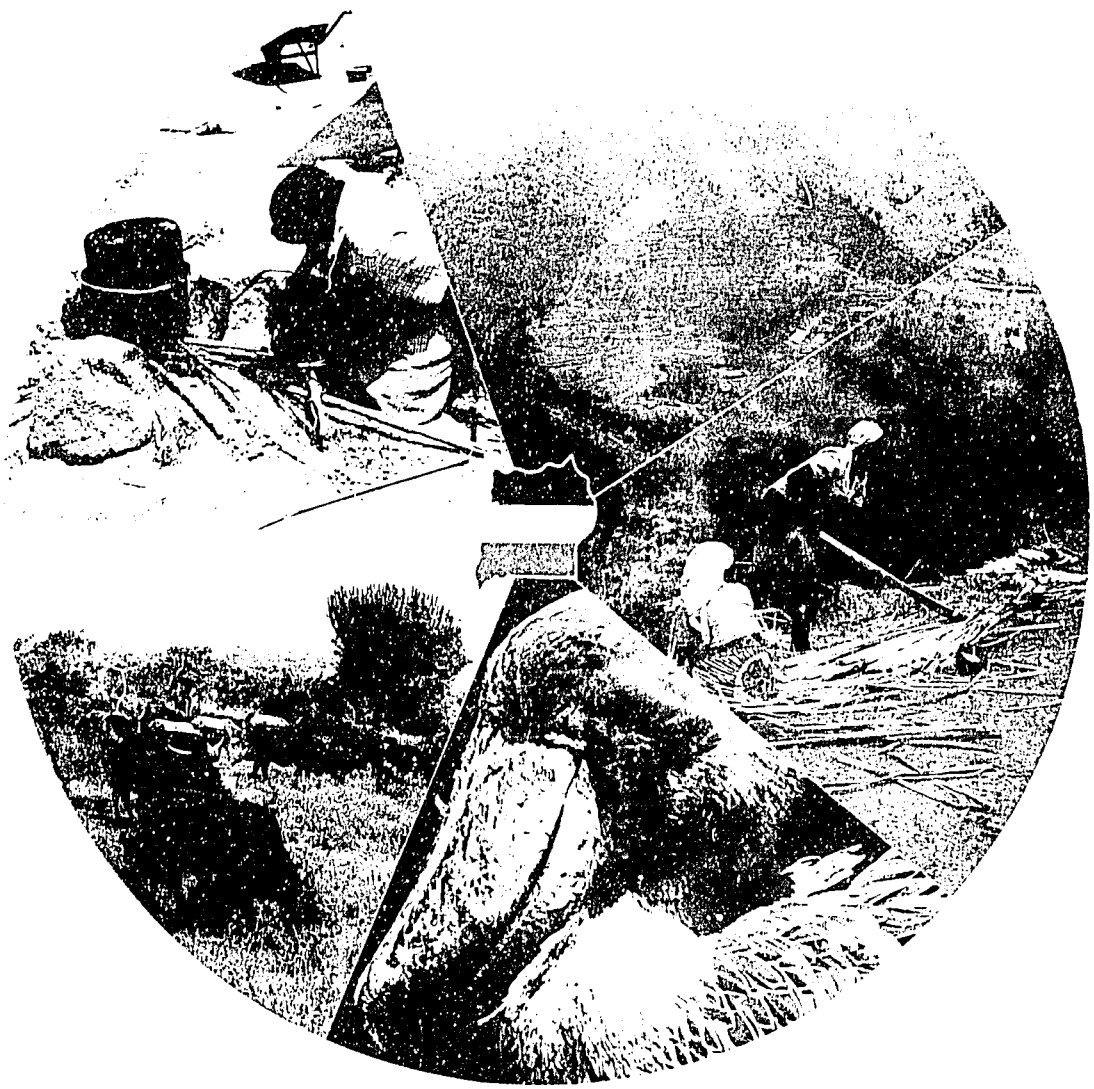
THE REPUBLIC OF UGANDA

STATE OF THE ENVIRONMENT REPORT FOR UGANDA 1994



MINISTRY OF NATURAL RESOURCES

National Environment Information Centre

STATE OF THE ENVIRONMENT REPORT FOR UGANDA 1994

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STATE OF ENVIRONMENT WORKING TEAM

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Rob Clausen	*United States Agency for International Development*
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Charles Sebukeera	*Deputy Program Manager, National Environment Information Centre*
Jim Seyler	*Chief Technical Adviser, Action Program for the Environment-National Environment Action Plan*
Eldad Tukahiirwa	*Director, Makerere University Institute of Environment and Natural Resources*
H.J. Tumwebaze	*Ministry of Finance and Economic Planning*
Frank Turyatunga	*Program Manager, National Environment Information Centre*

Consultants:	Cornelius Kazoora Jacob Moyini
Research Assistants:	Margaret Aanyu Edson Mujuni Kabann Kabananukye Pamela Kamusiime
Editor-in-chief:	Frank Turyatunga
Deputy Editor-in-chief:	Charles Sebukeera
Copy Editor:	Cathy Watson
Word Processing/Graphics:	Elizabeth Gowa
Layout:	Lau Cheaw Obel
Digital Map Production:	National Environment Information Center
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Finally, appreciation must be given to the efforts of Government and Donor Agencies that provided valuable information on the natural resources of this country. In similar vein, an expression of thanks should go to the people of Uganda as a whole whose growing concern and interest in environment protection, is essential for the sustainable management of natural resources of this country.

FOREWORD

On several occasions that I have had the opportunity to address Ugandans and the international community on matters related to protection of the environment, I have always emphasized the relationship between economic development and rational management of our natural resources. Due to the slow growth of our economy and the degree of poverty which pervades our communities, we have to rely on our natural resources to improve our livelihood and standards of living. This means that the levels of production and marketing of our products must increase. However, increased production *per se* does bring with it a host of environmental degradation problems.

In H.E. the President's address to the United Nations Conference on Environment and Development in Rio de Janeiro in June 1992, he pointed out that there were two categories of people who destroy the environment:

- those that do it out of ignorance and/or necessity; and
- those that do it out of greed, and do not want to use environmentally friendly and sustainable methods of resource utilization.

Most Ugandans fall in the former category. Since we need these resources for our own sake, it is in the interest of all Ugandans to protect and conserve them.

A number of environmental problems that I have come across in this country come to mind. They include:

- land degradation through deforestation, soil erosion and unsustainable agriculture, particularly in the districts of Kabale, Mbarara, Mbale and Bundibugyo.
- Poor animal husbandry methods such as pastoralism in Karamoja, which are no longer sustainable forms of resource utilization in rangelands
- Lack of energy for basic needs such as cooking and lighting in the districts of Tororo, Kumi, Arua and Kasese.
- The water hyacinth, a weed that is threatening our water works, hydroelectric power installations, water transport and artisanal fisheries in all districts bordering Lakes Victoria and Kyoga, and the River Nile. Government has also on several occasions raised its concern at the rate of denudation of our lake and river banks.

The seriousness of these and other environmental problems and the danger they pose to national economic development gives us the urgency to identify actions to halt and reverse them. Every Ugandan must, therefore, become a resource manager, starting at the homestead level and going up through to the national level. Individuals and communities must undergo behavioural change and embrace good environmental practices; those that have been charged with the management of these resources must continue to devise realistic but rational intervention measures; finally, up-to-date, accurate and timely information on the environment must be made available at local and national level.

I am, therefore, happy to avail to the people of Uganda and the international community, the first comprehensive report that deals with the complete realm of environmental protection.

As a Government and indeed as individuals, we may not have all the answers to the problems that affect our environment. I am, therefore, calling upon you to work with Government in developing appropriate policies and technical interventions that will ensure a full, clean and healthy environment for this generation and others to come.

As already evidenced through the launching of the National Environment Action Plan, and in line with the National Resistance Movement's Ten Point Programme, Government will continue to support this and other efforts that strive to make Uganda a better place to live in.

Finally, let me thank all those who have contributed in one way or another in producing this report. I urge all those involved in economic development and environmental management to read it.

Henry Muganwa Kajura
MINISTER OF NATURAL RESOURCES

PREFACE

The State of the Environment Report for Uganda, 1994 is one of the several documents that have been produced to support and strengthen the National Environment Action Plan (NEAP) process, which was launched by government in late 1991.

The NEAP is intended to provide a framework for integrating environmental considerations, broadly defined to include both natural and man-made environments, into the country's overall economic and social development. Much of the environmental degradation that has taken place in Uganda is a direct consequence of the political and economic conditions that prevailed between early 1970s and mid-1980s. Much of this has been halted or is being addressed by government. However, there is still lack of up-to-date information on the environment and the natural resources within it. Yet, adequate and up-to-date information that is both timely and accurate is a pre-requisite to sustainable environmental and natural resources management.

This State of the Environment Report (SOE) is meant to fulfil the following functions:

- To inform the public about the state of the environment in the country; the importance of resources and their value to society;
- to indicate key trends and projections, and opportunities for improvement; and
- to provide an accurate and useful reference document for those interested in environmental and natural resource issues.

This report, produced by the Ministry of Natural Resources through the National Environment Information Center (NEIC), is to be widely circulated in Uganda so that the majority of our people may be informed of the issues that relate to our environment.

In addition, it is one of the means selected by government to publish results of the environmental monitoring program developed under the NEAP process. This report will be published biennially, while environmental data reports and technical bulletins will be produced regularly and as the occasion warrants.

In order to develop a clear understanding of the environment in Uganda, it is necessary to start with local level information and aggregate this to form the national perspective. To this end, the Ministry of Natural Resources will continue with its efforts, and in collaboration with the District Development Committees, to produce District Environment Profiles. Already those for Iganga, Rakai and Kampala districts have been completed and preparation of the one for Mbale district is underway. Comparable studies have also been carried out for the Karamoja region.

District profiles which assist in the identification of existing resources, their state, available opportunities for sustainable utilization, and constraints related to their exploitation are expected to assist district development planning especially under the decentralization process.

I wish to point out that in preparing this report efforts have been made to bring out the "human side" of environment protection The report rightly presents the human being as the central focus for protecting our natural resources and quality of our environment In addition, the linkage between natural resources and environmental management, and social and economic development are adequately highlighted The section on **Environment and development** and that on **The human environment** should make interesting reading for those who wish to understand the correlation between environment protection and socio-economic development

I wish to thank first of all, the staff of the National Environment Information Center for working tirelessly to produce this report My thanks also go to the following the consultants and research assistants who were responsible for putting this report together, the NEAP Secretariat and the Task Force members who provided the initial material for building up this report and to the sector institutions and individuals who availed the much required information to the SOE team

A number of donors assisted government in one way or another in facilitating production of this report I wish to single out the following The United States Agency for International Development which funded production and dissemination of this report, the Danish International Development Agency which met the running costs for NEIC for part of the time and for providing some equipment, the United Nations Sudano-Sahelian Office which met the running costs and core activities of NEIC for part of the time, the United Nations Environment Program which donated the Geographical Information Systems hardware and software used by NEIC, and the United Nations Development Program for helping in reviewing the report

The World Resources Institute is commended for the technical assistance it provided to the Center during the report preparation process

Finally, I wish to extend my gratitude to those members of the Advisory Committee who have provided policy guidance and technical review of the report throughout this exercise

The Ministry of Natural Resources looks forward to receiving comments on this edition so that the subsequent ones may be even better and more informative

I wish you good reading

Ben Z Dramadri
PERMANENT SECRETARY
MINISTRY OF NATURAL RESOURCES

EXECUTIVE SUMMARY

Introduction

Uganda is one of the poorest countries in the world with a *per capita* income of US $ 170, below the Sub-Saharan African (SSA) average of US $ 340 in 1990. Given its abundant natural resource base and a generally favourable climate, and going by its economic performance in the 1960s, Uganda should be wealthy by both SSA and world standards.

Since the early 1970s Uganda has been faced with problems due to political turmoil. These have been compounded by poverty, low savings, high inflation, underemployment, excessive debt and inadequate managerial capacity.

At the same time, environmental stresses including deforestation, land degradation, overfishing, industrial pollution and lack of proper sanitation add new dimensions to economic problems. The new macro-economic policies and measures being formulated can no longer assume a sustainable natural resource base.

There is a need to harmonize the country's economic development goals with the use and management of its natural resources. Here lies the basis of the concept of sustainable development.

Environment and development

Uganda's Gross Domestic Product (GDP) grew by about 7% against a target of 5% in the 1992-93 financial year, a high rate by developing countries' standards. However, the country still faces a challenge of propelling economic growth to levels that will improve living standards and reduce poverty in a manner that is economically and ecologically sustainable. This is a daunting task given that past periods of decline in the economy continue to have a negative bearing on the country's earning capacity and its natural resource base.

The challenges that face the country must not only focus on raising living standards of the people but must also provide resources for those of the future.

Since 1986, Uganda's GDP has been growing steadily, averaging about 5-7% per annum for the last six years, with the greatest portion of this registered in the commercial as opposed to the subsistence sector. The improved atmosphere for investment indicates GDP will likely continue to rise if environmental factors remain favourable.

Uganda experienced an average annual growth rate in GNP of 2-4% between 1965 and 1990, which has been one of the lowest in SSA. This represents dismal economic performance given that Uganda's GNP in 1966 was larger than that of Kenya, Tanzania or even Thailand. The reigning military regime in the 1970s mismanaged the economy, efforts to revitalize it after 1979 suffered a setback due to insecurity that prevailed in the country. In addition, the terms of trade between Uganda and her major partners declined steeply after 1986. Inflation soared but is now dropping and has for 1993 registered an impressive average of 1.5%. These shortcomings are now partly being addressed through institutional and legal reforms including strengthening the central bank. Since it is necessary to have a strong financial sector in order to achieve sustained economic development, the central bank is now working towards maintaining adequate external reserves, ensuring a stable currency, formulating a

monetary policy and regulating deposit and non-deposit taking financial institutions to ensure that their activities are conducive to sustainable economic growth.

Uganda has a very narrow tax base with close to 50% of total revenue collections obtained from petroleum, beer, cigarettes, soft drinks and spirits. Tax revenue in 1993-94 was estimated at 8%, far below the SSA average of 2.1%. One result is that government has to rely on deficit financing to meet its development needs. The size of this deficit has tended to rise with time, a trend that does not augur well for sustainable economic growth.

Government has now put in place measures to widen the revenue base and rationalize and prioritize expenditure.

By the end of 1970, Uganda had reserves equivalent to four months' imports. However, between 1972 and 1980, the balance of payments account was constantly in deficit. Since 1986, the trade balance has been negative, and the balance of payments deficit is still large.

Failure to generate enough foreign exchange of its own has forced the country to depend on foreign aid for investment. Presently, the debt service ratio is about 60% before providing for interest.

Uganda has a high birth rate (50 births per 1000 people/year), a high population growth rate (2.5% per annum) and a high fertility rate (7.1 births per woman). Its current population of 16.67 million (1991 census) relies heavily on the natural resource base. These natural resources include the resources of crop lands, forests, rangelands, freshwater, wetlands, fisheries, wildlife and biological diversity, and existing stock resources such as minerals. Due to the lack of skilled manpower and scanty modern technology, these resource endowments have continued to determine the path of economic development.

The importance of natural resources in Uganda's economy is most obvious in agriculture, which contributed 54% to GDP in 1992, having declined from 72% in 1979.

Their share in the total country exports is another indicator of natural resources' major role. While high export shares have generally reflected the major role of natural resources in many economies in early stages of development, they have remained very important for Uganda - still accounting for almost 100%. Export of minerals, which once accounted for 30% of foreign exchange earnings, has long ceased. Instead since 1986, the export of non-traditional cash crops has been encouraged and their share of foreign exchange earnings is increasing steadily

Coffee still remains the main foreign exchange earner even when the decline in world prices has reduced the earnings from $400 million in 1986 to just about $ 100 million in 1992.

Employment in the agricultural sector has continued to be high with about 80% of Uganda's employed household population working in this sector (88% in 1975).

Natural resource-based activities also support the manufacturing sector, although on the whole the industrial sector is poorly linked to the natural resource base. Nevertheless, a few industries, especially those manufacturing cigarettes, cement, sugar, textiles and furniture, are based on local resources.

In the energy sector about 94% of the energy requirements in the country are met from trees (as fuelwood and charcoal) and about 1% from water as hydroelectricity.

The linkage of resources to industry extends beyond manufacturing and energy into tourism. Wildlife resources and biological diversity in general are essential components of tourism, which at its peak in 1971 fetched the country over $18 million from 85,000 visitors entering the country. Although past political instability and insecurity halted the growth of tourism, it has now picked up again with an estimated 75,000 visitors coming to Uganda in 1993 alone. Projections suggest the flow will increase to 125,000 in the late 1990s.

Finally, the environment provides valuable services that support economic growth and quality of life. Although it is still difficult to attach monetary value to these services, an indication of this value is reflected in the heavy costs that private and public sectors have to bear as these resources become depleted.

Uganda's economic and social welfare and its environmental quality depend on the effective and efficient management of the natural resource base. Changes in population, employment, settlement patterns and industrialization can affect resource use and environmental quality. At the same time, macro-economic variables, such as balance of payments, foreign debt, inflation rates, interest rates and investment levels, will be important determinants of how resources will be used and managed. Greater economic and social changes are coming to Uganda, and these underscore the need for this country to manage her rich resources effectively for all her citizens now and into the future. Natural resources will remain the foundation for Uganda's social and economic development for a long time to come.

State of Natural Resources

Agricultural landuse

The agricultural sector in Uganda generates over 50% of the GDP. Food production contributes 71% of sectoral GDP, is the main contributor to the country's export earnings and accounts for about 80% of the employed households in the country.

Agricultural use also takes up the largest share of Uganda's arable areas. Even though close to two-thirds of Uganda's arable land is not utilized, the current agricultural practices present some serious environmental problems, partly because the surplus arable land is located away from major population centers. The main environmental problems in agriculture include land fragmentation, soil erosion, inappropriate farming systems, soil compaction, agrochemical residues released into the environment, shifting cultivation and its effects, overgrazing, deforestation, siltation of water bodies and bush fires.

Forest resources

There are approximately 14,900 km^2 of gazetted forest reserves in Uganda. Forests also exist outside gazetted reserves on unprotected public areas and private land. Uganda's forests are unique, being rich in terrestrial biodiversity and covering a wide range of habitat types. They also provide multiple products and services. Forest products range from those that can be consumed directly after harvest such as firewood and food components to those that become intermediate industrial products. In addition, forests provide habitats for some unique insect, bird, reptile and mammal species, such as

the mountain gorilla of Mgahinga and Bwindi forests. The importance of forests to tourism cannot be over-emphasized. Perhaps the most significant use of forests in Uganda at present is provision of energy in the form of fuelwood. Very little of the woody biomass is obtained from gazetted forests or private lands. The bulk is from unprotected public forests and woodlands with no management in place to ensure sustainability.

The forest resource is faced with a number of environmental problems and threats, including: timber scarcity (the present estimate of sustainable timber supply will fall short of projected demand for savanna wood by the year 2000); aphid infestation, which has decimated large areas of cypress plantation in Uganda; deforestation and encroachment, largely through conversion to agriculture especially on non-gazetted areas; pitsawing, which is a wasteful method of converting roundwood to sawnwood; loss of vegetation on watersheds; and the conflict between conservation and exploitation policies. Currently the emphasis is towards enhancing the conservation values of the forests.

Wildlife resources

Uganda enjoys a high diversity of animal and plant species, mainly as a result of its geographical location in a zone of overlap between ecological communities characteristic of the dry East African savanna and those of the West African rainforest. It also lies astride the migratory routes of animals between the west and east and between the north and south of the continent. Protected areas for wildlife consist of seven national parks, eleven game reserves, twelve controlled hunting areas and six game sanctuaries. The main pressures on protected wildlife areas include the following: poaching, both traditional and commercial; encroachment, as unplanned population growth forces people to occupy these areas; fishing villages, which have resulted from expansion of settlement areas within protected wildlife zones; and excessive consumptive uses which are not controlled.

To a large extent, previous management activities were extensive in character and put greater emphasis on enforcement. The new management focus is intensive, directing individual national park activities according to the management plan, and with the active participation of the surrounding communities.

Forest and wildlife-related tourism

By 1970, tourism was Uganda's third largest foreign exchange earner, behind coffee and cotton. Between 1971 and 1986, the level of tourism declined drastically as a result of insecurity and the complete breakdown of law and order. Tourism has since picked up again in the country with the number of tourists arriving projected to exceed 100,000 per year in the late 1990s.

Uganda has many tourist attractions, including what some consider as its beautiful capital and a number of historic sites. However, the principal reason why tourists come to Uganda is the terrestrial biodiversity found in its forests and wildlife protected areas. The direct and indirect benefits that tourism generates are expected to increase as a result of improved conditions in the country. The growth of tourism in Uganda is not without its constraints, including tourist traffic, which is not yet regulated especially in pristine areas where eco-tourism is being promoted; local populations, which live near tourism areas and sometimes feel alienated and resort to destructive activities; and uncontrolled garbage disposal by tourists which is threatening animal life.

Wetlands

For its size, Uganda's wetlands are extensive and complex, covering an estimated 29,580 km^2 and occupying 12.5% of the area of the country. These wetlands are made up of areas with impeded drainage, swamp forests and papyrus and grass swamps. The country's wetland ecosystems fall into two broad categories: those associated with lakes and those associated with rivers and flood plains. In addition there are smaller unconnected units referred to as "dambos", which receive water from surrounding hills but have no outlets.

Collectively, Ugandan's wetlands provide biological diversity, biomass production, sediment, hydraulic, nutrient and toxins retention functions. The great role they play in local fisheries, water supply, sewage treatment, biodiversity conservation and support to agricultural production is well evidenced in Uganda.

Important as the country's wetlands are, some of the present uses of the resource and activities from other sectors of the economy pose serious threats to their existence. The following are the major ones: agricultural conversion, both for small-scale rural farming and for large-scale rice cultivation, drainage activities for dairy farming and other forms of agriculture, industrial pollution mainly from the manufacturing and mining sectors, other industrial impacts including brickmaking, over-harvesting of natural products such as fish and vegetation, burning of wetlands, which changes the state of their ecosystem, management constraints arising out of inappropriate land tenure systems, unregulated and unplanned wetland resource utilization and inadequate policies, and lack of accurate information available to all stakeholders.

Water

Uganda is well endowed with water resources in the form of direct precipitation, ground water, runoff, and surface water. Three of the lakes in the country are shared with other riparian states, and each of the eight major rivers have an estimated length in excess of 100 km with varying discharge rates. The groundwater resources comprise five aquifer systems; there are an estimated 8,000-10,000 natural springs; 8,000 boreholes had been drilled in the country by 1990; and there also exist 17 thermal and mineral springs.

Responsibility for water management has traditionally been vested in the government. However, it was seriously affected by the political turmoil and insecurity of the 1970s and 1980s to the extent that government virtually abandoned efforts in water resources assessment and monitoring. These are now slowly being restored.

