of wildlife conservation areas in Uganda

Category	Previous Name	Description	Permitted Activities
Wildlife Protected Areas (WPA)	National Park	Of national/ international importance for nature and landscape conservation Ecologically viable unit	Biodiversity Conservation recreation scientific research Sustainable harvesting of authorised resources
Wildlife Reserve (WR)	Game Reserve	Important for wildlife preservation, utilisation and management Viable size for management of wildlife population	Wildlife Conservation recreation, scientific research Consumptive utilisation (including sport hunting)
Wildlife Management Areas Wildlife Sanctuary (WS)	Animal Sanctuary	Area designed for specific biodiversity conservation purpose including preservation of critical species May be of varying size often small	Recreation scientific research Consumptive utilisation (e g hunting) prohibited
Community Wildlife Area (CWA)	Controlled Hunting Area	Jointly managed with local communities or other bodies, in order to receive direct benefits from utilisation of resources tourism etc	Consumptive utilization of wildlife including sport hunting Alternative land-uses permissable when compatible with the conservation objectives of the CWA
Wildlife Use Rights Areas		Area of land containing wildlife, owned either privately or collectively, for which use-rights have been granted to the landowner(s)	Landowners may be authorised to use non-endangered wildlife species, based on a management plan for profit

1 *The term Wildlife Conservation Area is used synonymously with the international term 'Protected Area but in the context of this Policy Document is restricted to those areas under the authority of the Ministry responsible for wildlife*

2 *A Wildlife Use-Rights Area in the context of this document has no legal status thus is not truly a Protected Area*

3 *Landowners are those with individual or corporate titles to land, leaseholders of it and those with undisputed individual or customary rights to the land*

Source *Uganda Wildlife Policy Document*

domestic animals and human beings

It is hoped that the arrangement will encourage greater community participation in the management of wildlife Within the national parks and wildlife reserves, collaborative arrangements in the management of these areas is to be practised Under this arrangement, the protected area managers jointly manage the area with the community and in return, the community is allowed regulated access to some of the resources (for example, bamboo shoots, building poles and materials for making crafts) The forest policy also advocates for joint management and benefit sharing of resources from forest reserves, be it on central forest reserves or private land

Improving the value from the efforts of wildlife conservation will, however, require that (i) a biodiversity strategy is produced, (ii) strong collaborative management links are established, especially between UWA and Forestry Department, and between UWA and Local Government system, and, (iii) innovative funding mechanisms for UWA are mapped out

9 1 9 Policy Gaps and Deficiencies

Agriculture still dominates the activities of the majority of Ugandans It is mainly carried out under three different land tenure systems (mail, customary, and leasehold) Lack of a uniform land tenure system was identified as early as the 1980s as one of the constraints to agricultural productivity The 1975 Land Reform Decree which made all land public land was never effectively enforced The 1995 Constitution has upheld the three tenure systems mentioned above and has reintroduced the freehold system To give legal effect to all the four land tenure systems, the Constitution provides for enactment of a law within two years to (i) regulate the relationship between the owners and occupants and (ii) provide for acquisition of registrable interest in land Despite these planned interventions, the lack of a land use policy is a very serious gap from the environmental point of view

The inter-relationships among agricultural activities, biodiversity, energy, water and climate are determined to a great extent by the quality of land use and management practices In the absence of a land use policy, agricultural productivity still remains low, biodiversity, especially on private lands threatened, deforestation is continuing unabated, energy deficits are increasing, and degradation of soil and water resources is becoming widespread In the energy sector, there are no policy guidelines for the development of energy from new and renewable energy resources The Forestry Policy also concentrates only on the resources within the protected areas with no regard except for protected species, to those on private landholdings The Forest Act is under review and hopefully some of these concerns will be addressed

9 2 Institutional framework

9 2 1 National Institutional Framework for Environmental Management

The SOER, 1994 recognised that the then Department of Environment Protection (DEP) under the Ministry of Natural Resources was very weak in coordinating, supervising and advising other ministries on environmental management issues It had a weak legal mandate, and its placement under a ministry could not allow it to effectively communicate directly with other ministries or supervise them on matters of the environment The SOER, 1994, further reported that to address the above institutional weaknesses a National Environment Management Authority (NEMA) had been proposed The year 1995 witnessed the enactment of the National Environment Statute 1995, which legally established NEMA NEMA has been fully operational since January 1996

NEMA is the principal agency in Uganda for the management of the environment with particular mandate to coordinate, monitor and supervise all activities in the field of the environment The specific functions are listed in **Box 9 1** To impact on other institutions and the general public, and to perform its functions, NEMA was elevated to one of the highest positions of all public institutions in the country This enables it to have its concerns on environment voiced at high levels of decision-making and policy formulation and give it the necessary political clout

The National Environment Statute establishes a Policy Committee on the Environment as the supreme organ of NEMA It is composed of 11 cabinet ministers with room for increasing or changing the number The Right Honourable Prime Minister is its Chairman The committee provides policy guidelines and formulates and coordinates environmental policies for NEMA, in addition to liaising with cabinet on issues affecting the environment Besides, it identifies obstacles to the implementation of environmental policy and programmes and ensures their implementation NEMA also has a board which oversees the implementation and successful operation of the national environment management policy and functions of NEMA Both the Executive Director and the Chairman of the Board of NEMA are ex-official members on the Policy Committee on the Environment **Figure 9 1** shows the institutional framework for environmental management in Uganda Basically, NEMA is horizontally linked to lead agencies and vertically to the local government structure and the private and NGO sectors These linkages are explained in subsequent sections

NEMA's horizontal linkage with lead agencies

At the time NEMA was established, there were many other ministries, departments and institutions which had their own legal mandate to address specific environmental issues or to manage certain resources These institutions were maintained except the Department of Environment Protection (DEP) As a strategy, NEMA works in liaison with all the above "lead" agencies These could be ministries, departments, parastatal bodies, local governments or public officers in which or whom any law vests responsibilities for environmental management

The lead agencies have the responsibility to develop internal capacity to contribute to sustainable environmental management, collect data and disseminate information, and promote environmental education and public awareness in their respective sectors They also ensure effective enforcement, implementation, compliance, and monitoring of laws, policies and activities within their mandates In addition, it is their responsibility to supervise within their legal and administrative mandate the conduct of EIAs and set standards and carry out inspection Coordination and communication between each lead agency and NEMA and among the lead agencies is strongly encouraged and is legally provided for in the National Environment Management Statute, 1995

NEMA's Vertical Linkage with Local Government

In 1993, the government started to implement the Decentralisation Policy under the Local Governments (Resistance Councils) Statute, 1993 At that time, the NEAP process was advanced in progress, and consultations to establish NEMA had begun Accordingly, within the Local Governments (Resistance Council) Statute, 1993 guidelines and responsibilities for environmental management were entrenched Under this Statute, the District Council was charged with formulating, reviewing development plans, solving local problems and making bye-laws It is serviced by the Health and Environment Committee