The current environmental concerns about water resources development and management are: knowledge of the available resources and potential, and the demands placed on them for development purposes; the optimal allocation of available water resources to meet the demand; and the determination, control and disposal of consequences of development in such a manner that the resource is not degraded over time.

More specifically, the main environmental issues related to water resources in Uganda include droughts and floods (the country's rangelands are drought prone and also localized floods are becoming more common during rainy seasons), irrigation and its attendant problems of agrochemicals and pressure on natural wetlands, consumptive demand for safe clean water (currently only 20% of rural and 40% of urban population enjoy clean water), lack of water quality control legislation, pollution from agriculture, industry and mining, and international relations (some existing interna-

tional treaties and provisions are generally accepted to have adverse environmental and socioeconomic impacts on Uganda and need to be reviewed and modified). The institutional, policy and legal weaknesses in the management of water resources in the country are currently being addressed.

Fisheries

The fisheries of Uganda constitute an important resource which contributes significantly to GDP, to the nutritional welfare of the people, and employs thousands. Quantities of fish caught in Uganda's waters increased yearly from 1961, peaking in 1978. They then declined until 1990 when the 1978 peak was regained; it has recently been surpassed. While Lake Victoria supplied 42.1% of the national catch in 1961, its share had declined to 6.4% by 1978, rebounding to 49.0% in 1992 due to the increased availability of Nile Perch (*Lates niloticus*), an introduced species.

Even when data on potential annual yield and annual harvesting levels are still incomplete, greater demand for fish in Uganda and her neighbours has led to increased fishing intensity.

Fish harvesting has been and is still predominantly artisanal; most of the processing is done by traditional methods such as sun-drying, salting, frying and hot-smoking. A number of processing plants have of recent been licensed to operate in the country.

The fisheries resource faces a number of environmental threats which include over-exploitation of fish, management which is not backed by efficient research, enforcement, extension or monitoring; energy scarcity for traditional fish processing; health problems especially malaria and water-borne diseases in the fisherfolk communities, pollution from various sources; eutrophication arising out of nutrients entering water bodies (already a problem in Lake Victoria), degradation of the fringing vegetation especially wetlands, global warming and its related impact on the oxygen levels in the lakes, and invasion of Uganda's lakes and rivers by water hyacinth (*Eichornia crassipes*), perhaps the most visible and well-publicized problem facing the fisheries resource in the country.

Energy

Energy is a critical means for development, and the stage of a country's development can often be gauged by its level of consumption of commercial energy. Compared to other countries in the region, Uganda's *per capita* consumption of commercial energy is very low, having been affected by the economic decline of the 1970s and early 1980s. There have also been an increased use of woodfuels, low investment in electricity generation, and distorted pricing mechanisms. Up to the present, woody biomass in the form of charcoal and fuelwood are still the main sources of energy nationally. Uganda's energy sector, divided into four subsectors of woodfuel, petroleum, electricity and new and renewable sources of energy, has the following environmental problems: deforestation (current demand of woodfuel outstrips supply by about 17%); use of agricultural residues which would have otherwise been ploughed back into the soil to conserve soil fertility; air pollution arising out of burning and production of wood-based fuels and utilization of petroleum products; the impacts of hydropower generation especially on near-site ecosystems and human settlements; electricity transmission and its potential hazards; and lower levels of nutrition in circumstances where scarcity of energy affects the quality and quantity of food consumed.

Population, health and human settlement

Uganda's total population of 16,671,700 (1991 census) has risen by 485.6% since 1931. The current fertility rate of 7.1 births per woman, birth and death rates of 50 and 15 per 1000 population respectively, and a dependency ratio of 102.6% are high by any standards.

About 89% of the total population is rural, and is engaged in agriculture based on household farms. The high population growth rate has led to a decline in output. About three-fourths of households spend less than $ 50 per month, most of which is spent on food alone. Poverty and population pressure have affected environmental health and consequently the ability of people to manage their environment.

Life expectancy is on average 47 years, infant and childhood mortality rates are 122 and 180 per 1000 live births respectively, with most diseases associated with improper food hygiene, air and water pollution, low incidence of immunization, AIDS, and a generally poor health care system. There is a low doctor:patient ratio of 1:20,000, the majority of trained personnel having left the country for "greener pastures" over the last two decades or so.

About 84% of the houses in rural areas are owner occupied, while about 60% in urban areas are occupied by tenants. Although it is estimated that 1000-1500 units of rural and about 10,000 units of urban houses are built annually, 44.5% of existing housing stock needs to be upgraded while 51.6% requires replacement. The majority of the housing units in Uganda are made of poles and mud (74.1%), a similarly large number (52.3%) are roofed with grass. This has negative effects on forest, woodland and wetland resources.

On the whole, infrastructure has continued to steadily improve: the rail network is about 1,280 km, road network is 20,300 km of gravel and 9,918 m of trunk roads of which 1,979 km is tarmac. The other basic social and infrastructure services are not easily accessible.

There are a number of environmental issues that relate to population, health and human settlement. These include: overpopulation, which is putting more pressure on natural resources, causing invasion of protected areas and accelerated rural to urban migration, poverty which has resulted in low levels of household income, food insecurity, reproductive wastage and poor health, low levels of education, and poor housing, life expectancy which, according to the census (1991) decreased from 48 years in 1960 to 47 in 1992, which is low and mainly due to preventable diseases; pollution of the air, water and land and its effects on human health, land and biological diversity resources, AIDS, which is not only taking a heavy toll on Uganda's population, but also putting an unprecedented burden on the country's health care services; poor disaster preparedness for natural and man-made hazards; wetlands misuse, deforestation, given the nature of the livelihoods in which the majority of Ugandans are engaged; poor sanitation and lack of access to clean and safe drinking water; and the nature of energy requirements which are gradually causing deforestation in the country.

Industry and mining

Industry

Being well endowed with natural resources which could form the basis for industrial production in the country, Uganda is currently pursuing a deliberate policy of industrial promotion by creating an enabling environment. However, the manufacturing share of GDP of 4.7% has shown little growth; manufacturing contributes about 2.06% to total formal employment. Industrial output of the informal sector is estimated at 70% of the total and therefore generates more jobs. In the formal sector, capacity utilization is still below 50%.

In 1991, the Uganda Investment Authority (UIA) was established as a "one-stop" center to process investment licences and also to safeguard the environment and health of employees.

The environmental issues in industry and mining in Uganda include: dust emissions beyond permissible exposure in industries processing coffee, cotton, cement, plastics and other products, which have resulted in respiratory disorders in workers; industrial effluent discharges which have contaminated fresh water sources and affected aquatic flora and fauna; lack of disaster preparedness in most industries, and hence the irresponsible absence of even simple fire fighting and emergency health aid equipment and materials; low capacity utilization due to lack of or poor maintenance and repair of plant and equipment; poor management and under-capitalization; reliance on imported raw materials, which drains resources that could have been spent on social welfare; infrastructural bottlenecks such as lack of clean water, and efficient and diversified energy sources; and lack of a clear policy on small-scale industries which form the bulk of the manufacturing sector in Uganda.

Mining

Mining in Uganda started in 1907 and contributed significantly to the national economy until the late 1970s when it came to a standstill. There are known mineral deposits of copper, phosphates, tin, wolfram and gold. Limestone mining at Tororo and Kasese is at a low level. A cobalt-ferrous by-product will soon be processed into cobalt using the bio-leaching process, and plans to produce lime pozzalana cement are underway. Clay mining is widespread and prolific. On the whole, Uganda has many types of minerals, which a number of industries use, but the quantity and quality of the reserves are not yet fully established.

Environmental issues in mining include: damage to the landscape, especially in the mining of clay, limestone and gold, creating hazards to humans and wildlife; pollution arising out of mining methods and processes; and deforestation mainly as a result of firing clay and limestone kilns.

Environmental legislation and policies

When Uganda gained independence, most basic aspects of the colonial policies and laws governing natural resources remained intact and continued to operate. This failure to develop homegrown laws to govern the use of natural resources is now exacting an expensive premium on the environment. Uganda has enacted not less than 60 statutes governing various aspects of natural resource management and the protection of the environment. However, these existing environmental and natural resources laws and policies present problems: lack of involvement of the local people since formulation and implementation of laws and policies have traditionally been the prerogative of central government (this has caused many people to see protected natural resources as areas of exclusion), limitations of existing laws which pay little attention to important environmental aspects such as biological diversity; reactive legislation which has tended to respond to crisis situations instead of being anticipatory; poor implementation and enforcement of environmental laws and policies due to lack of logistic, financial and human resources; and lack of coordination as most laws and policies have evolved along sectoral lines, becoming compartmentalized.

Environmental institutions

Before the Ministry of Environment Protection was established by the NRM government in 1986, environmental issues had been relegated to the background. The Ministry was thus formed to coordinate and enhance natural resource management, to harmonize the interests of resource users, to monitor the environment, and to advise government on policy and legislative reforms for ensuing sound environmental management. Following institutional reforms, much of this responsibility lies with the Department of Environment Protection within the Directorate of Environment, under the Ministry of Natural Resources. There are also a number of sectoral institutions directly concerned with protecting the environment. Analysis of these institutional arrangements under the NEAP

process has revealed the following issues: sectoral placement of environmental governance makes it difficult for the department to fulfil its mandate; the sectoral approach towards environmental management increases the bureaucracy, is highly centralized and results in poor communication between the planners and the implementors at the grassroots; environmental monitoring, coordination, supervision and management have remained on an ad hoc basis; and a number of areas of environmental interest are not covered under any sectoral jurisdiction and have as such suffered further degradation.

The NEAP has proposed the establishment of a National Environment Management Authority (NEMA) and made submissions on how such an Authority can bring environmental management to desired levels.

Environmental education and public awareness

In Uganda, like in most other developing countries, there is a general lack of understanding of the place and role of the population in the environment. Apart from the population lacking elementary knowledge on the development of the biosphere, some of the social, moral, economic and cultural heritages tend to contribute to the formation of negative views about the environment. Yet, the survival of Ugandans will continue to depend on the rational utilization of natural resources and sound management of the environment.

There is, therefore, need to create and maintain a deliberate effort on environmental education and awareness. The concept of environmental education and creating of public awareness is relatively new in Uganda. Current efforts to address it face problems including: lack of policy to incorporate environmental education at all levels of formal education (it has recently been addressed in the 1992 government white paper on education); inadequate financial resources which have limited the introduction of environmental education in the school curricula; lack of trained human resources; until recently there have been limited opportunities for environmental education in non-formal education in Uganda; erosion of indigenous knowledge due to colonial and post-colonial policies, modern systems in human settlements, agriculture, industrialization, education and use of manufactured goods which have collectively eroded indigenous knowledge in resource utilization, inadequate popular participation in resource management due to policies of exclusion, and high population growth which is putting pressure on natural resources.

Environmental Information

Uganda's environmental problems need urgent attention before they become bottlenecks to development. This calls for rational decision making and concerted effort from all government and non-governmental institutions and agencies and the private sector. The necessary ingredient to sound decision making is the availability of accurate, up-to-date and timely environmental information. The current state of environmental information exhibits the following weaknesses: lack of a strong environmental information system capable of monitoring the quality and quantity of environmental resources; lack of dissemination of environmental information which is currently at best ad hoc; data limitations with respect to availability, quality, coherence, standardization and accessibility; and lack of an inventory of existing data stock which should assist in identifying current information gaps and prioritizing data collection activities. The over-riding factor in all these cases appears to be lack of financial resources.

Environmental research

In the past, Uganda shared a lot of research facilities, and coordinated research programs and priorities with the other two members of the defunct East African Community. However, during the 1970s and 1980s, the country lost its research prominence. Although now there is an enabling environment for research, environmental research still faces some problems which include: lack of skilled and competent personnel (many left the country for better opportunities); lack of research facilities; and lack of support services.

Environmental monitoring

The first rationale for monitoring Uganda's environment is the fact that the economy is largely natural resource based. Second, Uganda's population is predominantly rural and poor; poor Ugandans are both agents and victims of environmental degradation. Third, Uganda is a signatory to several regional and international environmental agreements that have monitoring as an explicit and implicit requirement. Finally Ugandans need to be regularly appraised of the state of their environment in order to gain information about present levels of harmful or potentially harmful stressors; identify environmental risks and impacts not previously known so that they can be brought under control; follow the movement of harmful agents through the country's environment into living organisms including the human population; assess known environmental risks and evaluate their control measures; and identify and promote activities that are beneficial to the environment and thereby fulfil the principle of sustainable use of natural resources. Environmental monitoring in Uganda is currently typified by the following inadequacies: lack of a coherent and comprehensive monitoring system capable of providing early warning signals; inadequate description of useful environmental monitoring indicators; sectoral approach towards monitoring that lacks well defined processes and methods; and generally inadequate, unreliable and often inconsistent data. The poor environmental monitoring strategy has often led to management by crisis.

LIST OF ACRONYMS

ACP	AIDS Control Program
APE-NEAP	Action Program for the Environment-National Environment Action Plan
AFRENA	Agroforestry Research Networks for Africa
BRGM	Bureau De Recherches Geologiques et Minieres
CARE	Cooperative Relief and Assistance Everywhere
CIFA	Committee on Inland Fisheries for Africa
CMB-CPSU	Coffee Marketing Board Central Processing and Storage Unit
DANIDA	Danish International Development Agency
DOA	Department of Agriculture
DEP	Department of Environment Protection
DHS	District Health Services
DWD	Directorate of Water Development
FAO	United Nations Food and Agriculture Organization
GDP	Gross Domestic Product
GNP	Gross National Product
HBS	Household Budget Survey
HFCU	Housing Finance Company of Uganda
IBRD	International Bank for Reconstruction and Development, World Bank
ICRAF	International Centre for Research on Agro Forestry
IUCN	World Conservation Union
KCC	Kampala City Council
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MFEP	Ministry of Finance and Economic Planning
MLHUD	Ministry of Lands, Housing and Urban Development
MOH	Ministry of Health
MOLG	Ministry of Local Government
MPED	Ministry of Planning and Economic Development
MUHENR	Makerere University Institute of Environment and Natural Resources
NARO	National Agricultural Research Organization
NEAP	National Environment Action Plan
NEMA	National Environment Management Authority
NEIC	National Environment Information Center
NORAD	Norwegian Agency for International Development
NWSC	National Water and Sewerage Corporation
PAPSCA	Program for the Alleviation of Poverty and the Social Costs of Adjustment
PTA	Preferential Trade Area
SOE	State of the Environment
SSA	Sub-Saharan Africa
TASO	The AIDS Support Organization
TECCONILE	Technical Cooperation Committee for the Promotion of the Development and Environmental Protection of the Nile Basin
UCTU	Uganda Cooperative Transport Union
UEB	Uganda Electricity Board
UFD	Uganda Fisheries Department
UFFRO	Uganda Freshwater Fisheries Research Organization
UIA	Uganda Investment Authority
UNEP	United Nations Environment Program
UNICEF	United Nations Childrens' Fund
UNP	Uganda National Parks
UPTC	Uganda Posts and Telecommunications Corporation
URA	Uganda Revenue Authority
URC	Uganda Railway Corporation
USAID	United Nations Agency for International Development
WQPCL	Water Quality and Pollution Control Laboratory
WRI	World Resources Institute

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Errata

p.x	Second paragraph line 3: replace "savanna" with "sawn".
p.xii	Energy: Line 6: replace "fuelwood" with "firewood".
p.xiv	Environmental legislation and policy: Second last line: replace "logistic" with "logistics".
p.13	Second paragraph, second line: replace "fuelwood" with "firewood".
p.15	Fourth paragraph, first line: replace "African" with "Africa"
p.17	Table 2.1: Fourth column should read "Arable land, Km^2".
p.35	Section 2.7, Agriculture and Environment: First line: replace "systems" with "system".
p.42	Second paragraph, second line: delete "Figure 2.19"
p.42	Last paragraph, last line: replace "Figure 2.21" with "Figure 2.20".
p.44	First paragraph, third line: replace "Figure 2.22" with "Figure 2.21".
p.74	Table 4.1: Third column should read "Area in Uganda, Km^2"
p.78	First paragraph, first line: replace "northwestern" with "northwestern slopes of Virunga"
p.82	4.1.4.1 In-stream and off-stream water uses: First paragraph, first line: replace "users" with "uses" Second paragraph, first line: replace "Table 4.6" with "Table 6.2".
p.85	Second paragraph, third line: replace "nutational" with national".
p.98	4.2.3.6 Sustainability of catch levels: Last sentence: replace "1988" with "1983"..
p.113	Top of page: insert a heading "4.3.5.1 Agricultural conversion"
p.123	5.1.5 Family planning: First paragraph, last sentence replace: "higher-level education" with "higher level of education".
p.172	Figure 6.2: *Per capita* annual commercial energy consumption should be in tonnes of oil equivalent (toe).
p.189	Historical perspectives of industrial development: Third line: replace "manufacturing" with "manufacturing sector".
p.200	Second paragraph, first line: replace "scared" with "scarred".
p.200	7.5.5 Petroleum: First paragraph, second last line: replace "Laropi of Pakwach" with Laropi-Pakwach".
p.201	7.5.8 Clay mining: Fourth line: replace "malaria" with "mosquitoes".
p.206	Second paragraph, second line: replace "their" with "the".
p.208	Third paragraph, third last line: replace "hydraulic" with "hydrologic".
p.228	Box 8.5 item "A" should read "Geology and Topography".

1. ENVIRONMENT AND DEVELOPMENT

1.1 Introduction

Uganda is one of the poorest countries in the world with a *per capita* income of US $170, below the average level for all Sub-Saharan African (SSA). Given its abundant natural resources and generally favourable climate, and going by its economic performance in the 1960s, Uganda should be wealthy by SSA standards and should be ranked favourably by world standards. In fact, in 1966, Uganda's *per capita* income of US $160 was higher than that of Thailand [1]. Today, Thailand has nine times the *per capita* income of Uganda. However, Uganda's problems of political turmoil, poverty, low savings, high inflation, underemployment, debt and inadequate managerial capacity are man-made and can, therefore, be overcome.

At the same time, environmental stresses such as deforestation, land degradation, over fishing, lack of sanitation and industrial pollution add new dimensions to economic problems. This is because as new macroeconomic policies and measures are formulated, a sustainable natural resource base can no longer be assumed. It is for these reasons that natural resource use and macroeconomic planning must be harmonized. By implication, the management of natural resources is no longer of concern only to natural scientists but to all people of all disciplines and interests. There is a need to understand the inter-relationship between the state of a country's natural resources, the wastes it generates and its ability to achieve proposed economic development goals. This is the basis of the concept of sustainable development.

1.2 Prerequisites for achieving sustainable development

In the past economists tended to emphasize the notion of short-term economic growth accompanied by long-term qualitative change. Today, however, the new concept of sustainability in economic development suggests that short and long-term economic growth requires the integration of environment and equity considerations. Even though sustainability is a concept still open to debate, Uganda's understanding of sustainable development is in consonance with that of the United Nations Conference on Environment and Development (UNCED) and the Commission on Development and Environment (Our Common Future, 1987). "generations should meet their needs without compromising the ability of future generations to meet their own needs."

In Uganda, sustainable economic development can occur if the following are made possible.

- First, there is need for stable and sustainable economic growth, without which human needs and aspirations cannot be met. It takes production, growth and open and well-functioning markets to increase the goods and services to a growing population, to meet demands for a better life and, above all, to address poverty.

- Second, there is a need for more equitable distribution of resources and a more equitable distribution of the proceeds of growth among the regions and the population.

  To ensure social and political stability and economic equity, poverty must be reduced and social and gender inequalities addressed.

- Third, economic growth must bring about improvement in human welfare via increased investment in people through better education better health and better nutrition. Economic growth must be human-centred.

- Fourth, the capacities and resilience of Ugandan institutions must be nurtured and sustained. This requires a system of governance which fosters accountability, transparency and equity. Equally important, the citizens must be given the opportunity to participate in decisionmaking.

- Finally, but not least important, the natural resource base, so necessary to the sustainability of economic growth and quality of life, must be conserved and enhanced. Natural resources include both the material supplied by nature - land, water, air, energy, minerals, biodiversity and other living resources - and the environmental services that are essential for the continued functioning of the biosphere. All are important ecologically, socially and economically. The people must be made aware of these relationships. Better monitoring of the environmental impact of development activities must be institutionalized.

1.3 Limitations in measuring sustainable development

An important limitation in present day Uganda is that the way in which development planning information is generated does not help us to understand the environmental effects of macroeconomic policies and human actions. Nor does it help us to understand how these environmental impacts affect prospects for sustainable economic development. One explanation is that the desire for environmental stability has not influenced the design of policies for economic growth. In fact, the design of economic policies rarely plans for or considers the environment. For example, decisions to borrow money or to promote trade have important environmental consequences which are rarely examined beforehand. Second, the present system of reporting national economic indicators does not adequately capture the environmental benefits gained nor the costs incurred in investment decisions, consumption patterns and government policies. Finally, Uganda lacks the capacity to identify, quantify and value, let alone monitor environmental changes. Until Uganda improves its national accounting methods and its environmental monitoring systems, while at the same time recognizing local problems in data collection and analysis, decisions will continue to be based on poor information.

1.4 The challenge of sustainable economic development

In the 1992-93 financial year, Uganda's gross domestic product (GDP) - a standard measure of economic activity - grew by about 7%, against a target of 5%. This rate is high by developing countries' standards[2]. In spite of this, Uganda faces a challenge in the 1990s of propelling the economic growth at levels that will improve living standards and reduce poverty in a manner that is economically and ecologically sustainable. Between 1962 and 1970, the real GDP and *per capita* income grew annually by 5.8% and 3% respectively. The country maintained a reasonable savings rate, averaging 15%, which permitted the implementation of an ambitious investment program without undue pressure on domestic prices or the balance of payments. These positive trends were reversed between 1970 and 1979 because of economic mismanagement and between 1980 and 1985 because of political instability. These periods of decline continue to have a negative bearing on the earning capacity of the country and its resource base.

It is important to look at the factors in Uganda's economic decline. First, the economy became

dependent on coffee exports which accounted for as much as 96.8% of total exports in 1979 compared to 54% in 1970. But when world prices fell, coffee fetched only $100 million in 1991 as compared to $400 million in 1986. Tourism, once the third earner of foreign exchange after coffee and cotton, greatly declined in the 1970s. Exports of minerals, especially copper ceased by 1978. The industrial sector suffered considerably following the 1972 expulsion of Asians who owned and managed most of the industries. The road infrastructure, which in the 1960s was among the best in Africa, fell into disrepair.