Box 9 1 Functions of National Environment Management Authority (NEMA)

In accordance with the National Environment Statute, 1995 NEMA is the principal agency for environmental management and is mandated to coordinate, monitor and supervise all activities in the field of the environment Within this broad mandate, NEMA has to fulfil the following specific functions

(a) To coordinate the implementation of Government policy and the decision of the Policy Committee

(b) To ensure integration of environmental concerns in overall national planning through coordinating with the relevant ministries, departments and agencies of Government,

(c) To liaise with the private sector inter-governmental organisations non - governmental agencies governmental agencies of other states on issues related to the environment

(d) To propose environmental policies and strategies to the Policy Committee,

(e) To initiate legislative proposals standards and guidelines on the environment in accordance with this Statue

(f) To review and approve environmental impact assessments submitted in accordance with this Statute or any other law

(g) To promote public awareness through formal non-formal and informal education about environmental issues,

(h) To undertake such studies and submit such reports and recommendations with respect to the environment as the Government or the Policy Committee may consider necessary,

(i) To ensure observance of proper safeguards in the planning and execution of all development projects including those already in existence that have or are likely to have significant impact on the environment determined in accordance with part of this Statute,

(j) To undertake research and disseminate information about the environment,

(k) To prepare and disseminate the State of the Environment Report once in every two years

(l) To mobilise expedite and monitor resources for environmental management and

(m) To perform such other functions as the Government may assign to the Authority or as are incidental or conducive to the exercise by the Authority of any or all of the functions provided for under this Statute

Source *Section 7(1) of the National Environment Statute 1995*

The District Council is thus the highest level at the district to ensure the integration of environmental issues in the development planning process It is this council which has direct communication link with the District Support Coordination Unit within the office of Executive Director, NEMA

NEMA is allowed under the law to provide guidelines for the establishment of a District Environment Committee for each district in consultation with the District Local Council The functions of such committees are to ensure integration of environmental concerns in plans and projects of the district, to formulate bye-laws, to promote dissemination of environmental information, and to prepare the state of the environment report annually To date, there are a number of such committees in some of the 39 districts of Uganda, and others are in the process of being established

Participation of NGOs and the Private Sector

The Board of NEMA consists of two representatives from both the NGOs and the private sector NEMA also has a direct link with them as it can be seen in **Figure 9 1** It must be appreciated that unlike the Local Government structure which links to NEMA through the District Council, it is more difficult and expensive to do the same for NGOs and the private sector due to the inherent differences of organisation of members within these sub-sectors The NGOs do not have one umbrella organisation but rather some sectoral umbrella organisations for those active in the specific area of environmental management The NGO Board under the Ministry of Internal Affairs is a regulatory body and not representative of all NGOs Efforts by an international NGO, World Learning Incorporated, to bring NGOs involved in natural resource management under a forum (Natural Resource Management Forum - NARM Forum) in 1994, was not very successful Although many private sector associations exist, the bondage for their association differs and rarely are environmental objectives their priority

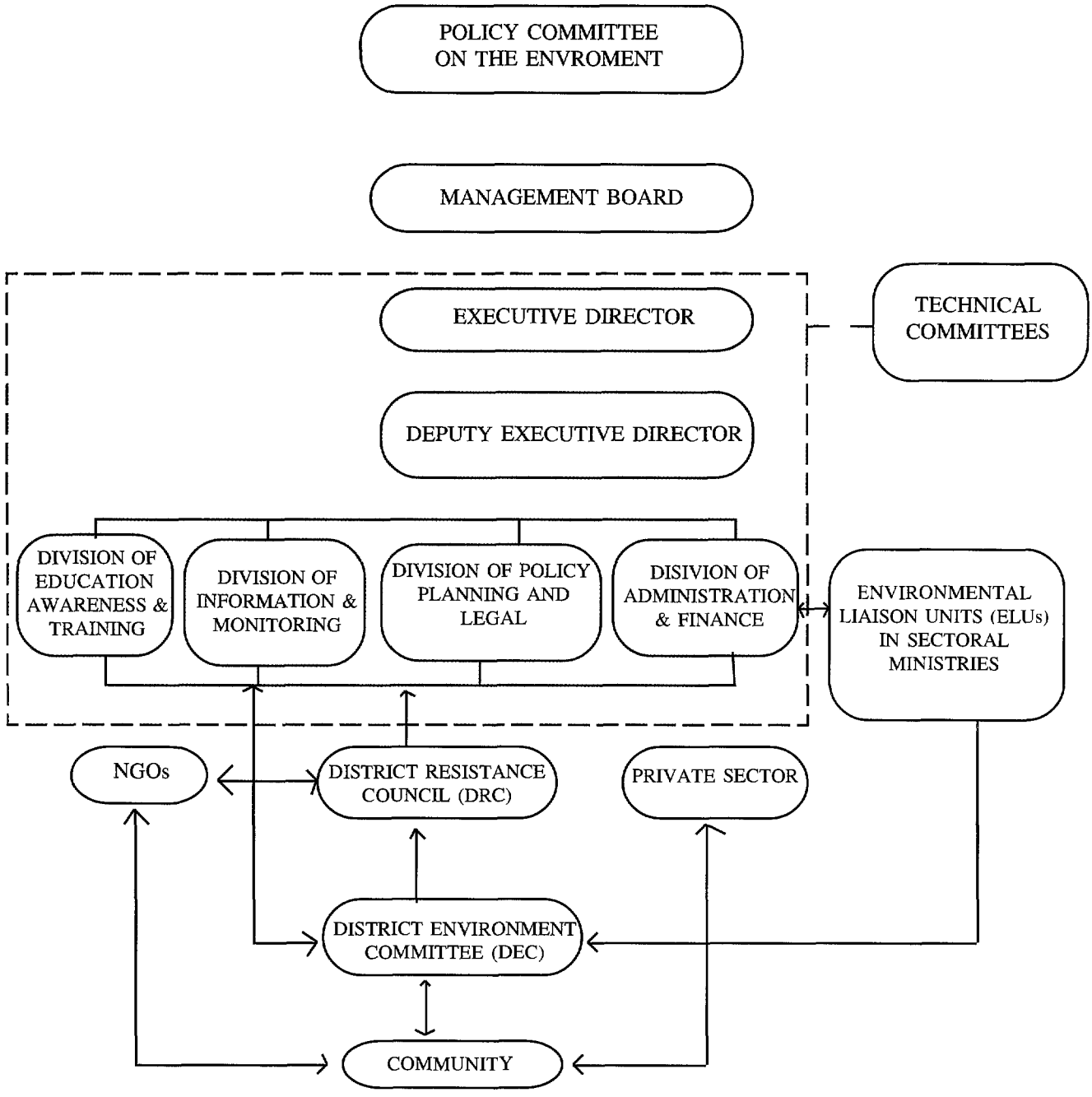
Much of the private sector is still composed of individuals or firms in the informal sector Despite the inherent limitations in the way these sub-sectors are organised, NEMA is still committed to having a linkage with them To maximise on cost effectiveness, it has for a start, established environmental liaison units (ELUs) in some of the umbrella associations like Uganda Manufactures Association (UMA), Uganda National Farmers Association (UNFA), and so on It has also established one in the Uganda Investment Authority Arrangements are being made to encourage NGOs to design a strategy on how best and cost effectively they should link to NEMA besides determining criteria on who is a *bona fide* NGO to deal with NEMA The issue of the *bona fide* status of an NGO is crucial and should be seriously evaluated before NEMA can enter into any meaningful and effective arrangement with one

Use of Technical Committees

Realising that some environmental issues need to be well studied or consulted upon before policy decisions are taken or implemented, NEMA is allowed to appoint as many technical committees as it considers necessary, to give advice on subjects relating to the environment The membership of these committees is composed of representatives from government, private sector, NGOs and academic institutions The standing committees established by the Statute are soil conservation, licensing of pollution, biodiversity conservation, and environmental impact assessment NEMA is already using some of these committees

The structure of governance for environmental management shown in **Figure 9 1** is intended to allow

Figure 9 1 Institutional frame work for Environment Management in Uganda, 1996



for quick flow of information, and to strengthen the functions of coordination and monitoring for environmental management Perhaps more importantly, it provides a framework for a bottom-up approach to both environmental and national planning processes The approach is also embedded in the Constitution which stipulates that with regard to planning, district councils shall prepare comprehensive and integrated development plans incorporating the plans of lower level local governments for submission to the National Planning Authority The National Planning Authority is, however, not yet formed by Parliament as required by the Constitution Accordingly, the districts are still working through the Ministry of Local Government with respect to their planning

9 2 2 Role of economic instruments

Economic instruments are measures or tools that affect costs and benefits of alternative actions open to various economic agents with the effect of influencing behaviour in a way that is favourable to the environment Many countries have used them to complement command and control in eliciting compliance for environmental management In Uganda, the National Environment Management Policy puts emphasis on the use of economic instruments (incentives and disincentives) There are some examples to show that economic instruments have a lot of potential in environmental management **Box 9 2** highlights one such instrument being implemented by the Foresty Department

Economic instruments are not only confined to local environmental problems The Magahinga and Bwindi Impenetrable Forest Conservation Trust is a case of an incentive provided by the international community through the Global Environmental Facility (GEF) for the conservation of these ecosystems because of their biodiversity and as resources of global significance With proceeds from the trust, local communities are being supported to offset the lost benefits they were deriving from harvesting timber and non-timber products The Bwindi Trust specifically addressed the interest of a marginalised group, the Batwa (pygmies) A special study was conducted with World Bank funds to ensure that their interests, as people who live and depend on the forest for survival, are protected

9 2 3 Peace, Governance and Environment

People need to live in a state of harmony and friendship and free from war and violence to contribute positively to the growth of their economy In addition, democratic governance is prerequisite for sustainable environmental management and poverty eradication Uganda has witnessed differences in levels of governance In the 1970s, political leadership, public sector management and service delivery were poor Rule of law broke down, and respect for people and their property deteriorated It is of no surprise that it was during that time that both economic and social indicators started to decline Encroachment in protected areas and poaching intensified, while tourism greatly deteriorated, and trade relations with neighbouring countries soured Foreign investment stagnated, incentives were poor, macroeconomic policies were missing, and as a result the key sources of foreign exchange earnings (for example, cotton, tobacco, tea, copper, tourism) all consistently declined

Aware of the lost opportunities for a sustainable livelihood, the people and government have been involved in a number of processes and policy reforms, all aimed at improving both peace and democratic governance as prerequisite for long-term sustainable economic development They have included the making of a Constitution, improving people's participation and accountability through decentralisation, allowing freedom of speech, and empowering women through affirmative action Through laws and policies, environmental management tools have been introduced The right of individuals to a clean and healthy environment has been enshrined in the Constitution, and the prospects for sustainable environmental management have been improved Solutions to the remaining insecure areas in the

Box 9 2 Use of Economic Instruments in Environmental Management

In 1988, Forestry Department started a peri-urban plantation project to replace forest plantations that were destroyed and degraded during the periods of civil war and lawlessness, through uncontrolled felling, encroachment and lack of management It covered the districts of Mbale Tororo Jinja, Kampala Mbarara and Arua As part of the project the private sector was granted occupation permits over public land provided they planted eucalyptus This was a form of property right Plots were demarcated in sizes of 5 ha More than 300 farmers have responded to the incen tive and have planted eucalyptus woodlots

In Masaka district, many individual households planted eucalyptus after CARE an NGO supplied them with free seedlings Many of these households are already selling their poles to earn money In Rakai a VI Tree-planting an International NGO is also providing 1 4 million seedlings to individual households These examples show that where individuals may lack access to land or financial resources to take on some environmental programs opportunities still exist for them provided somebody else meets costs of the start-up activities Many NGOs especially the interna tional ones have been instrumental in offering assistance at no cost to local communities involved in environmental management

Source Forest Department Report 1995

north of the country are being sought politically, diplomatically and militarily

9 2 4 Environmental Education

Why Environmental Education?

Like any other geographical area, Uganda's environment comprises three sub-systems the namely, biophysical, economic and social-demographic

Within the biophysical sub-system it is important to note that the majority of Ugandans depend heavily on the natural resources base As the human population is growing at a high rate in the context of a largely rural setting, there is great pressure on the country's natural resources Despite remarkable progress, the economic sub-system in Uganda is also characterised by prevalence of poverty, and it is generally agreed that poor people are both victims and agents of environmental degradation Also certain cultural attitudes such as the setting of annual bush fires impact adversely on the environment The central question is, how can Ugandans prevent the degradation of the environment, many components of which represent their life support systems? One way is through environmental education

In order for the spirit of the Stockholm (1972) and Tbilisi (1977) Conferences to be effective, environmental education should be viewed as an interdisciplinary approach, in and out of school, encompassing all levels of education and directed towards the general public, in particular ordinary citizens in rural and urban areas, youth and adult alike The aim is to educate people on the simple steps they may take within their means to manage and control their environment

Environmental education can be viewed as the process of recognising values and clarifying concepts to develop skills and attitudes necessary to understand and appreciate the inter-relatedness among humans, their cultures and the biophysical surroundings In this context, environmental education can be offered in a formal, informal and non-formal way