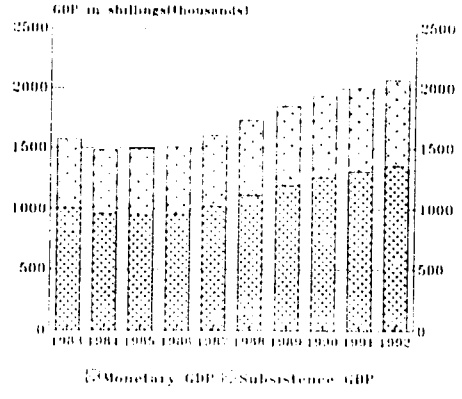
The challenge for the 1990s is indeed formidable. Economic development must focus not only on raising living standards of the current generation but must also provide resources for those of the future. Uganda's present challenge is that 55% of its population is poor, with less than $110 *per capita* income per year. The importance of reducing poverty cannot be overemphasized[3]. To double gross national product (GNP) *per capita* to $340 given the current population growth rate of 2.5% will require that the economy grows at 8% per annum from now till the year 2005. But even at that rate, Uganda will still be a poor country. Economic growth will need to be sustained at higher rates if improvement in human welfare is to be achieved. This level of growth in the economy will require considerable investment in the natural resource base and growth in natural resource productivity for some time to come. Despite the magnitude of the task, there are positive trends. Since 1987, the government has pursued policies aimed at correcting the deterioration in the economy which occurred between 1971 and the mid-1980s. There is also a growing awareness of the need for natural resources management. Arising out of the National Environment Action Plan (NEAP) process, efforts are under way to enact new laws, re-orient policies, strengthen institutional arrangements, and increase public awareness so as to reduce the pressure on natural resources and achieve sustainable economic growth.

1.5 The state of the economy

1.5.1 Gross domestic product

Since 1986, GDP has been growing steadily, averaging about 5.3% per annum for six years. While the subsistence portion of the economy is about 31%, almost all of the growth has occurred in the commercial sector (**Figure 1.1**). However, growth has been negatively affected by bad weather. With peace having been restored to the north and northeastern parts of Uganda, and with weather permitting, Uganda can expect GDP to continue to increase.

Figure 1.1: Rate of growth of GDP 1983-92 at constant (1991) prices

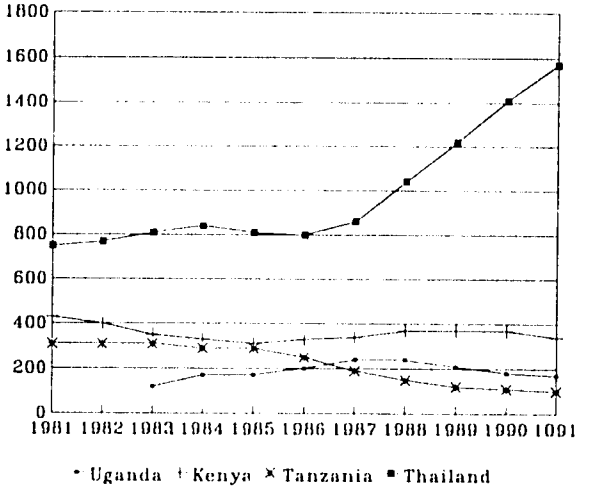


Source: Background to the Budget, 1993-94

1.5.2 GNP *per capita*

In 1991, GNP *per capita* for Uganda was $170 as compared to $340 for Kenya, $100 for Tanzania and $ 1,570 for Thailand[4] (see **Figure 1.2**). In 1966, Uganda's GNP *per capita* of $160 was higher than that of Kenya ($120), Tanzania ($90) and Thailand ($150)[5]. However, Uganda's average annual growth rate of -2.4% between 1965 and 1990 was the lowest in all of SSA[6]. Between 1971 and 1979, the economy was mismanaged by a dictatorial military government. The efforts to revitalize the economy after 1979 could not produce consistent achievements because of political instability. To make matters worse, after 1986 the terms of trade continued to decline even faster for Uganda than for her neighbours, Kenya and Tanzania. Furthermore, population growth (2.5% per annum) continued at very high levels

Figure 1.2: GNP *per capita* for selected countries 1966-91 in US $



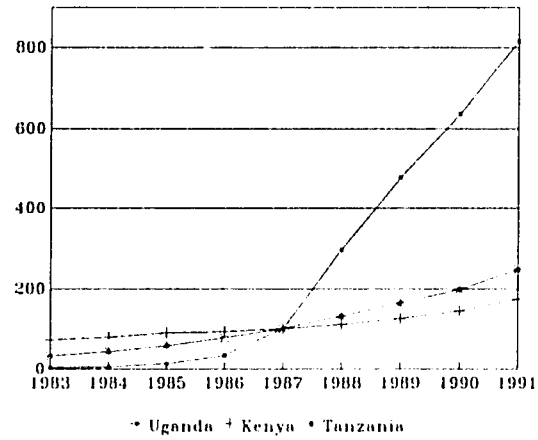
Source: World Debt Tables, 1987, 1989-90; World Development Report, 1993.

1.5.3 Rate of inflation

Between 1962 and 1970, the growth of the economy was stable and inflation grew at an average annual rate of only 3%[7]. However, because of economic mismanagement, inflation grew at a rate of 74% per annum between 1972 and 1980[8]. The high rate of inflation has been responsible for speculative investment in the past and for a variation in the consumer price index that has been much greater than that experienced by Uganda's neighbours (**Figure 1.3**). However, in recent years remarkable achievement has been made in controlling inflation. Whereas the annual inflation rate was as high as 356% in 1986, it currently stands at about 15%. **Figure 1.4** shows the inflation trend between 1987 and 1992. Inflation has not been conducive to savings: without savings, banks and other financial institutions have fewer funds to lend for investment.

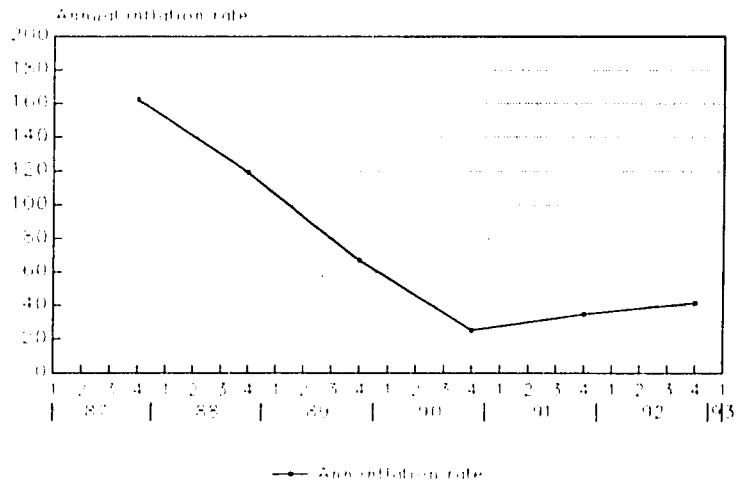
Uganda must have a strong financial sector in order to develop. To make the financial sector responsive, the government has already initiated institutional and legal reforms by strengthening the Central Bank's powers to maintain adequate external reserves, ensure the stability of the currency, formulate monetary policy, and regulate deposit and non-deposit taking financial institutions to ensure that their activities are conducive to sustainable economic growth and development.

Figure 1.3: Consumer price indices for Uganda and neighbours [1987=100]



Source: World Tables, 1993

Figure 1.4: Annual rate of inflation



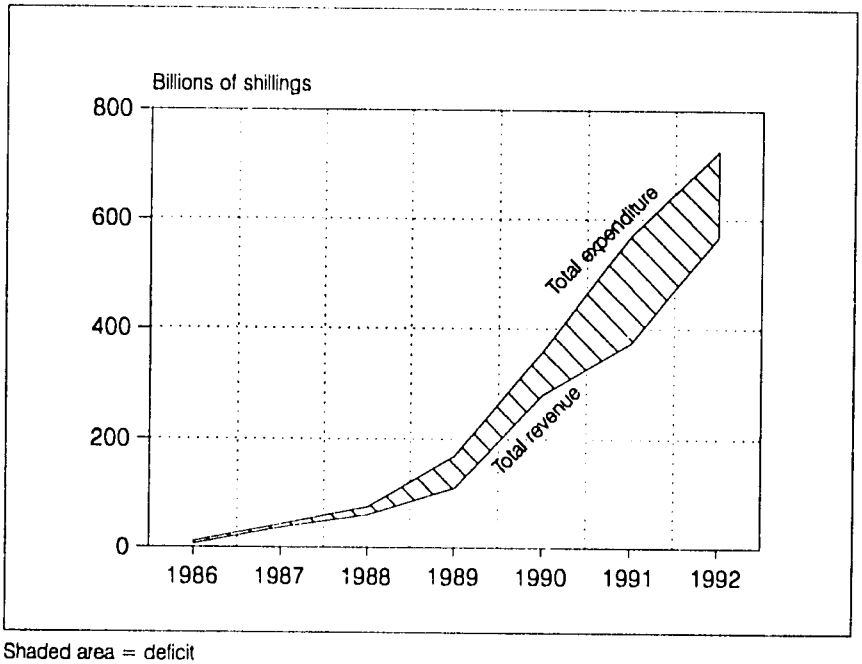
Source: Background to the Budget 1993-94

1.5.4 Level of government investment and deficit

Despite the modest improvement in the recovery of the economy, the government's capacity to generate resources for sustainable development is low by African standards. In 1993-94, tax revenue as a percentage of GDP is estimated at 8%, which is much below the 21% average for SSA countries[9]. The problem is that the tax base is very narrow. Currently, close to 50% of total revenue collections comes from five products (petroleum, beer, cigarettes, soft drinks and spirits)[10]. The shortage of funds has forced the government to rely on deficit financing to meet its development objectives. The size of the deficit has risen over time (**Figure 1.5**). This trend is not conducive for sustainable economic growth. Uganda's high level of deficit financing is linked to the low levels of exports and to deteriorating world prices of the major export, coffee. At this stage external funding supports 75-85% of capital expenditure.

The government has taken steps which are likely to improve the domestic saving situation: increasing revenue collection; reducing the size of the civil service and the military; and divesting itself of many parastatals and public enterprises which have been a drain on its financial resources. It is also encouraging export of non-traditional cash crops. All these steps are intended to widen the revenue base on the one hand, and to rationalize and prioritize government expenditure on the other.

Figure 1.5: Government revenues, expenditures and deficit



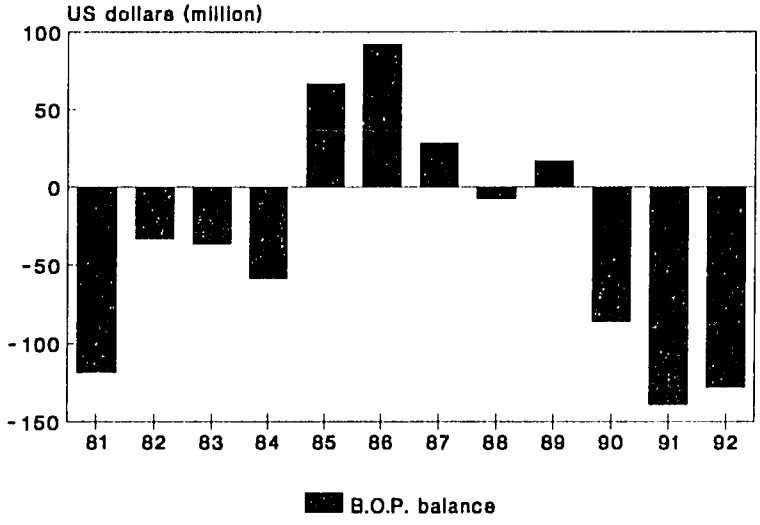
Source: Background to the Budget 1993-94

1.5.5 Balance of payments account

A strong balance of payments account is an essential element in any strategy to achieve sustainable economic growth. This is because it acts as a cushion against external and internal shocks. In 1970, the foreign exchange earning capacity of Uganda was based on exports of coffee (54%), cotton (18.7%), copper (8.8%), tea (5%) and others (13.5%)[11]. Export earnings were more than adequate to offset the import bill and to give the country surplus on its current account. By the end of 1970, Uganda had net reserves equivalent to four months' imports.

Between 1972 and 1980, the balance of payments account was consistently in deficit save for the coffee boom period in 1976 and 1977. Since 1980, the trade balance has been negative and the balance of payments deficit large (**Figure 1.6**). The main cause has been the deteriorating terms of trade, (**Figure 1.7**) mainly because of falling world prices of coffee in relation to the prices of the goods and services Uganda imports.

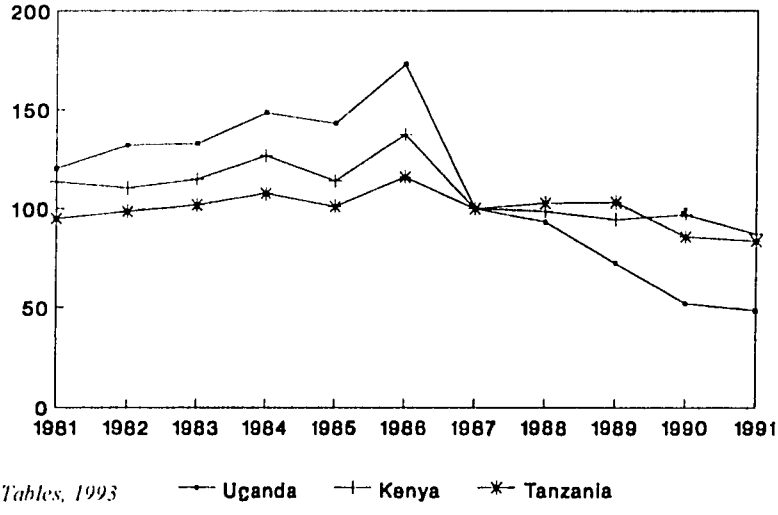
Figure 1.6: Balance of payments 1981-1992



Source: Background to the Budget 1993 94

The projection for 1992 is provisional

Figure 1.7: Terms of trade *1987 = 100*

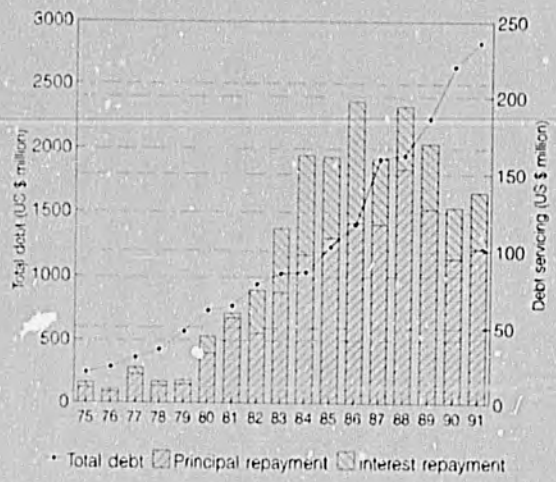


Source: World Tables, 1993

1.5.6 External debt

Failure to generate enough of its own foreign exchange has forced the country to depend on foreign aid for investment. At the moment, the ratio of debt servicing to foreign exchange earnings, is about 60% before providing for interest (see **Figure 1.8**). The debt problem has gone on for years and started when the government preferred borrowing money from abroad rather than encouraging direct investment. Restoring income growth and increasing exports to raise funds to repay debts will have to be done in the context of attracting domestic and foreign investment while managing its recovery. Uganda is already addressing the foreign exchange constraint by encouraging diversification of the export base and by attracting foreign investments.

Figure 1.8: Debt trends in Uganda



Source: World Debt Tables, 1993

1.6 Human resources and natural resources

Uganda is rich in human and natural resources. Prospects for sustainable economic development become more clear if the relationship between population and environment is first understood. Uganda's population has grown dramatically, rising from 2,463,400 people in 1911 to 16,671,700 people in 1991. It has a high birthrate (50 births per 1000 population each year as compared to 46 births per 1000 for SSA[12]), a high population growth rate of 2.5% per year and a high fertility rate of 7.1 births per woman (see **Table 1.1**)

Table 1.1: Human resources

Population size (1991)	16,671,700
Growth rate	2.5% per annum
Birth rate	50 per cent 1000 population
Fertility rate	7.1 births per woman
Percent urban (1991)	11%
Percent rural (1991)	89%
Life expectancy	45 years for males
	49 years for females
	47 for both
Infant mortality	122 per 1000
Literacy level (average)	54%
Literacy level men	64%
Literacy level female	45%
Per capita income per annum	$170
Percent of population with access to safe drinking water	20%
Percent of urban population with access to safe drinking water	40%
Percent of rural population with access to safe drinking water	17%

Source: MFEP (1992) Housing and Population Census 1991

The high population growth rate means that hundreds of thousands of people are added to the population each year, intensifying pressures on the economy and natural environment for basic needs like food, energy, shelter, water and social services. For example, 94% of energy demands in the country are met by fuelwood, and presently fuelwood consumption is exceeding the sustainable supply by a margin[1] of about 17%.

Population density in Uganda varies from place to place. Kampala, Jinja, Kisoro, Mbale, Kabale and Tororo support high population densities. Kampala and Jinja have continued to attract more people because they are the leading centers for business and employment. Problems of industrial pollution, housing, sanitation and sewage are easily noticeable in these two cities. High population densities in rural areas are often responsible for land degradation, deforestation and depletion of soils and other natural resources.

The principal natural resources of Uganda include the renewable resources of croplands, forests, rangelands, freshwater, wetlands, fisheries, wildlife and biodiversity and the non-renewable mineral resources. Because Uganda still has little skilled manpower or modern technology, these resource endowments have continued to largely determine the path and pattern of economic growth.

1.7 The role of natural resources in the economy

Uganda can boast of a comparative advantage in having a rich and diverse natural resource base. But experience has shown that whether a resource-rich endowment promotes economic growth depends not so much on the resources themselves, but on how they are being valued, used and managed, which in turn depends principally on economic policies and institutions. In fact, a rich resource base may promote over reliance on resource extraction which may lead to inefficient use, degradation of resources and stagnation.

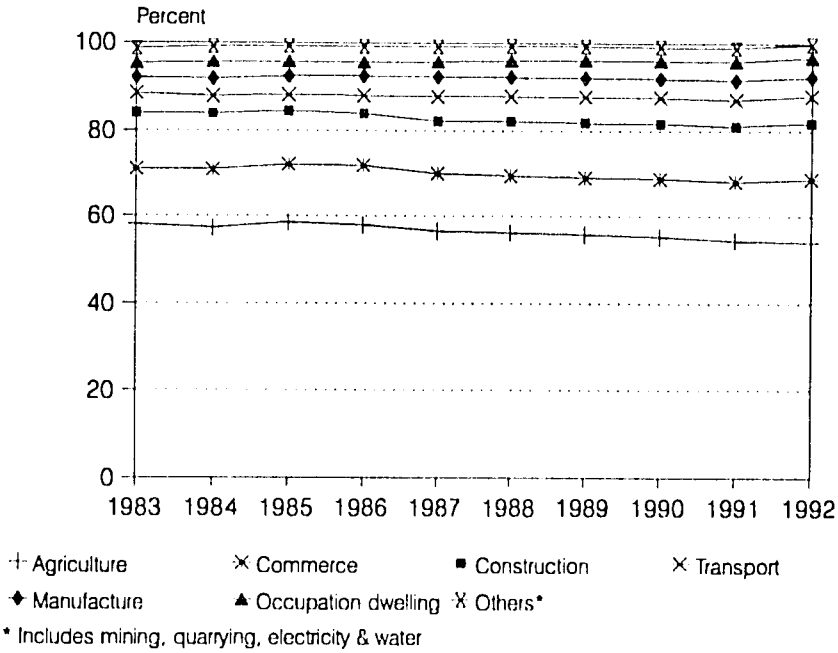
The problem in Uganda is that too much of the revenue generated from resource extraction is consumed rather than reinvested in maintaining and increasing the productivity of the resource sector. Despite these limitations, it would have been extremely difficult for the economy to sustain a growing population in the absence of political stability, technological know-how, and good economic policies had it not been for its natural resource base.

1.7.1 Resource-based production

The importance of natural resources to Uganda's economy is most obvious in agriculture. Of all sectors, agriculture contributes the most to the GDP. In 1992, it accounted for 54%, having declined from 72% in 1979 (**Figure 1.9**). Food crops make up the largest share of agriculture's contribution to GDP with 69.2%. This has saved the country from the costs of importing basic food and made the country relatively food secure. Livestock activities generated about 16.9%, forestry 3.4%, fisheries 4.7% and cash crops for export about 5.8%. (**Figure 1.10**)

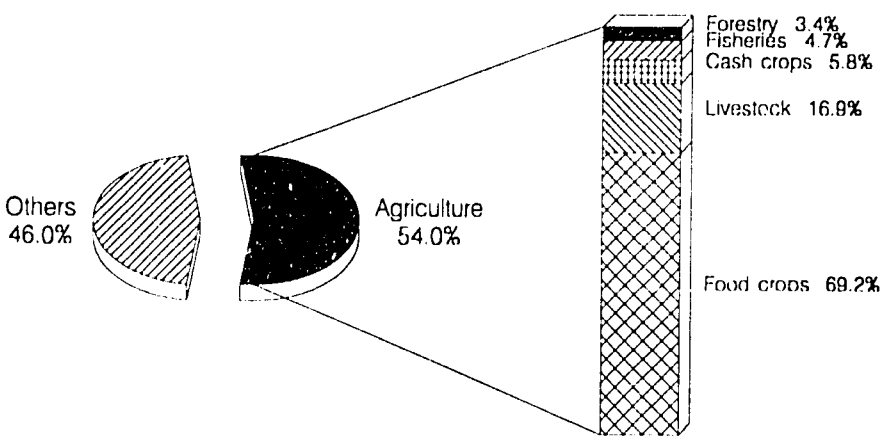
It is still too early to confirm whether the drop in the contribution of agriculture to GDP from the late 1970s to the present represents an expected structural change. But the emerging trend is similar to that experienced by fast growing economies: agriculture's contribution to GDP declines during economic development.

Figure 1.9: Sectoral composition of GDP 1983-92 (Percent of total GDP at constant 1991 prices)



Source: Background to the Budget, 1993-94

Figure 1.10: Agriculture's shares in GDP by subsectors in 1992



Source: Background to the Budget, 1993-94

1.7.2 Resource-based exports

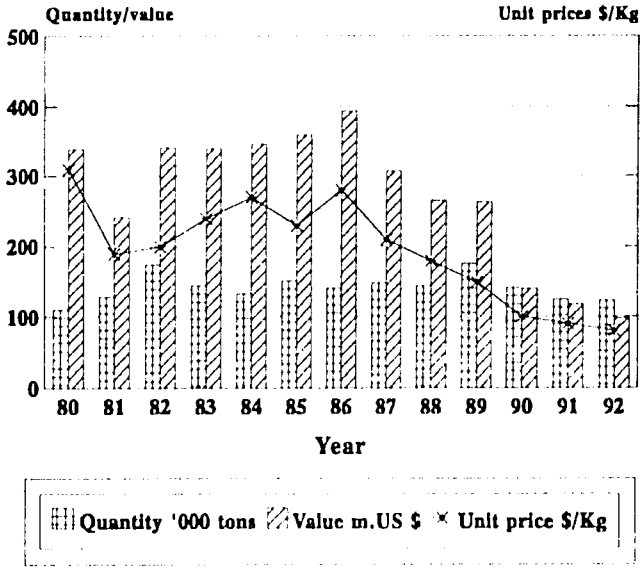
The share of resource-based exports in total country exports indicates the evolving role of natural resources in Uganda. While high export shares have generally reflected the major role of natural resources in many economies in the early stages of development, they have remained very important

for Uganda - still accounting for almost 100%. The change has been in the mix of the resource-based exports themselves. Whereas cotton dominated export values in the 1950s, by 1962 coffee was first. Exports of minerals, which once accounted for 30% of foreign earnings, ceased by 1978. Since 1986, the export of non-traditional agricultural export crops has been encouraged. To date, over $110 million has been earned because of this diversification. Natural-resource based exports will continue to play an important role in the recovery and growth of the whole economy. But there are certain limitations which need to be addressed. Most of the products are exported as primary goods with minimal processing. These products do not only have low value, they tend also to suffer from price fluctuations.