Formal environmental education is offered through primary, secondary, tertiary non-university and university establishments through their various curricula and extra curricula activities Non-formal environmental education is essentially instructive outside the formal classroom structure, that is it may consist of seminars, workshops, conferences or specialised instructions Informal education is also provided outside the formal classroom structure, and its key component is the traditional method of passing knowledge from one generation to another

National Initiatives

Although environmental education is a relatively new concept in Uganda, the country is achieving some success in moving away from education predominantly "about" the environment to education "from" and "for" the environment A number of initiatives are under way or have been carried out since the publication of the first National State of Environment Report, 1994 The most significant achievement has been in the area of policy reform emanating from the Government White Paper on Education 1992, the National Environment Policy 1994, and the National Environment Statute 1995

Government White Paper on Education

One of the national goals in the Government White Paper on Education is to ensure that in all future programmes to design curricula, there is need to include the development of awareness and concern for the protection of the environment

The National Environment Policy 1994

The National Environment Policy 1994, recognises that environmental education is an essential component of sustainable development and environmental protection Policy objectives on environmental education are to

(a) increase awareness and understanding among the politicians and the public of the need for sustainable environmental management,

(b) develop skills needed to implement national programmes of environmental management, and

(c) carry out local demand-driven research needed for the proper management of the nation's environmental resources, **Box 9 3**

The National Environment Statute, 1995

The Statute stipulates that

(a) Environmental awareness should be treated as an integral part of education at all levels

(b) In collaboration with the Ministry of Education and Sports, all necessary measures should be taken for the integration of environmental education in the school curricula

In addition to policy reform, the establishment of NEMA offered a clearer institutional hub for coordinating environmental education Within NEMA, there is an Education, Awareness and Training Division

Apart from the policy provision for environmental education, specific achievements are as described below

Formal Education

(a) The National Strategy for Environmental Education for the Formal Education Sector was finalised and printed in 1996, introducing a coordinated effort to implement environmental education

(b) The Project on Environmental Education in Primary Schools in East Africa (PEEPSEA) has developed materials, and these are being pilot-tested in some primary schools in Uganda This is two and half year pilot project is being coordinated by the National Curriculum Development Centre (NCDC)

(c) A model for introducing environmental education in secondary schools is now available This is a basic school approach to implementing environmental education

(d) In-service teacher training workshops on environmental education for teachers have been initiated and several are planned for the future to cover all time districts in the country

(e) Makerere University School of Education will start offering Master of Education-Science (MSE) Education specialising in Environmental Education, with effect from October 1997

(f) Initiatives in developing materials on environmental education For instance, there are two source books on environmental education published, and on integrating environmental education into English-language teaching for secondary schools Plans are under way to develop environmental education curriculum guidelines for Agricultural Colleges, Makerere University will be introducing a Master of Science Degree course in environmental education beginning in October, 1997, and, Soroti District is developing a district environmental education programme based in the formal education strategy guidelines for programme areas

Non-formal and informal or public awareness

A number of public awareness programmes have been carried out, including workshops, public lectures, publication of newsletters, production of posters, brochures and pamphlets Several activities of various NGOs relate to environmental education For example, the Wildlife Clubs of Uganda (WCU) has established over 26 district associations representing close to 1000 clubs WCU is also expected to sign a Memorandum of Understanding (MOU) with the Uganda Wildlife Authority (UWA) to carry out conservation education activities in communities surrounding wildlife protected areas In addition, Greenwatch, an NGO, carried out effective lobbying to make the public aware of the dangers of pollution emanating from Hima Cement Factory, which in turn acted as a catalyst to encourage NEMA and

Box 9 3

Objectives, guiding principles and strategies for environmental education in Uganda

Objectives

- To increase awareness and understanding among the politicians and the public of the need for sustainable environmental management
- To develop skills needed to implement national programmes of environmental management and,
- To carry out local demand driven research needed for proper management of the nation's environmental resources

Guiding principles

- Environmental education should be taught on a multi disciplinary basis and integrated into on-going curricula and not as a separate or additional subject, environmental education and public awareness programmes should be targeted to all those in public and private sectors whose activities significantly affect the environment,
- Awareness and behaviour which will result in improved environmental management should be strengthened,
- Institutional and/or individual awareness and capacity should be increased to improve future ability to evolve with and provide for a sustainable income under increasing land and resource pressure,
- Demand driven basic and applied research programmes are critical for environmental management, and these programmes should be prioritised, and
- Training programmes in environmental and natural resource management should be coordinated and strengthened

Strategies are to

- Develop a national strategy for carrying out public awareness through non-formal and informal environmental education programmes for the public and private sector especially policy makers, politicians administrators, bankers industrialists, transporters, farmers and all other natural resource users
- Develop environmental teaching materials initially for primary schools and eventually for all training institutions,
- Train trainers in the use of environmental educational materials, for example teacher trainers,
- Make environmental education mandatory in all formal education institutions,
- Strengthen existing higher level institutions to offer more programmes tailored to produce environmental economists planners trainers lecturers, lawyers and enforcement officers
- Provide in-service training in specialised areas such as environmental planning, economics, law information systems impact assessment pollution control and waste management
- Establish an environmental research fund to support research programmes in environmental management, and
- Facilitate better understanding of factors affecting resource use by promoting and supporting research programmes on environmental concerns, and develop appropriate technologies for sound environmental management and resource use

Source *NEMA (1997) Highlights of Achievements in Environmental Education in the Formal Education Sector* [Paper presented in the Environmental Education Committee Meeting May 1997]

the factory management to initiate corrective measures Also various environmental awareness programmes are now major components of projects being carried out by international and national NGOs and CBOs operating in Uganda Celebrations of National Environment Day, National Tree-Planting Day, National Water Day, and World Meteorological Day are annual events aimed at promoting environmental awareness NGOs effectively participate in these events every year

9 2 5 Issues in environmental education

Despite the foregoing achievements towards increased efforts for environmental education in Uganda, a number of issues are still of concern centering around policy, attitudes, institutional capacity and indigenous knowledge These concerns are grouped together under the three approaches to environmental education and elaborated below

Formal Education

Although Uganda now has a standardised curriculum for pre-primary school level that included aspects of environmental education, the teacher capacity required for its implementation is not developed Furthermore, the teachers that are available do not, to a large extent, have a clear perception of what environmental education entails Finally, there is a general lack of support materials to be used for pre-primary environmental education instruction

At the primary school level, although some initial efforts are being made to integrate environmental concerns in the education curriculum, particularly in science and social studies, there is a need to further improve teacher competence to handle environmental education Provision of additional environmental education materials is also required

Secondary school syllabuses do not address environmental education adequately, hence, the focus on environmental education is limited There is need to develop an education-environmentally responsive curriculum and to improve upon teacher competence

At tertiary level (universities, teacher training colleges, vocational schools and other institutions of higher learning), curricula appear compartmentalised whereas environmental education, requires holistic approaches While collaboration among institutions would appear to benefit environmental education this is lacking in many respects As do the pre-primary, primary and secondary school levels, tertiary institutions lack qualified personnel in environmental education The scarcity of similar personnel at teacher colleges is of particular concern since this sector could in turn train and provide teachers to the lower level schools The introduction of a Masters Degree programme in environmental education at the School of Education and the Bachelors of Arts in Environment Management and Tourism at Makerere University is, therefore, timely

To improve the delivery of formal environmental education services in Uganda, NEMA has proposed an institutional framework for implementation of its strategy The institutional strategy is based on the understanding that environmental education in the formal education sector calls for close coordination at the central, district and local levels, between not only the key environmental education sectors but also other related government institutions and NGOs

Informal Education

A remarkable network of community and rural training centres were established throughout the country in the 1960s as venues for promoting public awareness on various issues this infrastructure unfortunately collapsed in the 1970s and early 1980s Thus, the social, political and economic atmosphere was rendered unfavourable for informal learning Cultural values were also ignored As a result, the general public has not been made aware about environmental matters of concern to them in any significant way

Nevertheless informal means of delivering messages about the environment are making some significant progress through songs, drama, interviews, documentaries and discussions For example, a local drama group has developed a play extolling the values of biodiversity Also a number of groups around Bwindi Impenetrable National Park have developed plays and dramas to sensitise the local population about the many attributes of the Park

In attempting to promote environmental education through informal means, a number of obstacles remain inadequate logistical support to facilitate large-scale research and comprehensive programme design, the concentration of media facilities - especially television - in urban areas, and, a lack of resources to rehabilitate or expand upon the network of community and rural training centres

Non-Formal Education

Apart from the contribution of the extension staff of line ministries including the unified extension approach (UEA) (extension service) under MAAIF, non-formal environmental education is largely the pre-occupation of non-governmental and community-based organisations (NGOs and CBOs)

In general, most of the extension services relating to environmental issues are either non-existent or weak The capacities of institutions that carry out sectoral or unified extension services are inadequate, mainly because of the weakness of the parent ministries or district level organisations

As a result, NGOs and CBOs appear to be more active and effective in carrying out non-formal environmental education in Uganda A careful examination of the activities of NGOs and CBOs reveals that most of the non-formal environmental education activities are being carried out by international NGOs such as ACCORD, OXFAM, CARE and others directly or through local counterpart organisations In many respects, the institutional capacity of local NGOs and CBOs is low, this poses a serious question about the sustainability of non-formal environmental education in Uganda should international NGOs leave, withdrawing external financial assistance support to the local organisations

Indigenous knowledge

Although indigenous knowledge has not received due attention in the past in Uganda, it is increasingly recognised as an important source of knowledge about the environment This particularly concerns the manner in which local communities (prior to the modernisation concept adopted with colonisation) exploited the resources at their disposal It has also been recognised that employing formal and non-formal methods of education is an effective way to communicate and impart knowledge There is a wealth of knowledge in the local communities that is not tapped Practices like revering certain resources (such as tree species) through rituals and stories/tales inherently helped to conserve those resources

It is evident that the gap between the older generation, such as the elders of the local communities and the younger generation has widened over the years The latter are increasingly detached from tradition Within tradition and values, however, separation of wheat (good) from the chaff (bad) should be done Therefore, it is worth tapping indigenous knowledge and values that create unity, stability and sustainable use of resources The participation of all segments of society is indispensable

9 3 Environmental Information

9 3 1 What is Environmental Information?

The global information highway is with us Although relatively few Ugandans are "surfing" the internet The majority of Ugandans, however, cannot read or write and have never seen a computer Yet many countries, including Uganda, recognise that information is power Corporate entities, governments, NGOs and individuals are aware that information is indeed useful and can confer tremendous competitive advantage on those who have it

Environmental information can be defined as data, statistics and other quantitative and qualitative materials that decision-makers require to assess conditions and trends in the environment, to determine and adjust policy directions, and to invest funds[1] Environmental information is, therefore, required to allow decision-makers to analyse cause and effect, to develop strategies for action, to manage natural resources, to prevent and control pollution, and to evaluate progress made towards goals and targets

Also, environmental information may appear in various forms such as state-of-environment reports and other assessments and studies, statistical compedia and data-books, and in policy and programme statements by both public and private sector organisations Environmental information may be presented in many forms and a wide range of media The production of environmental information entails the collection and analysis of raw data, and their interpretation in forms that can be used for decision-making[2]

9 3 2 National Environmental Assessment and Reporting Practices

The systematic and formal management of environmental information is a relatively new phenomenon in the country In Uganda, as elsewhere in East Africa, the key players in environmental assessment and reporting are the lead institution and relevant sectoral ministries departments or agencies[3]

Previously, the Ministry of Natural Resources through the Department of Environment Protection and the National Environment Information Centre (NEIC) was the lead institution for environmental assessment and reporting NEIC had its beginnings in the Ministry of Environment Protection (MEP) in 1986 At that time there was very little natural resources information available and virtually no infrastructure to collect and manage such information (NEIC, 1995) NEIC was the result of a cooperative effort between UNEP and the Government of Uganda One area of focus was the development of a Geographical Information Systems (GIS) for Uganda in MEP The Geographical Information Systems (GIS) unit evolved and in 1992 became the core of NEIC Over the years, UNEP and in particular the Global Resource Information Database (GRID) maintained a close relationship with NEIC, especially in areas relating to the application of GIS and Remote Sensing (RS) technologies to the management of natural resources and the environment

After the NEAP process, NEIC was absorbed into the Information and Monitoring Division (IMD) of NEMA

9 3 3 The Environmental Information Network (EIN)

To effectively manage Uganda's natural resources and, in a more holistic sense, the environment it was recognised that information and expertise from the relevant sectors should be brought together

Over the years the National Environment Information Centre (NEIC) actively promoted cross-sectoral collaboration As a result, an Environmental Information Network (EIN) was established with the following objectives

- to operate as a network of members with open lines of communication between all (that is, no hierarchical structure or reporting requirement),
- to have a coordinating function through a "secretariat" (NEIC was selected for this role),
- to have membership open to all, with initial emphasis ensuring involvement of the large data-using and producing government agencies as listed in **Table 9 2**
- to provide a forum for communication on a range of technical, institutional and policy issues relating to the availability, dissemination and use of environmental information