Uganda has depended and still depends on coffee export earnings. The decline in world coffee prices has reduced the earnings from $400 million in 1986 to just about $100 million in 1992 (**Figure 1.11**). A second impact from the decline in coffee is the export tax. In 1985-86, coffee tax contributed two-thirds of all government revenue. Taxation on coffee exports was suspended as world prices continued to fall. At a time when the development needs of the country are still enormous, the decline in coffee earnings and the resulting fall in foreign exchange earnings imposes big constraints on the development of other sectors. It also raises a challenge to the nation to identify and strengthen alternative sources of hard currency.

If the peak 1970s levels of coffee, cotton and tea production were restored and sold at the reigning f.o.b. unit prices, Uganda would earn another $192 million a year from the three crops. This indicates the potential of natural resources. While that is the case, structural changes that have taken place in the economy, both domestic and international, mean that economic conditions are different from what they were twenty or even ten years ago. Accordingly, efforts to revitalize the production and export of these crops and new ones must take these changes into consideration.

Figure 1.11: Coffee exports, prices, and value, 1980-1992



Source: *MFEP (1993) Background to the Budget: Economic performance in 1992/93 and prospects for 1993/94. Government Printer.*

In the fisheries subsector, there is increased interest in commercialization especially for export. Four plants to process fish for export will collectively produce 14,745 tons per year. Expected yearly earnings are projected at $20.3 million[3]. This would substantially increase the contribution of fishing to GDP from the current level of 2.4%.

1.7.3 Resources-based employment

Employment in the agricultural sector has continued to be high. About 80% of Uganda's employed household population work in agriculture which is far higher than in Kenya, but a decline from 88% in 1975. This figure includes households cultivating their own land, working as day or contract labourers, and those working on tea, sugar and other plantations. It also includes households engaged in subsistence fishing, local woodlots, logging operations, and fuelwood harvesting, hunting and gathering, and other subsistence users of resources.

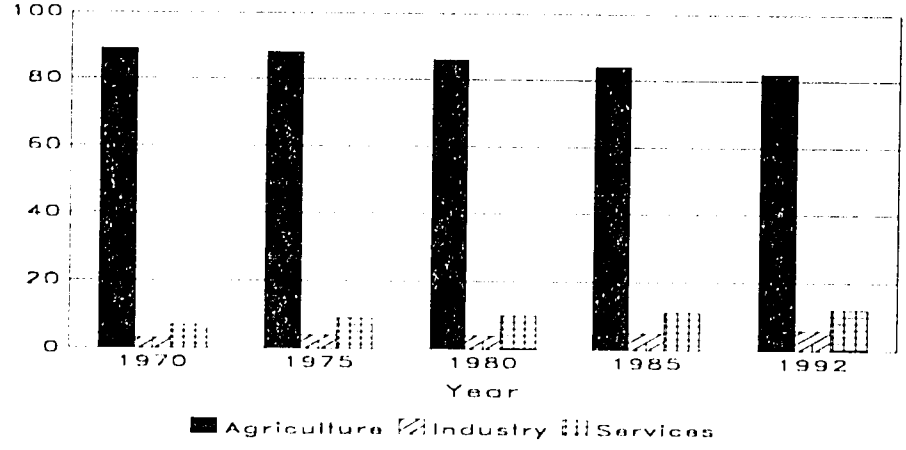
Fishing is also economically important because it supports 75,000 people in direct employment and upwards of 500,000 people in indirect employment. But perhaps the greatest benefit from the fisheries resource is its contribution to nutrition. It is estimated that *per capita* average consumption of fish is 12 kg/year.

As shown in **Figure 1.12**, the decline in agriculture's contribution to GDP has not been matched by a comparable decline in agricultural-based employment. For years insecurity in the towns and cities meant that it was safer to make a living off the land. Without security, infrastructural investments were lacking. Furthermore, farmers were not producing all that they could, because of a lack of credit, markets and transport. If farm productivity can be increased, it is likely that a large percentage of farmers will stop farming full-time and look for higher paying employment.

1.7.4 Resource-based industries

Natural resource-based activities are also supporting the manufacturing sector. But on the whole, the industrial sector is poorly linked to the natural resource base. This is mainly explained by the fact that from the early 1960s, industrial development was based on the policy of import substitution with more than 75% of its inputs being imported.

Figure 1.12: Employment trends by sector, Uganda



Source: African Development Report 1993 Economic and Social Indicators on Africa

Nonetheless, a few industries like those manufacturing cigarettes, cement, sugar, textiles and furniture are based on local resources. The sector's contribution to GDP and formal employment is still low, that is, 4.7% and 2.0% respectively. As the level of capacity utilization is improved, and as the level of domestic and foreign investment grows, this sector is likely to play a key role in development.

The energy sector also depends on domestic natural resources. As much as 94% of the energy requirements in the country is met from trees (as fuelwood or charcoal). Another 1% is met from water as hydroelectricity serving mainly the urban population and industries. It earns the country some modest foreign exchange through export to Kenya and to Tanzania.

The linkage of resources to industry extends beyond manufacturing and energy. Wildlife resources are an essential component of tourism, which by 1970 had become an important foreign exchange earner, third after coffee and cotton. At its peak in 1971, it fetched over $18 million from the 85,000 tourists entering the country[1]. Political instability and deterioration of the necessary infrastructure halted the growth of tourism. The loss to the economy was great. Tourism is rapidly increasing: an estimated 75,000 visited Uganda in 1993; most choose to visit national parks, other wildlife areas and cultural sites. Projections suggest the flow will reach 125,000 per year within five years. As the economy continues to recover, the country's wildlife and its rich biodiversity will be a source of foreign exchange.

Finally, the environment provides valuable services that support economic growth and quality of life. Unfortunately, it is difficult to attach monetary values to them. At best, they can be described. Natural ecosystems clear the air, dispose of wastes, regulate and conserve water, cycle nutrients and control diseases. These services can be valued in millions (and possibly billions) of dollars to the Ugandan economy. An indication of their value is the heavy costs that private and public sectors bear as these resources are depleted and their capacities for renewal are degraded: costs of reforestation to control soil degradation, of treating industrial effluent before discharge, and of treating people when they fall sick.

1.8 Emerging trends

Uganda's economic and social welfare and its environmental quality depend on the effective and efficient management of the resource base. To project the role of natural resources in Uganda into the 1990s and beyond, it is necessary to examine the trends in the present relationship between population, environment and economic variables. Changes in population, employment, settlement patterns and industrialization can affect resource use and environmental quality. At the same time, macroeconomic variables such as balance of payments, foreign debt, inflation rate, interest rates and investment levels will also be important determinants of how resources will be used and managed.

The population of Uganda will continue to increase. Second, the need for jobs will greatly increase. The structural shift of labour from agriculture to industry and services has been very slow. For some time to come, therefore, much of the population will remain in agriculture. Unfortunately, because of poverty, investment in intermediate technologies has been slow in coming. As a result, there are certain trends and practices within this important sector which have to be addressed.

Third, increases in agricultural output will have to come from the adoption of more intensive farming and not from the expansion of cultivation into new lands. It is estimated that output of 12 selected

crops can be increased by 114% with improved technologies[1]. Economic policies intended to improve the agricultural earnings of farmers will therefore be critical in reversing the above problems and those of soil degradation.

Agricultural productivity can be improved with changes in land tenure. Sector studies in the early 1980s pointed out that the multiplicity of land tenure systems in Uganda (there are four) was not conducive to agricultural productivity. Whatever land policy is eventually accepted will need to be supported by land use planning. The problem of "tenure" has also affected other resources like forests and fisheries.

In fisheries, the growing interests of commercial fishermen will need to be reconciled with those of the longstanding local artisanal fishermen. Optimum sustainable yields will need to be established so that the fish resource is not depleted. Excessive fishing has been identified as one important factor in the downward trend in productivity of Lakes Kyoga, Edward, George and Wamala.

Wood fuel is expected to remain the major source of energy for Ugandans for a long time to come. However, considerable pressure is being exerted on woodlands, forests and agricultural lands by the growing population. Current production of woodfuel from renewable resources is estimated at 15.6 million m^3 per annum, whereas consumption is about 18.3 million m^3 per annum.

In the manufacturing sector, there is growing interest in the exploitation of the natural resource base by investors. But in its drive for greater production and industrialization, Uganda has to be prepared to manage problems of pollution, industrial waste and occupational health. Failure to do so will offset the benefits to be derived from growth.

Great changes are coming to Uganda. Economic and social progress is deeply desired. It is now time to build consensus and support for managing our rich resources effectively for all our citizens now and into the future.

[1]In the following chapters, information is provided on each resource: its productive uses, its other attributes, threats to the resource, and suggestions for conservation measures, including new policies, institutions and laws.

2.0 AGRICULTURE

2.1 Importance

Agriculture, which consists of crop and livestock production, is the backbone of Uganda's economy. The arable land of Uganda, made up of land currently under cultivation, ranches and areas potentially available for pasture and cultivation, represents over 75% of the total area of the country (**Figure 2.1**). This percentage exceeds comparable figures of many of the member countries in the Preferential Trade Area (PTA). By 1969, Uganda's arable land area supported 53 persons per square kilometre. Now, the arable land base supports over 88 persons per square kilometre (**Table 2.1**). In the eastern, western and southern regions of Uganda, more than half the districts have rural population densities of over 180 persons per square kilometre of arable land.

In 1990, agriculture contributed 55% of Uganda's Gross Domestic Product (GDP). This is much higher than in industrialized countries and higher even than in many African countries like neighbouring Kenya (**Figure 2.2**). Infact, the 1990 data for Uganda showed an improvement over the situation in 1979 when 72% of the country's GDP was contributed by agriculture. Within the agricultural sector as conventionally defined in national accounts classification, the production of food crops accounted for the largest share of agriculture's contribution to GDP (**Figure 2.3**). It is also worth mentioning that about 56% of the agricultural GDP or 31% of total GDP of the country consists of subsistence crops which are principally produced for home consumption and therefore outside the cash economy.

Uganda has for a considerable time depended on one agricultural crop, coffee, for the bulk of its export earnings. **Figure 2.4** shows that even when the country's economy operated normally, as in 1970, coffee accounted for as much as 50% of total export earnings. During the years of political instability and macroeconomic uncertainty, as illustrated by the 1978 data, coffee's share of total exports increased to more than 95%. Of recent the crop's share of total exports has dropped due to the decline in world prices and a deliberate policy of export diversification. Other traditional export crops have been tea, cotton and tobacco. In 1991, coffee accounted for about 64% of total exports, the other traditional cash crops represented 12%, while non-traditional export items had increased to about 24%[1]. Major non-traditional agricultural sector export items include sesame seeds (simsim), beans, hides and skins, maize, fish and fish products.

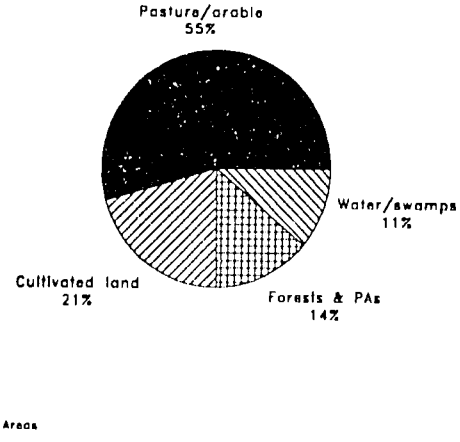
Unlike other countries in Sub-Saharan African, Uganda has not had to import significant quantities of food or agricultural raw materials. During the years of instability, however, food imports were fairly significant, amounting to US $ 8.6 million in 1987. But now, with the country enjoying relative peace, Uganda is becoming a major food exporter to nearby countries suffering from political disturbance and famine.

Almost similar in importance to its contribution to GDP and export earnings, the agricultural sector employs 80% of Uganda's households. In Kenya the percentage of those employed in the agricultural sector was 77% in 1990.

The agricultural sector contributes positively to the food security of Uganda. Food security is defined as the access to sufficient food for a healthy and productive life. People can achieve food security through their own production or acquisition of food through purchases. Based on available data in

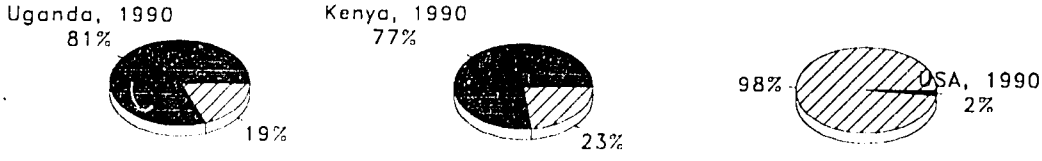
1991, the level of food available for consumption was found to be sufficient. This was based on the calorie equivalent of available food *per capita* (**Table 2.2**).

Figure 2.1: Land use in Uganda



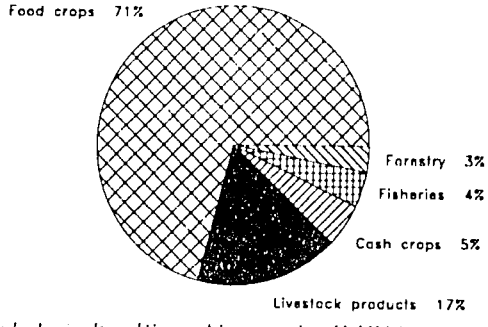
(Source: Adapted from World Bank, 1993, Uganda Agricultural Sector Memorandum Vol II: Main Report, Fig 11., Report No. 10715-UG, Washington DC) (Figures corrected to nearest full percentage)

Figure 2.2: Comparison of the contribution of the agricultural sector to the GDP of Kenya, USA and Uganda (%)



Source: State of the Environment Report, Kenya, 1989; b,c: MFED, Background to the Budget, 1992-93 "Economic Performance 1991-92 and prospects for 1992-93, d: FAO Yearbook of Production Vol 44, 1990 Statistical Series No. 99

Figure 2.3: GDP agricultural shares by subsector 1989-91 (%)



Source: World Bank, 1993 Uganda Agricultural Sector Memorandum Vol II Main report. Report No. 10715 Fig.1, Washington DC. 152 p.

Table 2.1: Population and arable land availability by district[a]

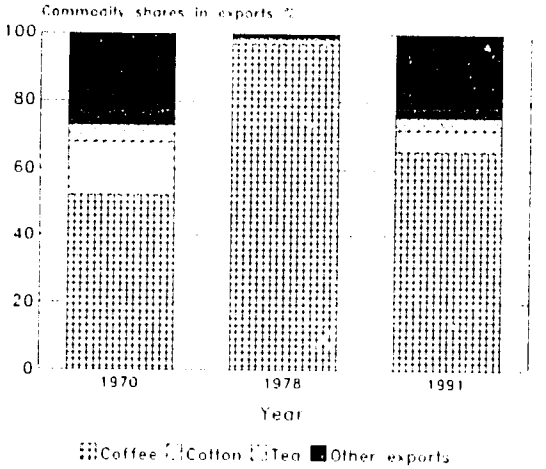
REGION	DISTRICT	RURAL POPULATION 1991 IN '000s	ARABLE LAND IN KM2 18	POUPLATION DENSITY 1991
Central	Mpigi	796	4,406	181
	Mukono	717	4,061	177
	Luwero	408	7,986	51
	Masaka	747	5,542	135
	Rakai	3 [illegible]	3,500	105
	Mubende	46[illegible]	8,963	52
Eastern	Iganga	899	4,489	200
	Jinja	208	619	336
	Kamuli	473	3,694	128
	Kapchorwa	112	1,064	105
	Kumi	225	2,454	92
	Mbale	645	2,022	319
	Soroti	384	8,407	46
	Tororo*	842	3,887	217
Western	Bundibugyo	116	394	294
	Bushenyi	735	3,559	207
	Hoima*	395	6,633	60
	Kabale*	598	2,353	254
	Kabarole*	741	7,607	97
	Kasese	343	1,478	232
	Masindi	275	5,369	51
	Mbarara	930	9,477	98
	Rukungiri	388	1,391	279

a 1991 Census

** 1991 Census Tororo + Pallisa, Hoima + Kibale, Kabale + Kisoro*

Source: The World Bank (1993); Main Report, Vol II, Table 2

Figure 2.4: Shares of agricultural commodities in total exports



Source: *World Bank (1993): Uganda Agricultural Sector Memorandum, Vol II, Main Report 152 p, Fig. 5, March, 1993 Washington DC*

Table 2.2: Caloric equivalent of average amount of available food *per capita*, 1991

FOOD ITEM	SHARE %	KG OF FOOD available per year	CALORIE/KG	TOTAL CALORIES per year
Bananas	50	480.0	670	321600
Cassava	22	211.2	1090	230208
Sweet potatoe	13	124.8	970	121056
Cow peas/pulses	3	28.8	3420	98496
Oilseed	2	19.2	5740	110208
Cereals	10	96.0	3500	336000
Total food	100	960.0	-	1217568
Uganda calories/day				4320 calories per day

Source *World Bank 1993, Uganda Agricultural Sector Memorandum, Vol II, Main Report Report No 10715-UG Washington DC, 152p*

2.2 Farm characteristics

Of the 18 million hectares of land classified as arable, only about 5 million ha or less than one-third of the total available area was under cultivation in 1990. Farmers allocated 36% of the cultivated area to perennial crops, and the rest to annual crops and some perennial root crops such as cassava (**Figure 2.5**). The distribution of farms by primary activity shows that crop production predominates among Uganda's agricultural activities (**Figure 2.6**). Almost 70% of farms report crop production as their principal activity, and about 25% are engaged in mixed farming. A much smaller portion rear livestock or engage in fishing only.

Close to 84% of Uganda's households live in rural areas. Of the rural households, 62% have farms of less than 1 ha, while 23% have somewhere between 1 and 2 ha each. In other words, 85% of the rural households produce crops and raise livestock on holdings of less than 2 ha each. The average landholding per household in different parts of Uganda is shown in **Figure 2.7**.

Ugandan farmers grow food and traditional cash crops. The main food crops include: cereals (maize, millet and sorghum); legumes (beans, field peas, cow peas, pigeon peas); oilseeds (simsim, soya beans, groundnuts); and root crops (Irish and sweet potatoes, cassava, yams). Traditional cash crops are: coffee (robusta, arabica), cotton, tea, and tobacco.

Several of the food and traditional cash crops were introduced into Uganda from other centers of genetic diversity. As such, in the case of crops like tea which are grown in monocultural plantations, it is possible that the country is operating with a narrow genetic base. Thus, opportunities for genetic manipulation to increase yields or enhance disease resistance could be limited.

As the diversification of Uganda's exports increases, the distinction between food and cash crops is becoming less defined. Some of the traditional food crops such as simsim have become significant export commodities.

Ugandan farmers also keep a diversity of livestock on their small farm holdings (**Figure 2.8**). Traditional herders constitute the largest group of livestock owners. However, most of the livestock research and development efforts have been focused on "modern" systems, such as ranches and the battery-keeping of chicken. Commercial farmers have benefitted while virtually no attention has been paid to the needs of the majority of livestock owners.

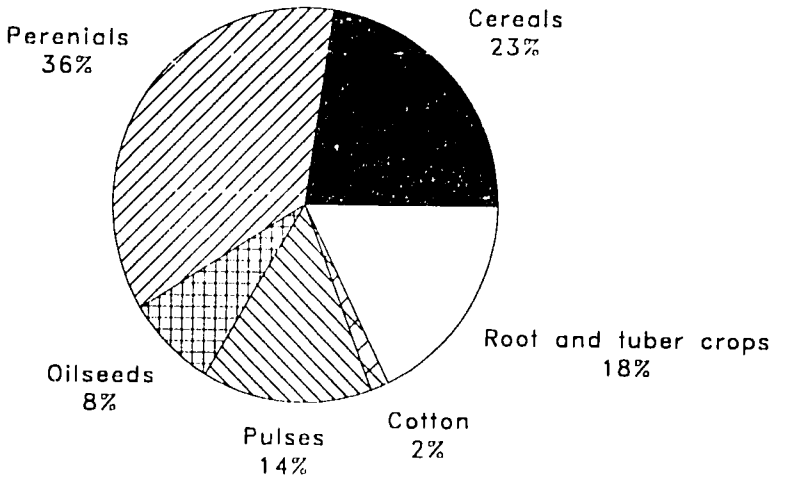
The most prominent group of traditional herders are the Bahima in Mbarara District and the Karimojong in Kotido and Moroto districts. These two groups are full-time livestock keepers. They are prominent because they continue to keep cattle almost exclusively and in large numbers. Traditionally this group of Ugandans view having large numbers of cattle as a measure of wealth. The second group of traditional livestock keepers are those who while deriving their livelihood from livestock also engage in crop production. This group is often referred to as agro-pastoralist and include the Baruli in Luwero District and the Iteso in Kumi and Soroti districts. The final group consists of those who, while deriving their livelihood from crop production, also keep significant numbers of livestock. This group is found in the remaining parts of the country.

In general, the traditional herders practise communal grazing and are entirely dependent on natural pasture. There is a complete disregard for proper pasture management since most of the traditional herders keep as many animals as the natural environment will allow. Environmental problems associated with traditional herding include: overgrazing with consequent invasion of rangelands by unpalatable plant species, soil degradation and subsequent erosion, animal starvation and impoverishment of pastoralists, bush burning, and lack of disease control.

The commercial livestock system benefits from modern techniques of livestock management in feeding practices, disease and vector control, pasture management, storage facilities and access to markets. Environmental problems associated with commercial livestock systems include: overgrazing near watering points and poor land utilization where ranches are understocked.

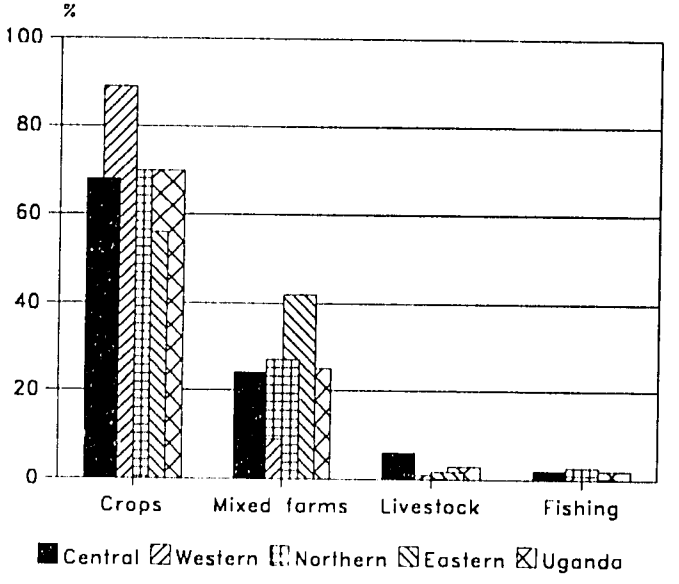
Farmers also engage in the harvesting of nuts and honey from forests and fish farming.