The EIN is supposed to carry out a number of functions including the building of awareness of information management needs and issues, capacity-building, promotion of standardisation, and elaboration of data release policies by data-producing institutions Equally important was the decision by member institutions that neither the EIN nor the secretariat (NEIC) should act as a repository of data In other words, network members remain in control of their own data Second, that the use of the word network does not in any way imply an electronic network Although the EIN is already in place, even if informally, its structure and other issues still need further discussion to ensure mutual understanding

9 3 4 Key Issues in Environmental Information Systems

A number of issues confront environmental information management, namely expansion of institutional inputs metadatabase development, data dissemination guidelines, capacity-building, and data compatibility These issues are briefly addressed below

- ***Expansion of institutional inputs***

Environmental issues are cross-sectoral Thus there is need to expand upon the number of institutions participating in the EIN Apart from this there is also need to improve upon the quality of environmental information to ensure that the country has data which are useful, reliable, timely and up-to-date The ability of sectoral institutions to provide environmental information has historically been rather poor

- ***Metadatabase***

As in other countries, environmental information in Uganda is held by various producers and users scattered all over the country An effort to guide information users on where to find the data they require in short time and with ease was initiated by the EIN through development of a metadatabase A metadatabase is in essence a database of databases It acts as a directory of information held by various national institutions participating in the EIN Furthermore it describes among others, the form in which this information is held, when it was published and geographical coverage

The Uganda Environmental Information Metadatabase exists in its infancy at the Information and Monitoring Division (IMD) of NEMA There are also lists of regional and international datasets which reference Ugandan datasets This metadatabase is accessible to any individual, institution or organisation interested in its contents It is available both on hard copy and in digital form To be able to improve the format and expand upon the existing metadatabase at NEMA, a number of activities still remain to be undertaken They include

- definition of the scope and content of the metadatabase,
- testing the definition to ensure feasibility of collecting the items required,
- simplification of the management system for data, and,
- institutional capacity-building for the management of an expanded metadatabase

Dissemination guidelines

It is generally accepted that dissemination of environmental information is an important role for producers of such information There are two basic elements which are related to the dissemination of various environmental information products First, the product medium has to be determined (print, electronic media, visual-aids) Second, decisions associated with cost recovery and prices of various environmental information products need to be established In Uganda, many agencies involved in generating environmental information see digital data becoming more common, and some of them are considering implementation of cost recovery mechanisms

In many developed countries, information is increasingly perceived under a user-pay philosophy as a marketable product with revenue potential to supplement production costs If such a policy is well perceived, re-investment of such revenue into the production of reports has the potential to improve the scope and quality of environmental information There are, however, some *caveats* First, cost recovery should not restrict the public's freedom of access to environmental information Second, where environmental information is provided to the population (news media and libraries), it is appropriate to provide it free of charge Third, special considerations will be pertinent in certain cases In this respect products used for education purposes should be subsidised under the rationale that education benefits the country in the long run

Finally, communication and marketing aspects should be considered to maximise the reception and impact of environmental information The objective of a product's communication and marketing strategy is to maximise the access and use of the product by key audiences The communication and marketing associated with the release of environmental information products must be related to the particular purpose, audience and scope related to individual products

This notwithstanding it remains clear that information is a public good and the cardinal reason why it is collected is to serve public interest For Ugandan institutions, a set of generally accepted guidelines would be of practical use and also stimulate a cohesive approach among institutions Such guidelines could serve as a basis for a formal policy if so required Among the issues to be considered are confidentiality, pricing and responsibilities of both producer and user In order to come up with appropriate guidelines for dissemination of environmental information in Uganda, the following activities will have to be undertaken

- review of legislative requirements in relation to dissemination of environmental information,
- development of guidelines addressing the issues described above,
- testing the applicability of the guidelines through review of actual practices in place in selected agencies, and,
- refinement of the guidelines and inclusion of examples on the basis of the successful tests
- ***Capacity building***

While there is dire need for sound environmental information management in Uganda, it is also true that the country lacks adequate capacity to ensure this In particular, there is serious lack of resources and skills in most of the institutions responsible for generating and disseminating environmental information There is, therefore, need to build adequate institutional capacity in the country In so doing, however, institutional capacity-building must be carefully planned to ensure tangible benefits are obtained Such a planning process should include

- in-depth assessment of the resources and skills in place in selected institutions, how they are used, and the organisation's plans for the future in this area,
- consultation with each selected institution on capacity building needs and identification of operational results expected,
- analysis of the results above to identify among others, priorities, common needs, and anticipated outputs, and,
- development of a plan for capacity building with an indication of the investment required, identifying specific measures to be undertaken in the short term (1 year) with detailed costs

The Environmental Management Capacity Building Project (EMCBP) funded by the World Bank is addressing the above issues as highlighted in **Box 9 1**

- ***Data compatibility***

Physical, biological and socio-economic data provide the foundation for the analysis and presentation of environmental information To be able to integrate information from the various sectors, the data-sets need to be compatible in the sense that they can be combined to give meaningful (and not contradictory) information

The acquisition, processing and storage of environmental data is time consuming, expensive and not a priority for many government institutions It also requires specialised training for the personnel to manage it properly Consequently, there are inadequate baseline and trend data Other problems include scattered data, limited access, data in unusable and non-integrated format, and lack of infrastructure and standards to facilitate easy exchange

To ensure compatibility of environmental data in Uganda, the current standards in use should be examined and reviewed with integration in mind Some of the tasks involved include

- examination and documentation of the standards used in existing (priority) datasets,
- identification of possible areas of incompatibility and collaboration with concerned agencies to resolve differences where possible, and,
- compilation of documentation to guide data integration activities

A national working group (NWG) chaired by the commissioner for statistics was constituted to, among others, look at the above issues and come up with recommendations The NWG has so far completed the compilation of priority datasets for environment planning and is now examining the issues of standardisation

9 3 5 Information Exchange Mechanisms

Until recently, the sharing of environmental information among Uganda institutions has been rather *ad hoc* and often informal Generally, there is limited formal exchange of environmental information between government institutions, non-governmental organisations and the private sector It is known that both non-governmental organisations and the private sector often have difficulty in accessing environmental information available at various government institutions On the other hand, there is no legally-binding requirement for the private sector and non-governmental organisations to make available to government environmental information in their possession

As described earlier in this section, Uganda currently has in place a nascent environmental information network that is operational and providing the beginnings of means of sharing information and capacity building expertise Currently, environmental information can either be accessed through the EIN secretariat at NEIC or by directly contacting information sources listed in the metadatabase With the Information and Monitoring Division of NEMA seen as its logical secretariat there is need to further strengthen the capacity of the emerging Environmental Information Network The IMD should be strengthened to

- administer and coordinate activities such as setting up and maintaining contact lists, arranging logistics of meetings, and distribution of reports,
- offer leadership in mobilising resources for the network, and
- spearhead capacity-building initiatives in environmental information management across sectors

Box 9 4
Strengthening the National Environment Information Centre

The National Environment Information Centre (NEIC) forms the core of the information unit in NEMA and has the primary responsibility of providing environmental information for planning and decision-making at national and sub-national level The centre has a task of preparing information for publication without duplicating or replacing more detailed reports from sectoral institutions while at the same time ensuring that the primary clients gain access to the varied and multi-sourced information from the relevant sectors through the establishment, facilitation and coordination of the Environment Information Network

The Environment Management Capacity Building Project (EMCBP) funded by the World Bank has extended focused support to NEIC so as to enable it fulfil the above mandate The starting point has been to identify the key sector institutions which have the official mandate for collecting and managing core information or datasets required in environmental planning These institutions in most cases act as information service providers, in that, although they use some of the information in their day to day activities, the bulk of their information is used by other institutions for planning purposes Examples of such institutions are Departments of Surveys and Mapping Meteorology, Statistics National Agriculture Research Organisation (NARO), Makerere University Institute of Environment and Natural Resources (MUIENR) Forestry Department (Biomass Study) and Agriculture Some of these institutions have however not been able to fulfil their mandates satisfactorily Their current inability to collect, update and maintain key data-sets probably lies in their lack of equipment and materials and inadequate financing Building a credible information network that would enhance environmental information exchange would require deliberate intervention in these institutions It is in this regard that the EMCBP besides strengthening NEIC has technical intervention programmes involving provision of equipment, materials and training, for Surveys and Mapping Department Forestry Department (National Biomass Study) Kawanda Agriculture Research Institute (Soil Section), Makerere University Institute of Environment and Natural Resources (Biodiversity Databank) and Department of Agriculture

In order to correctly assess and monitor the quality of environment it is important to keep abreast with what is happening at the local level Therefore apart from establishing the network for sharing information across and among the sectors (horizontal network) a mechanism for exchanging information between the center and the local level is being developed and strengthened through the EMCBP The vertical linkage besides providing the desired linkage between the major stakeholders and those at policy level, also provides a basic framework for including more detailed information in a national detabase Furthermore under the current decentralisation proc ess the districts have to be assisted in identifying their natural resource endowment their state, existing opportu nities for their sustainable utilisation and constraints related to their exploitation In other words, districts and sub district levels must be assisted to develop their own comprehensive databases to support development planning while at the same time facilitating environmental monitoring and assessment In this respect the EMCBP is building the capacity of some selected districts in information management through development of sub-county-based information systems that would form the basis of developing district databases The exercise has already started in Mbale and Kasese districts and is expected to extend to the districts of Kabale, Mbarara, Arua and Kampala by the end oi 1998

Source Charles Sebukeia 1996 Strategies for Environment Information Systems Management in Uganda (paper presented at the Project Implementation Review Workshop, November 1996)

In carrying out the above functions, it is important to recognise the role of IMD as a facilitator and not, for instance, as a technology leader or research organisation Also flexibility must be exercised to reflect the fact that the EIN is still at an embryonic stage In acting as the secretariat to the EIN, the IMD of NEMA will in effect be fulfilling one of its mandates namely, to develop close links and liaison between an environmental management institution and line ministries Furthermore, institutional capacity-building is defined as an investment programme area, and the strengthening of environmental information management capabilities is given as one of the focus areas to be addressed by NEMA

Apart from domestic environmental information exchange concerns, it is also important to recognise that Uganda belongs to a number of sub-regional organisations such as IGAD and KBO Uganda subscribes to the concept of sub-regional and regional environmental information networks through use of metadatabases, so long as such networks bring together countries and organise them around common problems and shared resources

9 3 6 Policy and Legislative Framework

Uganda has in place a comprehensive Environment Policy passed by Cabinet in 1994 The policy objective for environmental information is to collect, analyse, store, and disseminate on a continuous basis, reliable information relating to environmental management issues including biodiversity, soil conservation, fuelwood supply and demand, and pollution control[4]

The 1994 policy document has since then been elaborated into the National Environment Statute, 1995 The Statute grants everyone in Uganda the right to a healthy environment Furthermore, it mandates NEMA to prepare and disseminate a national state of environment report once every two years Similarly the Statute requires every District Environment Committee to prepare a District State of the Environment Report every year The Statute is also elaborate on other environmental reporting and assessments requirements

Both the National Environment Policy of 1994 and the Statute of 1995 are further reinforced by provisions of the Constitution of Uganda, the Decentralisation (and Resistance Councils) Statute 1993, and other sectoral policies and legislation (Wildlife Statute 1996, Water Statute, 1996, National Wetlands Policy, 1996, and so on)

Despite the existence of strong environmental and other supportive policies and legislation, these do not adequately deal with issues related to data collection and processing, and information management There is need for secondary legislation to address the afore-mentioned issues relating to environmental information management, such as matters related to management of and access to confidential information

9 3 7 Constraints in Environment Information Management

In many areas of environmental information management, be it in terms of EIS, EIN or production of assessment reports, Uganda is a leader in the East Africa

This was clearly established during the *User Consultation Conference on Environmental Assessment Practices in Eastern Africa* held in Kampala in September, 1995 Despite this leadership, Uganda faces a number of constraints as described below

Inadequate institutional mechanisms characterised by

(a) lack of facilities or deterioration of existing capacities in the sectoral institutions responsible for environmental information management,

(b) low levels of inter-sectoral coordination, and,

(c) the tendency to regard environmental information as belonging to sectors or individuals and, hence, the constant reference to "my data, my information", and the reluctance to share this information

Existing laws are not clear or do not adequately spell out what information is accessible to users and what is considered confidential or proprietary

Data quality and consistency is a constraint because most of it has not benefited from rigorous analysis and assessment

9 3 8 Assessment of Impact and Use of The National State of Environment Report (SOER),1994

The SOER, 1994, has been assessed for efficiency, effectiveness, relevance and impact

In this assessment, efficiency was understood to refer to the use of resources (time, human and financial resources) used in report preparation The main issue was to establish whether the same level of output could have been achieved with less cost and effort or in less time

Assessment of effectiveness provides a measure of the results actually achieved against the objectives that were set or anticipated, that is, it helps answer the question how well did the report meet its objectives?

Relevance addresses the degree to which the results obtained corresponded to the actual needs, that is, do the objectives need to be refined?