Figure 2.5: Percent distribution of cultivated areas, 1990



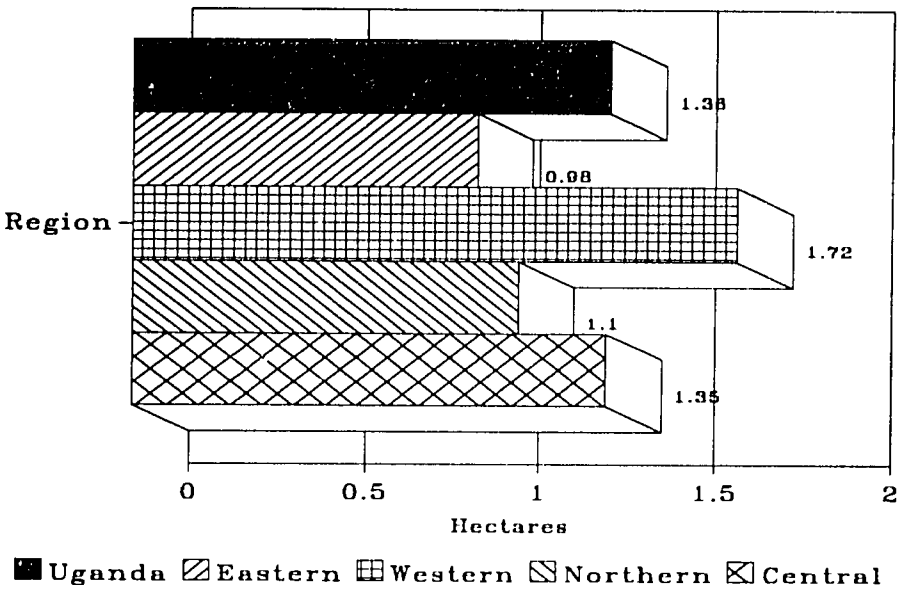
Source: *World Bank, 1993: Uganda Agricultural Sector Memorandum Vol II: Report No. 10715-UG, Main Report 152 p. [Figs corrected to nearest percentage]*

Figure 2.6: Percent distribution of farms by primary activity, 1990



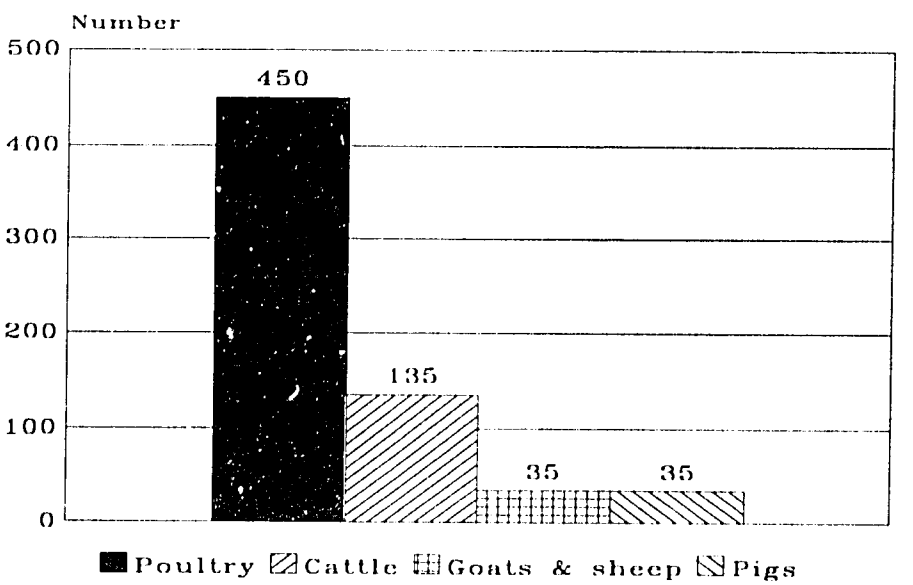
Source: *World Bank, 1993: Uganda Agricultural Sector Memorandum Vol II Report No. 10715-UG, Main Report 152 p*

Figure 2.7: Average landholding (ha) per household by region in Uganda, 1989-90



Source: *Ministry of Finance and Economic Planning Background to the Budget, 1992-93: Economic performance 1991-92 and prospects for 1992-93 June, 1993.*

Figure 2.8: Estimated holdings of domestic animals per 100 households, 1990



Source: *Ministry of Finance and Economic Planning Background to the Budget, 1992-93: "Economic Performance, 1991-92, and Prospects for 1992-93 June, 1993*

2.3 Farming systems

Many factors must be considered if farms are to be classed into different systems. Choosing an appropriate classification system and the detail with which classification can be carried out depend to a large extent on the availability of micro-level data. As a result, Uganda is variously described as having eleven agro-climatic zones, twenty ecological zones[19] and five[20] or seven[21] farming systems.

A farming system can be defined as an agricultural activity being practised by particular groups of people as dictated by the agro-ecological environment they live in. In Uganda the seven major farming systems are determined by the amounts and distribution of rainfall. They cover a wide variety of farming activities, which include both commercial and subsistence undertakings.

It is not the intention of this report to reconcile the differences in the classification of farming systems in Uganda. Instead the State of the Environment (SOE) report has adopted the seven farming systems as providing reasonably detailed and usable information with which to assess farming practices, production and environmental impacts. The map in **Figure 2.9** shows the location of the seven farming systems. The magnitude of environmental degradation associated with each of these farming systems varies from region to region (**Box 2.1**). For purposes of comparison and completeness, agroclimatic zones are described in **Box 2.2**.

It has been suggested that most present day African farming systems go back to the great variety of pre-colonial systems developed by different ethnic groups in harmony with their environments[22]. However, the past trend of farming sustainably seems to be disappearing in much of Africa. In Uganda, for example, increases in agricultural production have in the past been achieved through expanding the area under cultivation rather than intensifying farming methods.

Although Uganda does have sizeable areas of arable land into which agriculture can expand, particularly in the northern system, this picture can be misleading. Much of the potentially-available arable land is not where the bulk of the population is. Therefore, in the immediate future, Ugandans residing in the densely-populated farming systems areas will need to intensify management, which may in turn require an increase in the use of agrochemicals. The manner and extent to which public lands (common property resources) are cleared of vegetation to support increased production of traditional and new export crops will also have important consequences for the state of the environment.

2.4 Production and yields

2.4.1 Crops

The total area under food crops increased steadily from 1970 to 1978. Between 1978 and 1980, it declined precipitously. Since 1980, it has been increasing slowly but it is still short of the 4.6 million ha of 1978 (**Table 2.3**). Consequently, the food crop area per rural capita in 1990 was 71% of the 1970 value. Infact at its lowest, in 1980, the food crop area per rural capita was only 59% of the 1970 value of 0.42 ha.

The total area under traditional cash crop cultivation decreased by more than half between 1978 and 1989. This was largely due to a rapid decline in cotton production. The total area under cotton decreased from 677,500 ha in 1978 to 106,000 ha in 1989, with a further decline to 69,000 ha in 1990 (**Table 2.3**).

The recorded declines in areas under cultivation may have been partly due to statistical problems associated with data collection[23]. But farmers also reacted to insecurity and macroeconomic uncertainty.

The yields of all crops except bananas have increased (**Figure 2.10**). The banana yield index decreased from 122.4 in 1970 to 82.1 in 1990 (based on 1978=100.0). Yields of traditional export crops, except for tea and sugar, have also improved since 1978 (**Figure 2.11**). These yield data were derived by dividing reported production by acreage under each crop or group of crops. Both acreage and production figures should be regarded with caution[24 b]. Increased yields normally signify land-saving measures. However, due to their unreliability, the data do not conclusively negate the observation that for some time most of the boost in agricultural output will have to come from area expansions. In extending the agricultural frontier, farmers are likely to cultivate marginal lands and drain wetlands. Both actions are not environmentally sustainable unless well planned.

Crop production in Uganda is carried out predominantly in mixed stands as opposed to monocultural establishments. Pure plantations of tea and sugarcane exist, but they are few in number and small in size when compared to the total acreage under crops. The practice of mixed crop farming appears to be increasingly accepted. For example, in the intensive banana-coffee-lake-shore farming system, there is a significant increase in the proportion of area devoted to mixed cropping, except where beans and cassava are the dominant crops (**Table 2.4**). Mixed cropping is not always advantageous. For example, mixing two cereals such as millet and sorghum leads to a quicker exhaustion of the soil. Mixing cereals with legumes on the other hand improves the soil.

2.4.2 Livestock

As shown in **Table 2.5** the number of cattle (dairy and beef) in Uganda increased steadily from 1970 to 1979, decreased somewhat in 1980 and 1981, increased again from 1982 to 1986; and has been on the decline since then. The number of sheep increased from 1970 to 1986, declined drastically in 1987 and has not recovered since then. Although the number of goats fluctuated somewhat during 1970 to 1990, the overall trend was an increase from 1.8 million animals in 1970 to about 2.3 million by 1990. Similarly, the production of pigs also showed a long-term growth trend from 63,500 animals in 1970 to 552,900 in 1990. Data available for poultry cover the period 1978 to 1987, and show a sharp increase in their number from 407,400 to 8.3 million birds. It has been estimated that 70% of the cattle population is indigenous Zebu, 15% Sanga (Ankole), 13% intermediate crosses and 2% exotic breeds. While the *per capita* cattle population declined from 0.60 in 1931 to 0.26 in 1992, in absolute terms in 1992, the number of cattle was more than double the number that existed in the 1930s (2,104,000 head in 1931, and 4,500,000 in 1992)[25]. The pig herd is a mix of European and indiscriminate crosses, while the poultry found in the traditional systems include indigenous and imported crosses or breeds. The breeds for sheep and goats are mostly indigenous.

b"... Because of continuing harvesting of cassava and bananas in the course of the year, it was impossible for enumerators to be present at every harvest; data collected dduring one visit had, therefore, to be used in estimating the total yearly production. In view of this, the yield obtained for cassava and bananas may not necessarily reflect all the harvested realised by the holders...

"Yield estimation based on sub-plots has got its own weaknesses. Current thinking is that whole plot should be harvested in order to obtain fairly reliable estimates. This is difficult from the point of view of the associated workload to the enumerators and the inconvience to the holders. The readers of the yield rates should bear in mind the inherent weaknesses as a result of using very small sub-plots..."

Figure 2.9

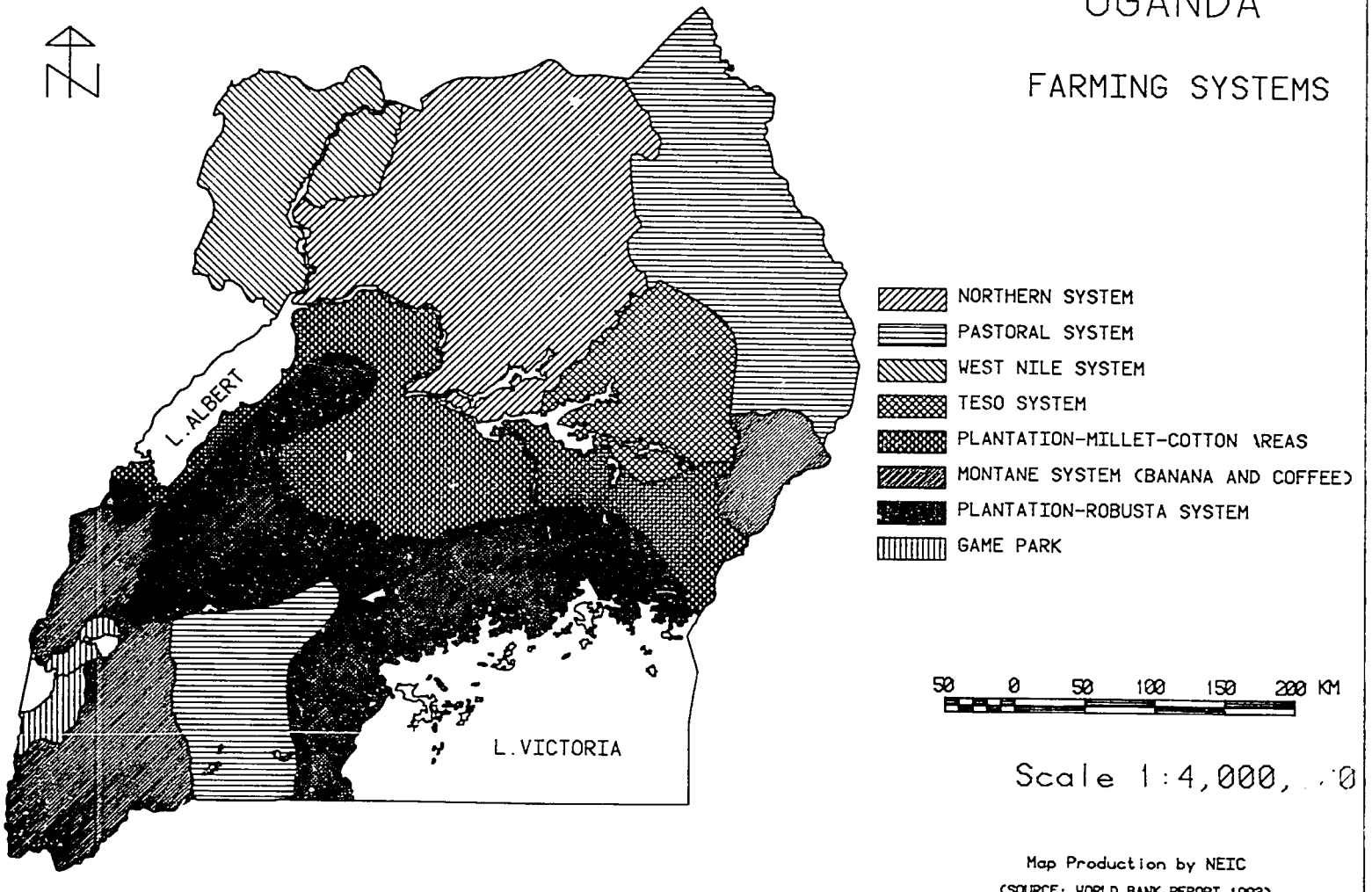
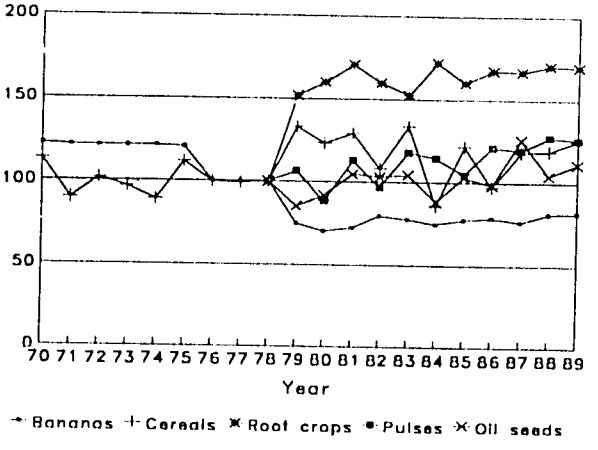

UGANDA
FARMING SYSTEMS
N
L.ALBERT
L.VICTORIA
NORTHERN SYSTEM
PASTORAL SYSTEM
WEST NILE SYSTEM
TESO SYSTEM
PLANTATION-MILLET-COTTON \REAS
MONTANE SYSTEM (BANANA AND COFFEE)
PLANTATION-ROBUSTA SYSTEM
GAME PARK
50 0 50 100 150 200 KM
Scale 1:4,000,
Map Production by NEIC
(SOURCE: WORLD BANK REPORT,1993)

Table 2.3: Trends in area cultivated for food crops and cotton ('000 ha)

YEAR	PLANTAIN	CEREALS	ROOT CROPS	PULSES	OILSEEDS	TOTAL FOOD CROPS	COTTON
1970	909	1,193	983	414	306	3,805	-
1971	905	1,301	1,003	634	386	4,229	-
1972	916	1,230	879	437	380	3,832	-
1973	974	1,237	883	496	316	3,906	-
1974	1,063	1,265	991	564	365	4,248	-
1975	1,097	1,270	1,168	564	361	4,460	-
1976	1,180	1,351	1,076	602	327	4,536	-
1977	1,240	1,236	1,007	467	359	4,309	-
1978	1,287	1,277	1,042	607	377	4,590	678
1979	1,173	787	599	347	186	3,092	417
1980	1,173	723	557	329	164	2,946	312
1981	1,180	746	685	413	185	3,209	121
1982	1,209	865	859	538	225	3,696	170
1984	1,209	906	805	522	269	3,711	199
1985	1,210	798	684	455	210	3,357	160
1986	1,210	896	788	532	269	3,695	180
1987	1,336	855	769	497	210	3,667	140
1988	1,302	872	805	578	277	3,834	99
1989	1,322	1,067	833	615	299	4,136	106
1990	1,379	1,053	819	688	352	4,291	69

Source: World Bank, 1993: Uganda Agricultural Sector Memorandum, Vol III, Table 10. Statistical Annex. Washington DC' 28.p.

Figure 2.10: Food crop yield indices 1978=100.0



Source: World Bank, 1993: Uganda Agricultural Sector Memorandum, Vol III, Table 12. Statistical Annex. Washington DC'

Box 2.1
Current environmental impacts of farming systems in Uganda

SYSTEM	ENVIRONMENTAL IMPACTS
I.INTENSIVE BANANA-COFFEE SYSTEM (south Mukono, Rakai, east Masaka, Mpigi, southeast Mubende, south Luwero, Ssese Islands, Kampala/Entebbe, most of Jinja and Iganga districts.	Soil degradation in unprotected areas
II.WESTERN BANANA-COFFEE-CATTLE SYSTEM (most parts of Mbarara and Kabarole, Bushenyi, Rukungiri)	- Shorter or even absent fallow periods; - Intensive grazing in sparsely populated parts; - soil degradation on overgrazed hilly areas and around watering points; - Deforestation in some parts; -declining soil fertility in many areas.
III. FOREST SAVANNA MOSAIC BANANA-COFFEE SYSTEM (north Mukono, Kamuli, south Luwero, most of Bunyoro, central Mubende, north Kabarole)	- Much arable land available for cultivation; - some soil erosion and compaction in limited area due to overgrazing.
IV. MEDIUM ALTITUDE COFFEE SYSTEM (parts of Bukonjo and Bwamba counties, slopes of Mt. Elgon and Kapchorwa, Rukiga county of Kigezi, Okoro county in West Nile)	- soil erosion and degradation has reached alarming proportions an steep slopes due to poor cultivation techniques; - Land highly fragmented due to customary land tenure and high population density.
V. KIGEZI ANNUAL FOOD CUOP MONTANE SYSTEM (northern slopes of Mufumbira Mts. altitude above 1800m of Kigezi)	- Tremendous land shortages; - Serious land fragmentation; - Livestock herded and grazed on marginal hillsides, roads and valley bottoms; - Serious decline in soil fertility as a result; - Evidence of silting of streams and small lakes;
VI. THE NOTHERN AND EASTERN CEREAS-COTTON-CATTLE SYSTEM(Gulu, Apac, Lira, Karamoja, Kitgum, Kumi, Soroti, Tororo, Pallisa, parts of Mbale)	- Fallow period becoming shorter or have been abandoned altogether in some parts where population density is high; - Generally low soil fertility; - Exessive communal grazing is a common practice; - Soil erosion by water and wind serious in densely populated areas; - Siltation of rivers beginning to appear.
VII. THE WEST NILE CEREAL-CASSAVA-TOBACCO SYSTEM (Arua and most parts of Nebbi)	- Exessive grazing on communal lands.

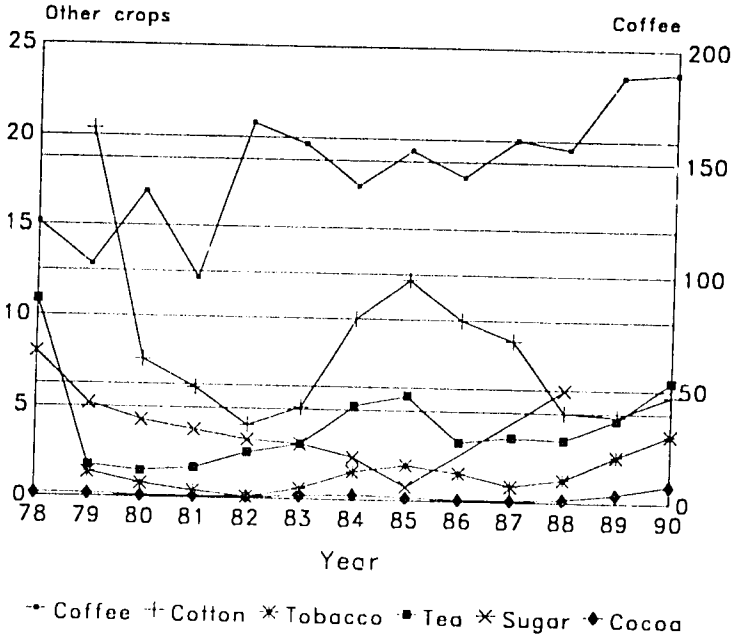
Source: NEAP Secretariat. Draft Topic Paper on Land Management: Agriculture, Livestock and Rangelands. Report by Task Force No. 3 (1992)

Box 2.7
The Agro-climatic zones of Uganda

ZONE	AREA	AGRICULTURAL SYSTEM
I	Busoga/Bukedi	Banana, millet and cotton system with outliers of the main coffee-banana system.
II	Bugisu/Sebei	Montane systems: Arabica coffee, bananas (wheat and maize in Sebei
III	Teso	Teso systems: Finger millet, cotton and cattle keeping (mixed agriculture)
IV	Karamoja	Pastoral system-cattle keeping
V	Lango/Acholi	Northern systems: Finger millet, cotton tobacco(some mixed agriculture also)
VI	West Nile/Madi	West Nile System: Basic agriculture like Zone V, but with predominance of cassava as staple food.
VII	Bunyoro/Toro	Arabica and robusta coffee and banana system, montane systems: heterogenous agriculture but basically bananas, coffee and tea.
VIII	Ankole	Montane systems in the west: Pastoral to the east. Arabica and Robusta coffee, tea, bananas and cattle.
IX	Kigezi	Montane systems but with larger annual crop acreage than other montane systems. Sorghum is a major staple, Arabica coffee and tea.
X	L.Victoria crescent	Main robusta coffee and banana system: robusta coffee, bananas, tea, cocoa and sugar.
XI	Northern Buganda	Western extension of the banana-millet, cotton system, but now largely taken up by big ranching projects.