Evaluation of impact is an assessment of the long-term effects whether or not these were anticipated at the start of the report preparation process

In summary, the following were the principal findings from the evaluation exercise

(a) Although the use of time, financial and human resources were well balanced with the requirement of the report preparation and dissemination tasks, improved organisation and planned allocation of these resources could have yielded much better results Prior to preparation of subsequent SOERs a short concept paper to guide research assistants, consultants and other participants should be prepared and discussed

(b) The SOER,1994, was an important contributions to the Uganda National Environment Action Plan Process

(c) The Advisory Committee was a useful group that provided access to data and information available in the various institutions represented by its members However, it appears a more logical strategy to limit its participation to oversight of the SOER process and general technical guidance A more detailed and technical input in the report preparation process should be left to a small dedicated group which should be well remunerated to carry out this function

(d) Development of internal capacity for SOER production is critical if sustainability and continuity is to be achieved However, in cases where the institution responsible is overwhelmed with other activities (as is the case in Uganda), a national sub-contractor should be used Development of capacity for SOER production in the private sector should be, therefore, a valuable investment

(e) The SOER, 1994, being the first in the country, was justifiably lengthy However, it was generally felt that subsequent editions should concentrate on developing indicators for identifying trends, covering areas omitted in the previous one, and reporting on emerging issues An SOE database should be developed and continually updated

(f) The SOER needs to be user-friendly and to appeal to wider readership Careful editing with this goal in mind needs to be done Editors should possess the desired competence, time and capacity to handle the issues discussed in the report

(g) There should be a balanced use of graphics and text in order to swiftly convey the message In addition, since the report has both technical and non-technical material, pictorial illustrations could be used to reduce the amount of technical language

(h) As the readership is wide and varied, there were conflicting responses with regard to report size, structure, content, user-friendliness, simplicity/complexity and dissemination of the report

This implies that a family of products, each aimed at a specific group needs to be extracted from the main report and disseminated accordingly The initial thinking focuses on fact sheets and policy briefs, state-of-resource (thematic) reports, school resource materials or specific reports to address environment issues of immediate local and national concern This was deemed more productive than having a short (biennial) reporting cycle

For the large illiterate and semi-literate sections of the community, an audio-visual component could be added to the family of products and pro-actively disseminated There was also an overwhelming call to translate the report in local languages However, the feasibility of this is questionable given the diversity and richness of local languages in Uganda

(i) Various ideas on the strategy to achieve wider dissemination, readership and increased use of the report were advanced One that received substantial support was the use of bookshops as outlets for the report, as long as its release was widely publicised However, this has to be balanced against the principal objective of the report - which is to improve environmental awareness and gather the population support in moving towards sustainable development Again, the logical conclusion seems to be that certain groups and institutions have to be targeted, and the report delivered to ensure access This is particulary the case for those who cannot afford the price charged, or are rural

Evaluation of impact seemed to require a much longer period between release of the report and any assessment that would seek to determine the latter's influence on such aspects as decision-making, public awareness and general environmental education

Another factor to consider is that it is perhaps hard or deceptive to attribute certain decisions or levels of awareness to a single report when it is one of the many reports produced in the country addressing issues on environment and development Thus, it may be difficult to establish a direct causal link between the report and improved quality of life at the bio-physical and human welfare levels A humble submission is to assume that the report has contributed to a process That notwithstanding, there are certain obvious pointers that can be quoted with some certainty These include

- influence on the passing of the National Environment Bill, 1994, into law (now referred to as the National Environment Statute, 1995),
- wide and continuous reference to the report in the media,
- wide use for educational purposes especially at graduate and post-graduate level, but more generally for mainstream environmental education and awareness,
- use of the report as a reference document by many individuals, institutions and organisations,
- the fact that other countries in Africa have appreciated the report and expressed the interest to share in Uganda's experiences, and,
- it is a much sought after document which continues to quickly run out of stock even after several re-prints The willingness to pay an equivalent of US$10 per report could also be considered as an indicator of its value and potential for impact

These impacts had been anticipated at the start of the report preparation process However, the 1994 SOER team was pleasantly surprised at the successes achieved given limited financial resources, experience and technical assistance The findings from the SOER, 1994 assessment largely influenced the approach to preparing the SOER,1996

Table 9 2 Datasets held by selected members of the Environmental Information Network, 1995

Makerere University Institute of Environment and Natural Resources	- Uganda mammals (species and their distribution) - Uganda birds (species and distribution) - Uganda amphibians (species list only) - Uganda reptiles (species list only) - Uganda flowering plants (species and distribution) - Uganda insects (species and distribution) - Uganda fishes (species list) - Uganda's protected areas
Uganda National Council of Science and Technology	- Technology promotion and development information - Reserch project directories Profile of Uganda society - Science and technology information management network profile on member organizations - Library collections for reference
Ministry of State for Karamoja	- Karamoja minerals distribution and type - Karamoja irrigation survey report - Karamoja GIS report - Karamoja database report - Kotido Baseline survey - Karamoja Development Plan
Department of Geology	- Geological information - Geophysics and seismological information - Mineral engineering information - Laboratory Services/equipment of the department
Development Network of Indigenous Voluntary (DENIVA)	- Maps of Uganda and other parts on various scales - Documents on Agriculture and Environment - Newsletters from various organizations - Women and health Reference library with books covering many fields
Department of Meteorology	- Rainfall statistics - Maximum, minimum, dry/wet bulb temperatures - Dew-point temperature and relative humudity - Winds and upper air data - Radiation, sunshine and evaporation data - Present and past weather visibility and cloud cover - Atmosphere pressure and pressure tendency - Phenological data - Soil temperatures - Soil moisture
Department of Environment of NEMA)	- District wetlands and related information - Various types of thematic maps of Uganda - Various reports on projects (past, on going) - Biological diversity conservation - UNEP reports

Department of Agriculture	Agricultural landuse data Agricultural production data Livestock related data Remotely sensed data for Uganda (including early warning reports)
Bank of Uganda Agriculture Secretariat	National Agricultural inputs data Agricultural production data Agricultural processing and marketing data Policy analytical data
Department of Water Development	Rainfall data River stage and flow data Evaporation rating and water quality Number of boreholes wells Hydrological data and aquifers
Ministry of Gender and Development	Gender policy Gender and development training District profiles Health and Women Women and Law Women and Education Women and Environment Various periodicals which are gender responsive
Forest Department	Natural forest inventory reports Plantation forest inventory reports Stock mapping report Plants species in forests Small mammals in forests and related information Birds of Uganda Infrastructure (e g roads) Administrative and protected areas boundaries Population and land use classes and drainage Contours Gazetted Forest Reserves
Uganda Management Institute	Newspapers Research papers Environment related publications Finance and economic planning Agriculture and animal husbandry District Administration profiles Legal Information on various aspects Political and public programmes/activities General reading material
Fisheries Department	Fish production factors Catch assessment Socio economic data around fishing sites Fish marketing data General aquaculture statistics Fish farming development Fish farming regulations
Statistics Department	Land information Climatic data Demographic data Immigration and Tourism Agricultural

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