Source: Annex 4 - Table 1: Agro-climatic zones of Uganda in COWI Consult, 1988. Coffee farming Systems Development Project. Final Draft Report. Prepared for the Republic of Uganda, Ministry of Agriculture/European Development Fund.

Figure 2.11: Trends in the yields of export crops, index (1978=100.0)



Source: *World Bank, 1993: Uganda Agricultural Sector Memorandum., Vol III, Table 8. Statistical Annex. Washington DC 28.p*

Table 2.4: Mixed cropping trend in the intensive banana-coffee lake shore farming system, 1965 and 1990-91 compared

CROP	MIXED CROPPING, STATED CROP PROMINENT	
	1965 (%)	1990-91 (%)
Coffee *	55.2	80.0
Banana	54.6	83.2
Sweet potato**	22.0	50.0
Beans	94.0	91.9
Maize	83.6	85.7
Cassava	85.4	50.1

* *1965 data refers to robusta only, while the 1990 91 data includes both arabica and robusta.*
** *1990 91 data are averages of first and second season crops.*

Source: *Ministry of Agriculture, 1965. Uganda Census of Agriculture, 1965; Uganda National Census of Agriculture and Livestock (1990/1) Vol III. Crop area, yield and production; assorted tables; Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) 1991*

2.5 Agricultural inputs

Basic agricultural inputs are land and labour. Ugandans have traditionally made use of a variety of plants and animals and with excellent soils and climatic conditions, farmers have been able to harvest three crops a year as well as maintain perennial food and cash crops. With the demand to increase production and productivity, farmers are expanding their use of traditional and modern inputs, including tractors, fertilizers and pesticides, improved seeds, livestock and irrigation.

Table 2.5: Livestock numbers

	CATTLE *	SHEEP	GOATS	PIGS	POULTRY **
			('000)		
1970	4280.5	827.5	1801.4	63.5	...
1971	4223.9	915.0	2211.8	87.5	...
1972	4472.6	887.9	1953.0	88.2	...
1973	4628.7	921.3	2100.8	74.6	***
1974	4723.3	996.5	1872.8	71.5	...
1975	4867.9	1051.0	2168.7	93.1	...
1976	4989.5	1097.0	2299.7	122.0	...
1977	4911.1	1138.9	2384.8	161.2	...
1978	5245.6	1195.8	2003.1	169.2	407.4
1979	5242.2	1255.6	2642.3	177.7	154
1980	4770.6	1318.4	2543.6	186.6	377.0
1981	4745.4	1384.3	2670.8	195.9	176.2
1982	4821.1	1453.5	2804.3	205.7	324.4
1983	4871.3	1035.5	1978.9	232.8	1000.0
1984	4993.1	1602.0	3091.0	227.0	1200.0
1985	5000.0	1674.0	3246.0	238.0	3000.0
1986	5200.0	168.0	3300.0	250.0	5000.0
1987	3905.2	682.8	2502.8	470.4	8330.0
1988	4259.8	690.1	2110.0	452.3	***
1989	4183.7	644.1	2279.7	552.9	...
1990	4300.0	830.0	3040.0	620.0	10000-2000.0

* = Dairy and beef cattle
** = Total number of birds on commercial farms including chicken, geese, turkeys and ducks.
*** = not available

Source: *World Bank, 1993, Uganda Agricultural Sector Memorandum, Vol III, Statistical Annex, for 1970 to 1989; and Vol II, p 114 for 1990.*

2.5.1 Mechanization

Mechanization is being encouraged as a means of increasing agricultural output in Uganda **(Box 2.3)**. However, improperly applied, mechanization can lead to serious degradation of agricultural soils, principally through compaction.

Agricultural mechanization was first introduced in Uganda in 1947 as a development scheme within the Ministry of Agriculture. Of the total number of tractors in the country in 1990, close to 44% were found in the central and southern regions of Uganda, while the east had about 26%, the west 11% and the north 19%. The west and Victoria agro-climatic zones had over 40% of the tractors in the country. The agro-climatic zone with the least mechanization was Kigezi, which is not surprising given its mountainous terrain.

Box 2.3

Uganda Government Policy on Agricultural Mechanisation

The Government policy on agricultural mechanisation is to

- increase agricultural output through mechanisation;
- have a well planned system for the importation of appropriate agricultural machines;
- have a proper arrangement for after-sales service of imported machines through

  i) training tractor operators and mechanics as well as farmers;
  ii) availing spares for tractors and other machinery;
  iii) having well equipped workshops for carrying out repairs.

Source: *Ministry of Agriculture, Animal Industry and Fisheries, Mechanisation Division, 1990. National Agricultural Tractor Census Report 243 p.*

During a recent tractor census, farmers were found in possession of 29 different categories of implements[26]. The most common was the disc plough. Furthermore, the ratio of operational disc ploughs to operational tractors was estimated at 82%. This meant that 2 tractors in every 10 could not be used in opening up land, especially where disc ploughs were needed.
Only 20% of the owners used their tractors exclusively for ploughing. The most common use was for both ploughing and transport (53%). The availability of spare parts is a critical criterion for choosing the type of tractor to buy and its efficient use thereafter. While 57% of the tractors in Uganda were originally obtained from government, close to 62% of owners obtained spares from private sources.

The educational background of a tractor operator has a strong bearing on the efficiency with which the individual will operate the machine, including the degree to which conservation-oriented tillage practices are followed. Fifty-five percent of Uganda's tractor operators were reported to have a primary level education, about 4% were considered to have no appreciable amount of literacy. More importantly, more than half of tractor operators received no prior technical training.

By 1990, there were 1,828 mechanized farms in Uganda of which 70% were privately owned. The investment needed to purchase a tractor is out of the reach of most of Uganda's farmers. As an alternative, ox-ploughing is used. The investment needed to purchase the animals and plough is very modest compared to tractors. Furthermore, ox-ploughing saves the country imports of petroleum products, and the practice is less damaging to soils. In the 1970s, the use of draft animal power became particularly attractive and profitable in the eastern districts of Soroti and Kumi due to the increased demand for annual cash crops like cotton, suitable topography, soils and vegetation, and the relatively easy access to animals. However, there has been no significant use of oxen for transport in any part of Uganda, although ox-cart transport is very environmentally friendly. The current lack of interest should be thoroughly studied, including comparisons with other modes of transportation[27].

2.5.2 Purchased physical inputs

In Uganda, purchased physical inputs including seeds, pesticides and fertilizers make up only a small part of the total cost of crop production. **Table 2.6** shows the contribution of purchased physical

inputs to the total cost of production for the major export and food crops. The data clearly show that, except for arabica coffee, flue-cured tobacco, maize and groundnuts, where purchased physical inputs accounted for over 23% of their total cost of production in 1992, for all other crops, purchased physical inputs accounted for only a fraction of production costs.

The main coffee input is mulch, with some use of insecticides for arabica. Purchased physical inputs required for cotton and cocoa production consist almost entirely of insecticides. On the other hand, herbicides and fertilizers are used to a considerable extent in tea production. There is virtually no purchased physical input used in cashew-nut growing. Both flue-cured and fire-cured tobacco require significant amounts of seeds, insecticides and fertilizers (NPK). With the exception of a few farmers, usually characterized as progressive, who use improved seeds, some insecticides and pesticides on food crops, the use of purchased physical inputs in food crop production is currently negligible.

Despite a low level of usage, before 1971 Uganda had a well-established agricultural inputs supply and distribution system. After 1971, many of the supplying firms ceased operation, and the inputs distribution system became disorganized. Inputs supply was haphazard and low (about 22% of demand). It fell further to reach a much lower level by 1979. For instance, the superphosphate factory in Tororo which was a major supplier of fertilizers, closed down in 1978 due to lack of spare parts and foreign exchange. It is still closed to date. Other supplies (hoes, pangas and seeds) were also drastically affected[25]. During the 1980 to 1986 period, the supply of inputs continued to decline and considerable shortages occurred, alleviated somewhat by donor agencies and bilateral arrangements. The inputs market is still fragmented[26], and there are limited quantities of selected inputs in several districts. Furthermore, there is little price competition among regions, and prices vary widely, sometimes by as much as 400%. This distortion is partly attributed to the subsidized sale of inputs by the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), and the pricing policies of donor funded agricultural projects.

In conclusion, the main characteristics of purchased physical inputs (seeds, herbicides, fertilizers, insecticides, livestock drugs and feeds) are:

- except for the production of improved seeds, there are virtually no significant quantities of purchased physical inputs produced locally. Supplies are through imports.

- in crop production, there is little demand for and low rate of inputs usage on farms. In the past, this was largely due to high rates of inflation and failures of research and extension. Farmers were rarely shown the benefits of using improved inputs. There have also been inefficiencies in input procurement and marketing due to lack of competition.

- consequently, the production processes in Uganda's agriculture are low-input, low technology.

2.5.3 Agricultural labour and wage rates

Except for the few progressive farmers and owners of plantations who use hired labour, most producers are still largely dependent on family members in their operations (**Table 2.7**). In February 1992, the average national wage rates were U Sh 533/day for contract labour, U Sh 10,219/month for permanent labour and U Sh 36,528/ha for contract ploughing. The range of wage rates illustrates that labour is relatively abundant in districts such as Lira, Apac, and Kapchorwa. In others such as Mukono and Masaka it is the major constraint to increased production. This observation tallies with

the result of a survey by Makerere University and the University of Wisconsin Land Tenure Center, in the districts of Masaka and Luwero, which identified labour shortage as the main reason for not using all available cultivable land[30].

2.5.4 Water for irrigation

Over 99% of the agriculture in Uganda is rainfed. Although most of Uganda receives adequate rainfall in the range of 600-1600 mm per annum, its uneven distribution causes moisture deficit at critical stages of crop and livestock production. The recent failure of the usually reliable first season rainfall in 1992 resulted in severe crop failures and decreases in livestock numbers in fifteen districts. Therefore, irrigation can be a supplementary source of water to rainfall or a principal source of water for crop and livestock production.

At present, irrigated agriculture is limited mainly to pilot schemes, with an estimated area of 6,550 ha and representing a water demand of 65 million cubic meters per annum. About 410,000 ha are considered to be suitable for irrigated agriculture. However, the area with the greatest potential amounts to about 187,000 ha, and irrigating even this area could have a damaging environmental impact (**Table 2.8**).

2.6 Socioeconomic characteristics

2.6.1 Rural incomes and expenditure

Rural households have limited sources of income, generated principally from agriculture. The rural population is generally poor as shown in **Figure 2.12**. It has been estimated that 92% of the poor in Uganda live in rural areas. Furthermore, not only is poverty more widespread in rural areas, it is also deeper. The prevalence of rural poverty has important implications for agriculture and the environment. First, it is unlikely that the rural population can afford any degree of intensification on their holdings. Second, the poor are known to be both victims and agents of land degradation. The gross margin and return to family labour for selected food and cash crops are shown in **Table 2.9**.

2.6.2 Social and economic indicators[c]

The largely-rural population of Uganda is engaged in both food and cash crop production. In a survey in 1990-91, over 50% of all farm holdings belonged to owners who each had five or more persons in their households (**Figure 2.13**). Traditionally, rural people sought to escape poverty by having large families which provided cheap labour. It is not surprising, therefore, that the average size of farm holdings increases sharply with the number of persons in the households (**Figure 2.14**). Over 50% of farm holdings are controlled by individuals between 35 and 64 years of age. Young people (20 years or younger) have close to 2% of holdings while those over 65 years have about 11% (see **Figure 2.15**). Over 75% of the holders of farmland are married. The majority of Uganda's farmers are unable to (32.2%) or can barely (54.6%) read. Slightly more than 87% of holders of farmland are full-time farmers.

[c] Percentage used in this section were obtained from a survey of agricultural holdings in Uganda which covered 26 districts out of a total of 38. Despite the incomplete coverage of the country, the percentages and numbers reported in this section constitute reasonable representation of national characteristics

Table 2.6: Contribution of purchased physical inputs to cost of production (U.Sh/ha and %) of selected export and food crops, February 1992

	SEED	HERBICIDES	INSECTICIDES/ PESTICIDES	FERTILISERS	TOTAL PURCHASED INPUTS	TOTAL COST OF PRODUCTION	PURCHASED INPUTS AS % COST OF PRODUCTION
			U.Sh/ha				
EXPORT CROPS							
Arabica coffee			32000	60000	92000	351306	26
Robusta coffee				40000	40000	427826	9
Cotton			16000		16000	218572	7
Tea		12750		50000	62750	440671	14
Cocoa			12000		12000	217407	5
Cashew-nut						397816	0
Tobacco-flue cured	20000		32738	140800	195738	842643	23
FOOD CROPS							
Maize	30000		16000		46000	197411	23
Beans	18000		16000		34000	184790	18
EXPORT CROPS							
Groundnuts	65000		16000		81000	297302	27
Soya beans	10000				10000	153080	6
Sim sim	5000				5000	143971	3

Source: *Bank of Uganda, Agricultural Secretariat. Report on Agricultural inputs situation (July, 1991 to March, 1992) National Inputs co-ordination Unit, August, 1992*

Table 2.7: Per hectare utilization of family and hired labour in the production of various crops, May 1992

CROP	FAMILY	HIRED	TOTAL LABOUR
	(no.)mandays/ha		
Arabica coffee	240	90	330
Robusta coffee	235	85	320
Cotton - eastern, ox-plough	98	36	134
Cotton - northern, hoe	168	56	224
Cotton - western, tractor hire	123	57	180
Tea	266	108	374
Cocoa	110	120	230
Cashew nuts	235	30	265
Flue-cured tobacco	423	140	563
Fire-cured tobacco	291	80	371
Maize	97	74	171
Beans	125	39	164
Groundnuts	195	75	270
Soya beans	116	55	171
Simsim	128	35	163

Source: *Bank of Uganda, Agricultural Secretariat. Report on Agricultural inputs situation (July, 1991 to March, 1992) National inputs co-ordination unit, August, 1992*

Table 2.8: Irrigation potential in Uganda

LOCATION	POTENTIAL GROSS AREAS (hectares)	MAIN SOURCE OF WATER
Albert Nile valley	2200	Albert Nile, Anyur
Aswa river catchment	3600	Aringa River, Pager
Karamoja and N.E. Teso	10000	Okere River, Namalu River, Akokoro River
Lake Salisbury area (Bisina)	11200	Akororo River and Lake Salisbury (Bisina)
North Bugisu and Sebei	9200	Siroko River Mt. Elgon streams
Lake Kyoga basin	80800	Victoria Nile, Lake Kwania, Lake Kyoga
S. Busoga	22000	Lake Victoria
West region rift valley plains	24800	River Sebwe, River Mubuku, Lake George, River Nyamagasani, Kazinga Channel
R. Katonga and Lake Wamala, Kibimba valley	1200	Lake Wamala and Kibimba river
Koki lakes and Orichinga valley, ie the Lake Mburo and Nakivali	2000	Lake Mburo, Lake Nakivali
TOTAL	186800	

Source: Sir William Halcrow, 1964

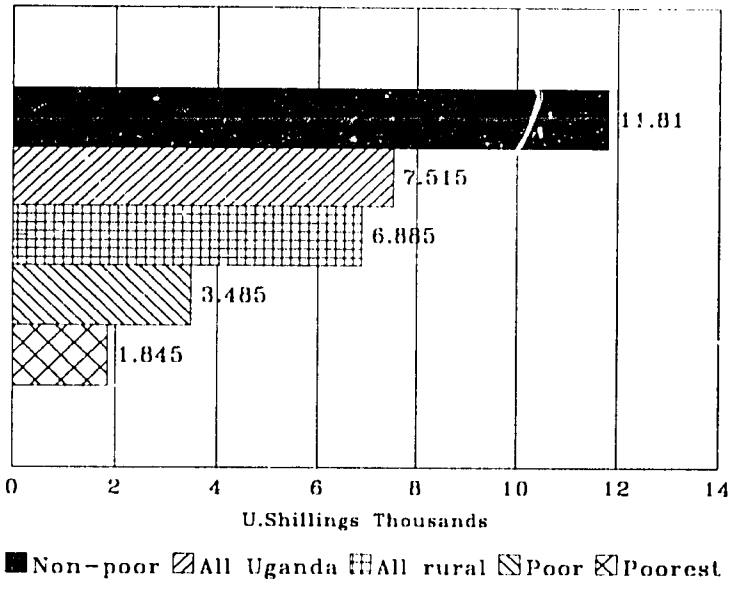
2.6.3 Women in agriculture

It is reported that Ugandan women provide 68% of labour needed in food crop production and 53% of the labour in export crop production[1]. On the average, women control 16.3% of the farm holdings of Uganda while men control the remaining 83.7%. Not only do women control a small number of farmholdings, but the few they control consist of areas of less than 1 ha each **(Figure 2.16)**. This implies that women's contribution to agricultural production through their labour is not matched by their control over the most important factor, land.

2.6.4 Migration and agriculture

Three factors have been responsible for Uganda's population migration patterns. These are, the rural to urban shift in search of better living standards, exodus from areas of insecurity, and the quest for new land for cultivation[2]. These forces have combined to produce the migration pattern shown in **Figure 2.17**. With the return of security to virtually all of Uganda, the movement of people due to insecurity will probably cease to be significant. However, the rural-urban shift is likely to continue. This shift will definitely have environmental impacts, but largely in the urban areas and a levelling off of population density in rural areas. Therefore, from an agricultural and rural environmental perspective, the most important type of migration is the quest for new land. Future migration will be determined primarily by rural population density. The most likely movements will be from the densely populated districts in the west - Kabale, Kasese, Bundibugyo, Rukungiri - and east - Jinja, Mbale - towards less densely-populated and reasonably fertile districts in the west, center, and north.

Figure 2.12: Real *per capita* monthly household expenditures, 1989-90



Source: The World Bank, 1993 Uganda Growing out of Poverty A World Bank Country Study Washington D.C

2.6.5 Land tenure

Land tenure systems differ across Uganda. Tenure practices are a mix of traditional practice, colonial regulations, and post-colonial legislation. They include: customary tenure (the most widespread), mailo land (a system whereby members of the Baganda nobility received freehold rights to estates), leaseholds; and freeholds. Currently, a government effort is underway to assess the feasibility of converting all tenures into freeholds.

Figure 2.18 shows that of 26 districts that were surveyed, the predominant tenure under which farm holdings are held is "kibanja", accounting for 64.6%, followed by customary or public tenure.

2.7 Agriculture and the environment

Agriculture is a complex systems which relies on inputs of human energy and intelligence, land, technologies, security and economies. Increasingly agriculture is dependent on the world market. Even crops grown for local food consumption are finding their way into international commerce. The natural environment supports this system of production and, in turn, is affected by how well farmers maintain the soils, water and living resources. This section identifies some of the most important ways in which agriculture influences the natural environment.

2.7.1 Land use

Land is the basic resource for agriculture, but the use of land depends on ownership, tenure, prices and customs. In a recent survey, farmers were asked about their reasons for clearing land. **Table 2.10** shows responses about the use to which people put forested areas after they had been cleared. In the densely-populated montane agro-ecological zones of Kabale, most respondents said they cleared forests for the purposes of re-planting. Since land is very scarce in Kabale, most of the clearing must

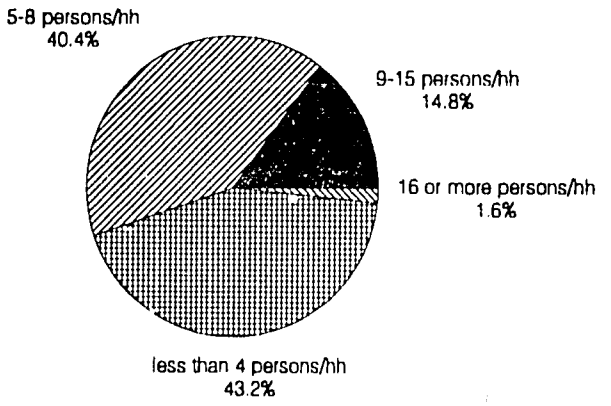
be of owner-managed woodlots and remnants of indigenous montane forest vegetation. In Nebbi district which includes both the montane and West Nile agro-ecological zones, clearing of forested areas was primarily done for increased agricultural production of both food and cash crops and some pasture. Most of the clearing of forests for purposes of agriculture in Nebbi district is likely to have occurred outside of the montane area which is heavily populated, and in the West Nile zone where sizeable areas of public land exist. In the montane agro-ecological zone of Mbale, some clearing of forests did take place but most likely by encroachers on gazetted forest reserves.

Table 2.9: Margin and return to family labour for export and competing crops, May 1992

CROP	YIELD (kg/ha)	PRODUCER PRICE (sh/kg)	GROSS MARGIN (sh/ha)	FAMILY LABOUR (sh/md)	RETURN PER MANDAY (md/ha)
PERENNIALS					
Coffee (R)	1,150	210	97,518	235	415
Coffee (A)	750	475	148,937	240	621
Tea (GL)	5,000	60	99,346	266	373
Cocal (dry)	350	540	75,326	110	685
Matoke	8,500	66	246,250	350	704
SEASONAL					
Cotton	550	340	113,817	168	677
Maize	1,700	110	63,010	97	650
Beans	750	200	62,510	125	500
Groundnuts	800	350	125,460	195	643
Soyabeans	100	150	76,960	116	663
Simsim	400	350	85,460	128	668
Cassava	7,000	36	111,247	200	556
Sweet Potatoe	4,000	40	80,790	110	734
Finger millet	1,400	180	154,255	178	867
Sorghum	1,400	150	114,726	160	717
Paddy rice	1,500	300	319,800	307	1,042
Tobacco (flue)	950	750	239,147	423	565
Tobacco (fire)	800	490	144838	291	498

Source: Bank of Uganda Agricultural Secretariat. Report on Agricultural Inputs Situation (July, 1991-March, 1992) National Inputs Co-ordination Unit, August, 1992 Table 4.3, P.38

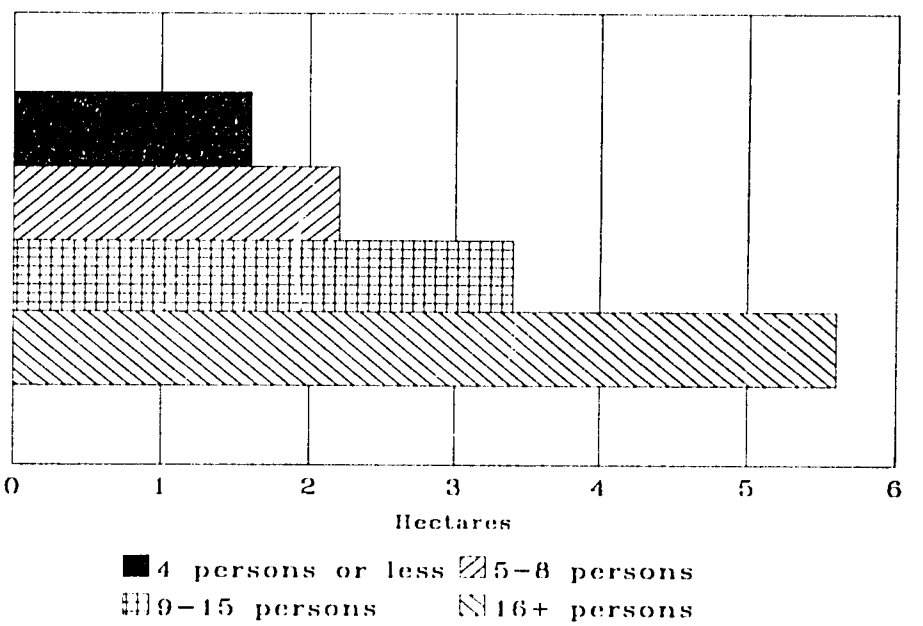
Figure 2.13: Percent distribution of the number of farm holdings by size of households, 1990-91



hh = household

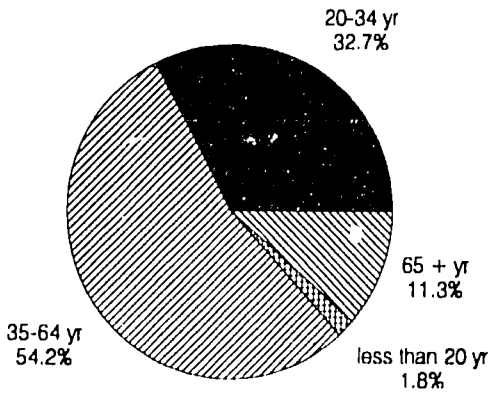
Source: *Ministry of Agriculture, Animal Industry and Fisheries, 1992. Report on Uganda National Census of Agriculture and Livestock (1990-91) Vol II. Holding Characteristics. Entebbe, Uganda.*

Figure 2.14: The average size of holdings by household size, 1990-91



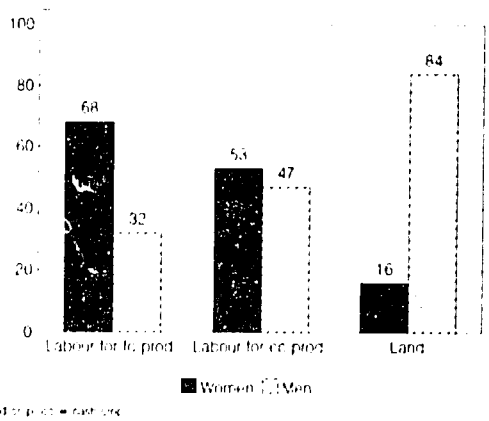
Source *MAAIF, 1992. Report on Uganda National Census of Agriculture and Livestock (1990-91), Vol II. Holding characteristics*

Figure 2.15: Percent distribution of number of farm holdings by age of holder, 1990-91



Source: *MAAIF, 1992: Report on Uganda National Census of Agriculture and Livestock (1990-91), Vol II. Holding characteristics*

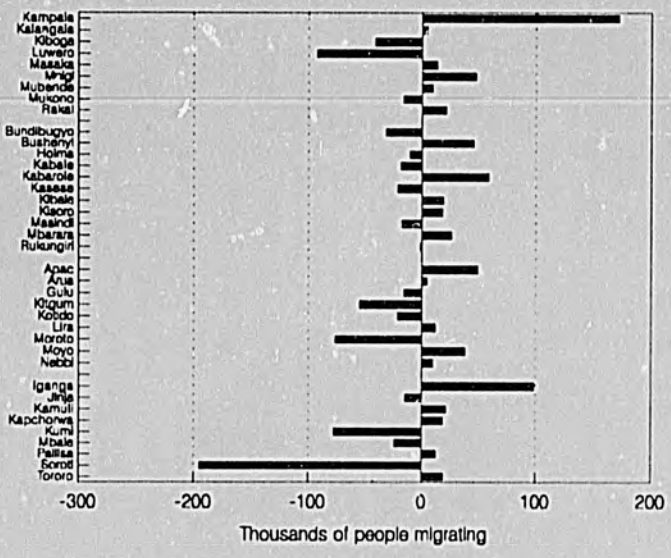
Figure 2.16: Percent distribution of women's labour and control of farms



Source: *MAAIF, 1992: Report on Uganda National Census of Agriculture and Livestock (1990-91) Vol II. Holding characteristics*

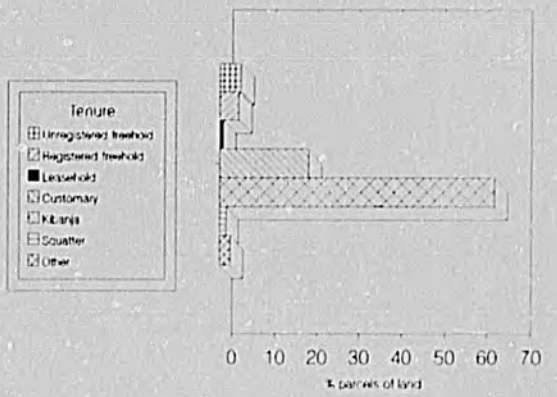
In Gulu District, which is within the northern agro-ecological zone, the prominent reason for clearing forested areas was expansion of farmlands. Most of the clearings in Gulu District occur on public woodland areas. In Mpigi District, within the Lake Victoria agro-ecological zone, there was virtually no clearing of forested land for the purpose of increased agricultural production. This may be partly explained by the predominance of the "mailo land" tenure system in the district. On a national scale, however, the overriding reason why people clear forested areas is connected with their desire for more land on which to grow crops or graze livestock. It has long been a feature of smallholder farming that new areas are opened up to meet increasing demands, even though a high proportion of the land in Uganda is in fallow at any one time[33].

Figure 2.17: Net migration 1980-91 after allowing for population growth



Source: World Bank, 1993, Uganda Agricultural Sector Memorandum Vol II, 1993, Fig. 21

Figure 2.18: Distribution of parcels of farmland by types of tenure in selected districts of Uganda, 1989-90



Source: MAAIF, 1992: Report on Uganda National Census of Agriculture and Livestock (1990-91) Vol II. Holding characteristics, Uganda

Farmers have also expanded their holdings under cultivation and pasture from wetlands. Previously the use of wetlands was discouraged because of the belief that they were major sources of diseases like malaria and bilharzia. This notion has now changed and over the last twenty years, wetlands have been under considerable pressure from agricultural conversion, resulting in excessive draining in Kabale and Bushenyi districts. Elsewhere in places like eastern Uganda, wetlands have been drained for the commercial production of rice (an estimated 20,000 ha)[14]. One of the major environmental concerns is that while substantial yields of crops and dairy production are realizable after the initial clearance, later they decline due to oxidation, acidification and shrinkage in the reclaimed areas. As a result, over time,

the economic value of the conserved wetlands is often greater than the converted wetlands.

2.7.2 Soil degradation/conservation

Erosion, a principal form of soil degradation, has been largely caused by the combined effects of poor farming practices and high population pressures. The traditional fallow system of 2-3 years is no longer possible in the densely populated parts of Uganda. In Kabale, Tororo and Mbale, fallow periods have been abandoned altogether. Even in areas with low population densities, the excessive working of existing fields is causing soil erosion since shortage of labour constrains the opening up of new areas.

Topsoil, the principal resource for food, export crops and livestock, is vitally important because agriculture is the main engine of Uganda's economic growth and is critical for the livelihood of Ugandans. Uganda's soil resource must be conserved. Despite this, the resource has not received the attention usually given to critical factors of production. The MAAIF has been and still is the principal custodian of soil management in Uganda. However, there is as yet no national soils policy. What exists now are colonial bye-laws which cover specific areas. A draft national soils policy has been prepared by the United Nations Food and Agriculture Organization (FAO), the United Nations Environment Program (UNEP) and the Government of Uganda (through the Department of Environment Protection). The broad aims of the policy are to: provide a framework for action to prevent and or reduce soil degradation, promote sustainable soil productivity, and avoid degradation of other land-based resources that depend on soil.

Despite the absence of a clear cut national policy on soils, Ugandan farmers do practise some soil conservation measures including: mechanical and cultural soil conservation techniques (terracing, contours, strip cultivation, ridges,grass strips and bunds), crop rotation, intercropping/mixed cropping, agro-geology (involving the use of rocks instead of processed inorganic fertilizers), organic farming, and agroforestry alley cropping.

Another form of soil degradation is caused by the use of heavy machinery for cultivation, which results in soil compaction. The degree of agricultural mechanization is at present limited. Some organizations have expressed a desire to move away from the use of tractors for cultivation and towards encouragement of ox-ploughing. Today, there is very little information available on soil compaction and its impacts.

In the traditional rangelands of Uganda, overgrazing has aggravated the impacts of recurrent droughts, resulting in extensive soil erosion.

2.7.3 Use of agrochemicals

In the densely-populated parts of Uganda, the scarcity of farmland is a serious problem. The conventional reaction to such scarcity is to intensify management on lands already under cultivation. Intensification of management is usually accompanied by increased use of inputs including agrochemicals. Agrochemicals are usually applied to increase yields or prevent losses resulting from insect, pest and disease attacks.

At the moment, Uganda's mode of agricultural production is characterized as low-input low-

technology. Because increased mechanization may not be feasible on most of the small farm holdings, the use of agrochemicals may present a tempting alternative means of increasing yields. The agrochemicals which are used tend to depend on availability and price. The use of some of the chlorinated hydro-carbons in African countries, such as DDT, which have serious environmental consequences and are banned in the industrialized countries, is often not regulated. Furthermore, the low levels of education of Ugandan farmers may also make it easier for them to misuse the agrochemicals, principally through excessive application. The farmer's safety is also jeopardized by handling these agrochemicals. Poor handling can lead to poisoning and death.

Although Uganda's use of agrochemicals is currently small in comparison to its agricultural output, increased and diversified production is likely to result in greater demand. In particular, the diversification of exports, through the introduction of new and input-sensitive crops such as vanilla, flowers, and vegetables, is likely to boost the demand for agrochemicals unless organic farming techniques are introduced in place of the former.

2.7.4 Water

Rainfall variability, evaporation and the extent of crop and livestock water use, considered together, determine the broad pattern of agriculture in Uganda. It is generally agreed that Uganda can increase the acreage under irrigation. But making water available for irrigation means either mining ground water or drawing water from existing water bodies. Ground water mining lowers the water table and decreases the amount of water for human consumption and other uses especially in semi-arid areas. Piping water from open water bodies may influence the flow and hence ecology of riparian systems. Furthermore, agrochemicals such as fertilizers, the use of which is essential for the success of irrigated crop and pasture production, may result in increased salinization of soils and pollution of ground water reservoirs.

2.7.5 Biodiversity

Land clearing for agriculture in Uganda, decreases biodiversity, whether on common or private land or in natural forest reserves. Much of Uganda's biodiversity is found in areas with good rainfall, adequate water and fertile soils as in western Uganda, around Lake Victoria and on Mt. Elgon in the east. These biodiversity-rich areas are also the ones with high population densities. They are also characterized by inefficient farming methods, fragmented and unplanned settlement, and increased use of agrochemicals to boost yields per unit area. There is also encroachment on national forest reserves. All these activities can be detrimental to biodiversity and should be carefully assessed.

2.8 Factors constraining sustainable agriculture

Six principal factors appear to constrain sustainable agriculture in Uganda. First, the lack of security - the past wars, civil disorder and breakdown in law and order - has had a profound effect on agricultural production. Food area per rural capita decreased from 0.42 ha in 1970 to a low of 0.27 ha in 1979 with a slight recovery since then to 0.30 ha in 1990. As a result, the index of *per capita* food production decreased from 100 in 1970 to 67 in 1990. Second, features of Uganda's existing land tenure systems impede sustainability in agriculture. There are no written records of ownership under customary tenure, which makes it difficult to resolve land conflicts or keep track of changes in ownership. Leases are currently costly and cumbersome to obtain, and hitherto the conditions of offer have not explicitly emphasized environmental care.

Table 2.10: The uses to which people put forested areas after clearance

	POPULATION DENSITY (36) people per Km2	PER CAPITA AVAILABLE CULTIVABLE AREA (ha)	FOOD CROPS	PASTURE	CASH CROPS	REPLANTI	BANANAS
			%				
Kabale	254	0.39	23	0	3	78	2
Rukungiri-Kajara	207	0.48	91	90	37	0	5
Bushenyi-Ruhinda			2	17	1	15	0
Nebbi	109	0.92	89	35	83	0	6
Gulu	26	3.82	63	1	14	2	28
Mpigi	181	0.55	3	0	1	3	0
Iganga	200	0.50	91	3	5	0	19
Mbale	319	0.31	46	16	0	0	4
National	91*	n.m	52	25	15	11	7

is based on rural population density

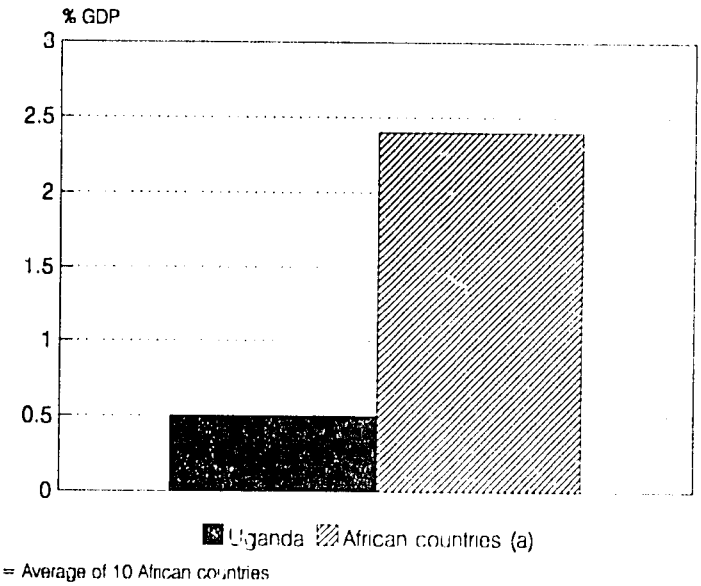
Note:
- *The figures above refer to percentages of people who responded positively. The answers were not mutually exclusive.*
- *Other data from: Makerere University Institute of Environment and Natural Resources (MUIENR), 1992. Environmental and Natural Resource Management Policy and Law - issues and options - Uganda. Prepared in collaboration with the World Resources Institute, P.92.*

Third, constraints imposed by inefficient agricultural marketing systems have serious implications for sustainable agriculture. Inefficiencies may result in a switch to other crops (at one point in Mukono District, farmers cut coffee trees in favour of crops like bananas, beans and pineapples). Windfall profits made by middlemen due to poor market information shift producers' surplus away from the farmers to the traders, thereby perpetuating the poverty of the farmers (the farm gate price of maize was U.Shs. 65/kg compared with the Uganda\Kenya border price of U.Shs. 150/kg, October 1993).

Fourth, over the last decade, the terms of trade of agricultural commodities worsened. This adversely affected the export earnings of many producing countries including Uganda (**Figure 2.19**). In 1986, Uganda generated approximately US $ 400 million in export earnings from the sale of 150,000 tons of arabica and robusta coffee, at an average price of US $ 2.80 per kilogram. By 1992, earnings had dropped to less than US $ 100 million, principally because the world price had declined to US $ 0.80 per kg.

Fifth, in absolute and relative terms, government funds for agriculture in Uganda have been very low. The absolute amount of locally-generated government resources allocated to agriculture-related services is only 0.5% of GDP. Agriculture's share of the government budget is only 4%. Uganda's central government provides about US $ 3.75 *per capita* per year to support agriculture (**see Figure 2.19**). Finally, investment into agricultural research is woefully inadequate at 0.2% of agricultural GDP: 2.0% is the recommended level for developing countries[35]. Action is being taken to rectify the dismal state of agricultural research in Uganda. A new entity, the National Agricultural Research Organisation (NARO), has been established. NARO's proposed allocation of research staff by priority areas is shown in **Figure 2.21**.

Figure 2.19 : Average per capita allocation of central government expenditure on agriculture, Uganda compared to ten Sub-Saharan African countries.



Source: *Group 9A Agricultural Policy committee - National Agricultural Research Strategy and The Uganda Working Plan Vol 1 - Strategy, organization and management, 1991 Table 5.1*

2.9 Policy framework for sustainable agriculture

2.9.1 Changes in the agricultural system

Since 1986, food crop production has been the subsector most responsive to increased security and reduced economic uncertainties and inefficiencies. It registered an average annual growth rate of 5.9% between 1986 and 1990. However, it is unlikely that this growth rate can be sustained in the future: the domestic market is limited in size and the export market for many food crops is unpredictable. Increased income in the future is likely to lead to shifts in what Ugandans eat. Consumers may incorporate more livestock products in their diets than they do today. Matoke, sorghum, sweet potatoes, rice, cassava and beans are expected to lose production shares, while maize is expected to increase its share (**Table 2.11**).

Although the markets for Uganda's traditional export crops are currently depressed, there are compelling reasons to believe that incremental improvements are possible. For one, there is a large underutilized capacity, which can be brought into operation again at reasonable marginal cost. For this and other reasons, it has been forecast that quantities of coffee beans, cotton lint and made tea will increase at annual growth rates of 4.6%, 42.3% and 18.8%, respectively. Except for cotton, an annual crop whose acreage was severely affected by the insecurity in the 1970s and 1980s, it is unlikely that increases in exports will result in significant commitments of additional farmlands. Instead, increases in exports of made tea and coffee beans will largely result from the rehabilitation of and improvements on existing acreage.

In contrast to the traditional export crops, the market for non-traditional export crops has been relatively healthy. Earnings from exports of maize, sesame seed (simsim,) beans, and hides and skins have grown very rapidly in recent years and are expected to continue to grow (**Figure 2.22**). In addition, the government is encouraging the production of horticultural crops as a means to diversify and increase the absolute value of earnings. Some of these crops can be grown without external inputs and may even be environmentally beneficial. For example, "essential oil" grasses (*Citronella* and lemon grass) could be developed as barrier vegetation to control erosion in the montane agro-ecological zones of Uganda[36]. In the majority of cases, however, the production of oils, spices, flowers and vegetables is likely to require significant inputs of agrochemicals (**Table 2.12**).

2.9.2 Principles and policy

Below are suggested policy instruments which would help to ensure sustainable agricultural production in harmony with the environment. They address the issues of commodity pricing, economic incentives for conservation, land tenure, and land use, extension services, soils and education/training/research.

Guiding principles

- Increased agricultural production must be based on improved farming systems and increased security of land tenure, rather than an expansion of cropland.
- Agricultural policy and planning must be based on a rural land use plan, including up-to-date soils and land use surveys and mapping.
- Agricultural policy and planning must involve local people.
- Agricultural policy and planning must incorporate the environmental costs of soil erosion and other negative environmental impacts in the economic analysis of agricultural development.
- Agricultural policy and water resources policy must be integrated and coordinated.
- Land users must be offered an incentive to implement agro-forestry and aquaculture as a sustainable practice.
- Women must be deliberately involved in agricultural policy and planning, given their important role in agriculture.

Commodity pricing

- There is a need for improvement in marketing systems, accompanied by increased information to the farmers about quality control and marketing for their produce.
- Farmers should form associations or cooperatives based on their own initiatives and not controlled by government.

- As much as possible, pricing policy and practice should restrain from promoting the cultivation of crops that degrade the environment. Where the promotion of such crops is unavoidable, suitable and sufficient soil and water conservation policies and practices should be required.

Economic incentives for conservation

- People's behaviour should be induced to change through incentives rather than enforcement.
- The enforcement responsibilities of many government agencies should be reduced to a level where they can enforce a few important regulations effectively.
- As much as possible, the tax structure should be used to provide positive incentives for actions which compromise social welfare.
- Local communities should receive sufficient benefits from protected areas, so that they collaborate in their maintenance and preservation.

Land tenure and land use

- Not only should property rights to land be emphasized but also rights to other natural resources (planted and natural trees, water, rangelands, minerals, wetlands, fisheries and wildlife).
- Security of tenure should be provided to rural land users so that they carry out more sustainable agriculture, including agroforestry.
- If wetland development is required for agriculture, there must first be an environmental impact assessment.
- Where feasible, traditional community institutions should be empowered with authority to manage and regulate resources on common land.
- Customary rights of land and resource use should be recognized and protected where possible, including options for conversion to freehold status.

Extension services

- The environmental dimensions of the agriculture extension system should be strengthened, including research and training for extension workers.

Soils

- Proper procedures and guidelines should be developed for the application of agrochemicals to Uganda's various soils.
- Proper procedures and guidelines should be developed for the use of farm machinery and equipment by soil -type categories.

Education/training/research

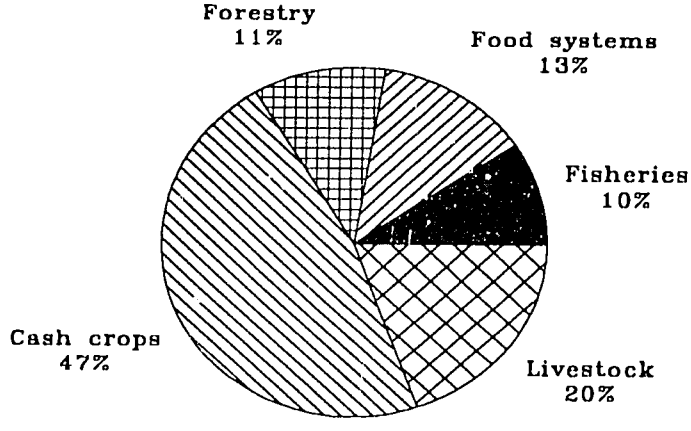
- Environmental education should be mandatory in the curriculum of all formal education institutions.
- Public awareness and informal environmental education programs should be initiated for the public and private sectors and women.
- Research services, currently fragmented in several ministries, should be consolidated in one entity.
- Incentives, conditions of service and accountability should be improved.

Table 2.11: Changes in shares of total quantities of food crops produced (%)

CROP	ACTUAL (1991) %	PROJECTED (2005) %	% CHANGE IN SHARE
Matoke	30	24	-19
Millet	11	11	0
Maize	8	17	102
Sorghum	6	6	-11
Sweet potatoes	12	9	-20
Rice	3	3	-1
Cassava	8	8	-2
Beans	10	9	-14
Others	10	12	17
TOTAL	**100**	**100**	

Source: World Bank, Uganda Agricultural Sector Memorandum, Vol II, Main Report. 152 p. March, 1993

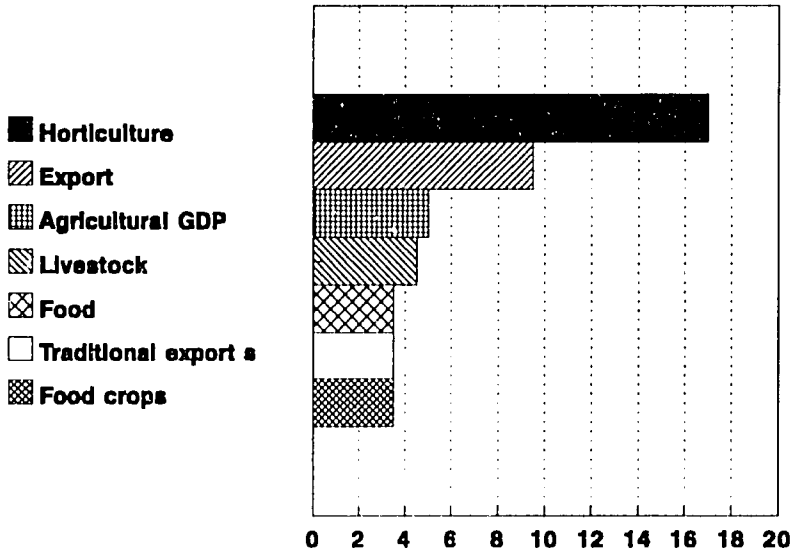
Figure 2.20: NARO proposed allocation of research staff for high and medium priority projects.



Note: Totals based on rounded-off figures

Source: Group 9A Agricultural Policy committee. National Agricultural Research Strategy and The Uganda Working Plan Vol 1 Strategy, organisation and management, 19091 Table 5.1

Figure 2.21: Projected growth rates in earning for the period 1992-2005



Source: World Bank, Uganda Aricultural Sector Memorandum, Vol II, Main Report. 152p. March, 1993

Table 2.12: Provisionally recommended fertilizer application rates and labour requirements for selected non-traditional export crops for Uganda

	FERTILIZER (Kg/ha)	LABOUR (man months/ha)
Asparagus	NPK-800	33
Extra-fine beans	CAN-100	30
	DAP-200	
	TSP-200	
Mangetout	CAN-100	33
	DAP-150	
	TSP-200	
Chillies	NPK-350	20
Okra	NPK-250	12
Baby corn	NPK-450	22
Mini courgettes	NPK-300	12

d to be modified after soil analysis

CAN Calcium Ammonium Nitrate
DAP DiAmmonium Phosphate
TSP Triple Super Phosphate
NPK Nitrogen, Phosphorus, Potassium in the ratio 10 20 10%

Source: Sergeant, A. and M. Wauters. 1993. Opportunities for non-traditional agricultural exports from Uganda. Vol 2. Vegetables. International Science and Technology Institute, Inc. High Value Horticulture Plc, UK for the Export Policy Analysis and Development Unite (EPADU). Ministry of Finance and Economic Planning, Kampala, Uganda. 58p+4

3.0 FORESTS AND WILDLIFE RESOURCES

3.1 Overview

For its size, Uganda has extremely rich and diverse forests and wildlife. Uganda is among six African countries regarded as internationally important for biodiversity with species and habitats ranging from dry savanna/semi-desert type to those of temperate conditions in the montane areas higher than 3000m above sea level. Seven of the mainland Africa's 18 bio-geographic regions are found in Uganda, more than in any other country[37]. This, therefore, means that Uganda has a variety of habitats with associated species and unequalled elsewhere on the continent. Uganda is third in Africa in the number of mammal species, and Fourth in the number of bird species. The country possesses over half the world's population of mountain gorillas.

This rich diversity of habitats and species has great significance in protected areas (forest reserves, national parks, game reserves, game sanctuaries, and controlled hunting areas). These protected areas (PAs) currently occupy about 13% of the total area of Uganda. As of 1964, at least 90 types of natural or semi-natural vegetation communities were recognized consisting of forest, forest/savanna mosaic, swamp forests and savanna types[38]. The animal diversity in PAs is immense. The indigenous fauna include more than 40 different species of primates, ungulates, carnivores and other relatively large mammals. There are fifteen mammalian species and sub-species endemic to Uganda.

3.2 Forest resources

3.2.1 Introduction

Uganda's forests are vital for the wellbeing of its population. Although much smaller in size than its neighbours, its forests are unique. They are rich in terrestrial biodiversity and cover a wide range of habitat types.

Forests provide a multitude of products and services. For example, by contributing to stable climates, forests are vital in creating, maintaining and controlling environments essential for all other human activities including agriculture. Forests help to ensure sufficient and regular rainfall and adequate water supplies. They reduce soil erosion, flooding and silting of rivers and lakes. Forests modify drought and desertification. Forest products range from those that can be consumed directly after harvest such as firewood and food (leaves, fruits, bark roots, shoots, bushmeat, insects, mushrooms and honey) to those that become intermediate raw materials (logs, sawnwood, plywood, flowers) for the manufacture of charcoal, furniture and other construction items, paper and paper board, textiles, animal feeds, alcohols and pesticides. Not all these benefits are as yet being provided by Uganda's forests but they could become the basis of future industries.

Forests also provide *in situ* conservation of genetic resources. It is quite likely that genetic material for future plant breeding currently resides in the Tropical High Forests (THFs) of Uganda. Some of the crop land races have tremendous potential for increasing yields. For example, wild coffee in Kibale Forest is estimated to be capable of yielding up to 100,000 kg/ha/year without the slightest input from man[39]. Forests also provide habitats for some unique mammal, bird and insect species. The Mountain Gorilla of Bwindi and Mgahinga Forests is an example.

Forests also provide a great opportunity for tourism and recreation. Uganda's THFs provide some

of the richest diversity of plant and animal life in the world. Increasing numbers of people worldwide are now showing interest in visiting tropical forests to see rare species. Uganda is well on its way to developing a viable forest-derived eco-tourism business. The Mgahinga Forest National Park and the creation of Strict Nature Reserves (SNRs) in many of the THFs are examples of efforts to boost eco-tourism.

Common economic indicators, such as the GDP, grossly understate the value of forests to Ugandan society. Many of the values of forests, such as watershed protection, erosion control and genetic reservoir, are not captured. Furthermore, benefits derived by local communities in proximity to forests are largely outside market transactions.

The United Nations Food and Agriculture Organization (FAO) has estimated that in 1890, approximately 45% of Uganda was covered with forests and woodland, representing, some 10,800,000 ha. Since then, there has been substantial loss of forest land to other uses so that by 1967, only 14% of the country was covered. The decline in forest is continuing[1].

3.2.2 Forests today

Figure 3.1 shows comparisons of the extent of forest loss for selected African countries and the continent as a whole. Uganda, with its rapid growth in population and agriculture, has approximately 21% of its original forest lands remaining, including woodlands.

The extent of closed and open forest and their rates of deforestation in the 1980s in Uganda are shown in **Table 3.1**. FAO has estimated that Uganda is losing about 50,000 ha or 0.8% of its forest lands each year. Most of this deforestation is occurring in woodlands, scattered throughout the country.

There are approximately 14,900 km^2 of gazetted forest reserves in Uganda: some 7,500 km^2 is savanna woodland and forest plantations, 5,900 Km^2 is THF and 1,500 Km^2 is montane catchment forest. Thus, about 7.7% of Uganda's land surface is gazetted for forestry and 3.0% consists of THF cover[1]. **Figure 3.2** shows the composition of forests by major vegetation types. The spatial distribution of forests is shown in the accompanying map in **Figure 3.3**. Descriptions of the main forest vegetation types are presented below:

- **Tropical High Forests** (usually defined by FAO as closed forests). These forests occur at about 1,500m above sea level. The vegetation communities include: moist montane, moist dry montane and montane bamboo forests. These vegetation communities are less species rich than those that occur at lower altitudes. These forests occur in southwestern Uganda (Bwindi, Rwenzori) and in the east (Mt. Elgon and the mountain massifs in Karamoja).

- **Medium Altitude Moist Evergreen Forest**. Vegetation types in this zone include: forests on Ssese Island, and around the shores of Lake Victoria and in Kibale, Itwara and Kalinzu. The forests in this zone are similar to true lowland tropical rainforest, being structurally complex and rich in species including many epiphytes, lianas and large trees with impressive buttressing.

- **Medium Altitude Moist Semi-Deciduous Forest**. Four forest types are represented, characterized by those found in Mabira, Budongo, Mubende and Busoga. A large proportion of trees in these communities remain leafless during prolonged periods when the dry season is longer and more severe.

- **Savannah ecosystems**: The gazetted area representing savanna ecosystems was 740,000 ha in 1987 and is part of a total 5.25 million ha of savanna ecosystems in the country. Both within and outside protected areas, savannah ecosystems are a main source of fuelwood. Unfortunately, gazetted areas do not include all vegetation types. For example, vegetation associated with *Butyrospermum* (Shea Butter, a source of vegetable oil) and *Borassus* palm (a source of fruits, palm hearts and building construction materials) are either under-represented or not included at all.

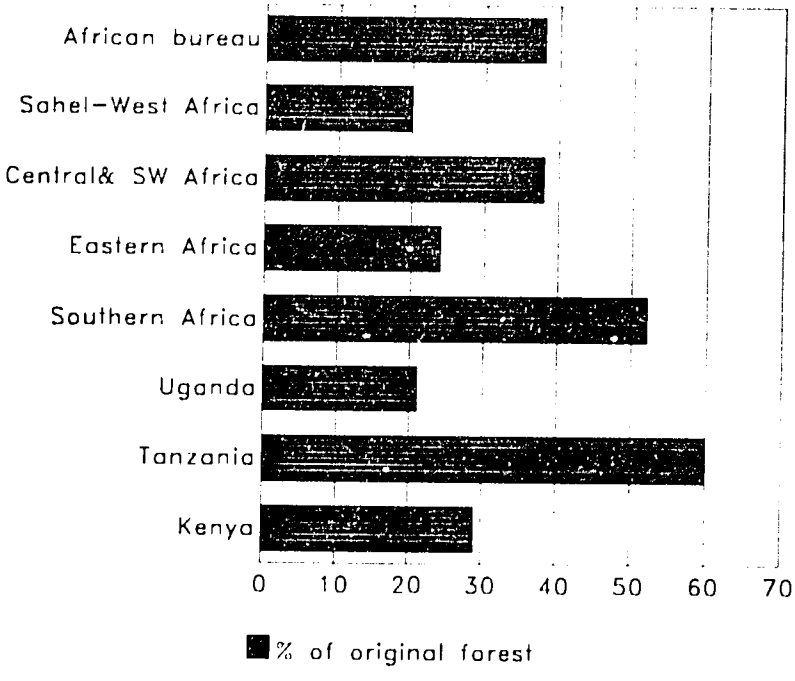
- **Agro-ecosystems**: These consist of large softwood plantations and planted woodlots. They are man-made ecosystems of both indigenous and exotic tree species.

Table 3.1: Forest cover and deforestation in Uganda

	EXTENT ('000 ha)	AVERAGE ANNUAL DEFORESTATION (1981-83)	
		AREA ('000 ha)	PERCENT (%)
Total forest	6,015	50	0.8
Closed forest	765	10	1.3
Open woodland	5,250	40	0.8

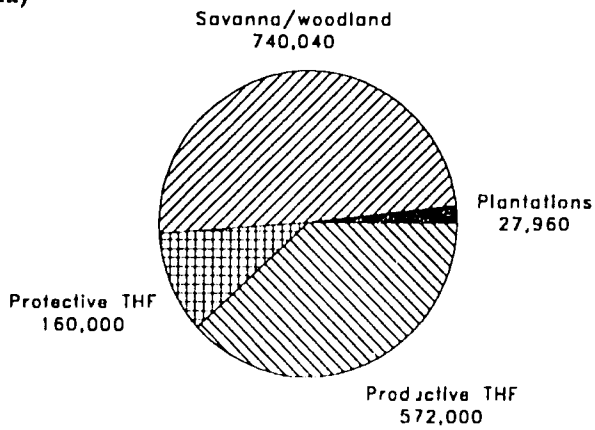
Source: WRI, WRR 1992-93 Table 19.1

Figure 3.1: Remaining percentage of original forests 1980s



Source: WRI (1992-93)

Figure 3.2: Distribution of Uganda's gazetted forest reserves by major vegetation types (ha)



Source: NEAP Secretariat, Task Force No. 5 (Nov. 1992)

3.2.3 Forest products demand and supply

3.2.3.1 Economic contribution

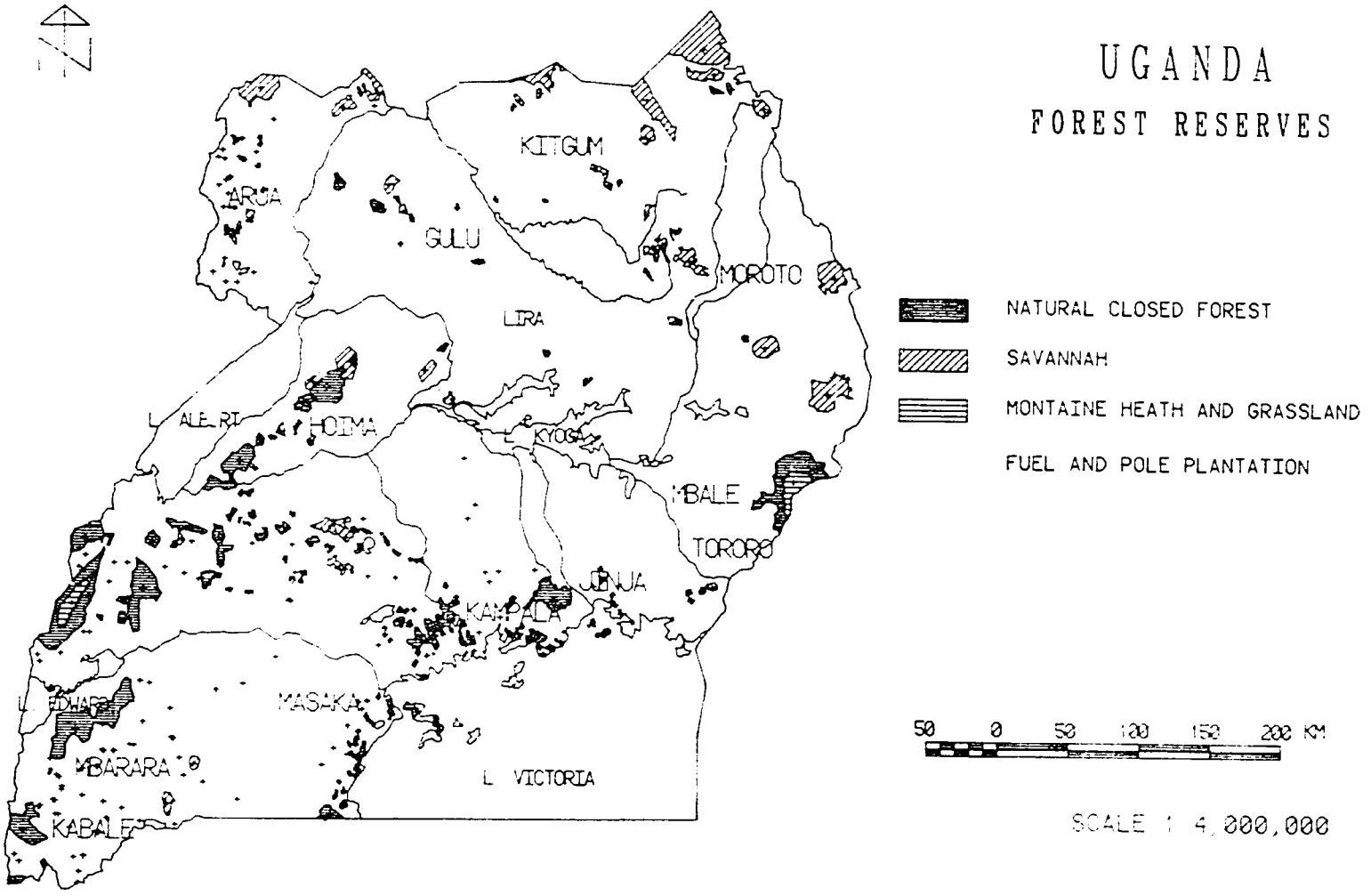
The contribution of forestry to the GDP of Uganda ranges anywhere from 1.2% to 3.0%[42]. **Table 3.2** shows forestry's contribution in both the monetary and non-monetary sectors for selected years. By these figures, the non-monetary contribution is three times as important to the Ugandan economy as the monetized activity. There is currently no readily available data on the number of individuals employed directly in the forestry sector. Nor is there any information on employment associated with the indirect and induced activities in the sector. However, based on 1973 data, one can deduce that the forestry sector employs a lot of people on a permanent basis[43].

Table 3.2: Contribution of forestry to GDP in constant 1991 prices, selected years

YEAR	MONETARY			NON-MONETARY			TOTAL		
	Total GDP	Forestry contribution U.Shs million	%	Total GDP	Forestry contribution U.Shs million	%	Total GDP	Forestry contribution U.Shs million	%
1983	1006180	12047	1.20	566017	16601	2.93	1572197	28648	1.82
1987	1026400	12307	1.20	583194	18654	3.20	1609594	30961	1.92
1992	1361137	15624	1.15	707551	21834	3.09	2068688	37458	1.81

Source: Statistics department, Ministry of Finance and Economic Planning. Background to the Budget, 1990/91

Figure 3 3


UGANDA
FOREST RESERVES
NATURAL CLOSED FOREST
SAVANNAH
MONTAINE HEATH AND GRASSLAND
FUEL AND POLE PLANTATION
KITGUM
ARUA
GULU
MOROTO
LIRA
L ALBERT
HOIMA
KYOGA
MBALE
TORORO
JINJA
KAMPALA
L EDWARD
MASAKA
MBARARA
L VICTORIA
KABALE
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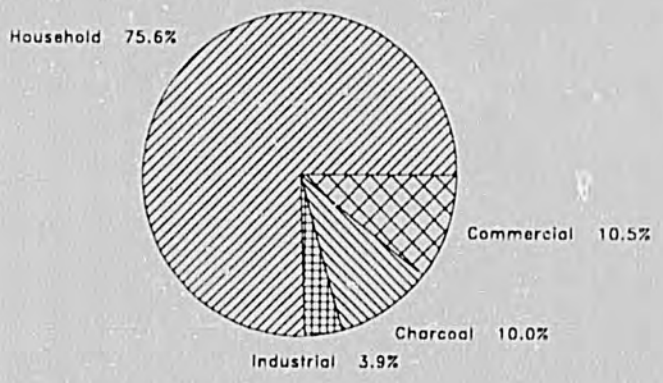
Digital Map By NEIC
(SOURCE UGANDA ATLAS, 1967)

3.2.3.2 Fuelwood

Approximately 96% of the total quantity of energy consumed in the country is provided for by woody biomass (mostly fuelwood)[44]. Fuelwood is used for household heating, cooking and lighting, and also for commercial and industrial energy requirements and charcoal production. In fact, fuelwood constitutes the major contribution of the forestry sector to GDP.

Although there are no firm statistics, it is believed that fuelwood consumption is increasing. This is expected since over 75% of total consumption is for household purposes and should closely follow the rate of increase of the rural population. Over the period 1981 to 1992 (inclusive), household consumption of fuelwood represented the largest use category at 75.6%, followed by commercial consumption (10.5%), then charcoal production (10.0%), and industrial consumption (3.9%) as depicted in **Figure 3.4**.

Figure 3.4: Percent consumption of fuelwood by use categories, 1981-1992 (inclusive)



Source: MFEP Background to the Budget, 1993-94

Data on the consumption of fuelwood is extremely sketchy. For one thing, while it is conceptually feasible to record woody biomass removals for fuelwood from gazetted forest reserves, most of the supply comes from outside protected areas with no records kept. Under the Uganda Biomass Study Project, estimates of consumption and supply of fuelwood are being improved. For example, it has been discovered that a home of 5 people on average uses 39.64 m^3 of fuelwood per year. This represents 20 kg of firewood per day and 2.5 kg of charcoal per day for cooking meals[45]. Other estimates are shown in **Box 3.1**.

Historically, most of the fuelwood consumed in Uganda has been through removals from unprotected public areas. This stock of woody biomass resources has been seriously mined to the point where acute shortages of fuelwood exist in some districts of Uganda. It has been forecast that nationally, if present utilization rates persist and no ameliorative actions are taken, Uganda will face a severe fuelwood shortage by the year 2021.

Plans are underway to promote the use of new and renewable sources of energy, practice energy conservation, increase the generation of hydroelectric power and promote rural electrification. However, it is quite likely that in the medium term at least, fuelwood will continue to represent

the major source of energy for Uganda's growing population and commercial and industrial activities. Therefore, unless the growing stock of woody biomass is increased, the country will face an increase in scarcity of fuelwood. This will be accompanied by increases in the prices of fuelwood which could very well put it out of the reach of most of the rural population and urban poor. Other biomass sources are likely to become substitutes for fuelwood. But the use of these other sources of biomass could have serious environmental consequences. To alleviate the impending fuelwood crisis will require the increased establishment of woodlots by individuals and communities to substitute removals from the "common lands".

Box 3.1

FIREWOOD AND CHARCOAL USE RATES IN UGANDA

A 100 KG OF FIREWOOD CAN
- cure 3.5 Kg of tobacco leaves,
- dry 22 Kg of tea leaves,
- brew 15 litres of "enguli" (crude alcohol),
- bake 40 Kg of fresh fish,
- fire and kiln 125 Kg of fresh fish,
- cook a 5-person family meals for five days.

B 100 KG OF CHARCOAL CAN
- cook a 5-person-family meals for 40 days,
- cook a student's meals (while at school) for 20 days)
- roast maize, meat, cassava and other foods on street-sides for 10 days.

Source: United Nations Environment Program (UNEP) 1988. Strategic Resources Planning in Uganda Volume III. Forests. Report No. 88-5932, p 51

3.2.3.3 Industrial wood

The production of roundwood timber, processed wood products, charcoal and other forest products is shown in **Table 3.3**. Uganda does not produce any pulp and so requirements are usually imported. For any other wood products, consumption requirements in excess of production are also usually met through imports.

Excluding charcoal, the major primary wood processing industry is sawmilling with its principal output of sawnwood. Using three scenarios of GDP growth to the year 2000 A.D. and a roundwood to sawnwood conversion efficiency of 40%, **Figure 3.5** shows that under the scenario of high GDP growth rate, the present estimate of annual sustainable timber supply will fall short of projected demand for sawnwood production by the year 2000 A.D. Both the low and medium growth rates would be close to being in balance with the long-run sustainable timber supply. Ideally, even if it is assumed there will be no domestic production of pulp at least to the year 2000, plywood could be produced. The demand for plywood production would also represent an incremental requirement which should be added to that of sawnwood. If done so, industrial roundwood scarcity is likely to be experienced much earlier than the year 2000.

To some extent, the scarcity of industrial roundwood can be avoided in the medium term. As of 1991, it was estimated that Uganda was using 100,000 m^3 of industrial roundwood a year of which 95% came from hardwood forest and 96% was being cut by pitsawyers[36]. As a consequence, the forest resource was being used inefficiently and wastefully. Unable to produce to capacity, sawmills tended

Table 3.3: Uganda: Production of roundwood timber, processed wood products, charcoal and other forest products ('000)

	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
Round wood timber												
Logs (cubic meters)	51.0	60.0	51.0	65.0	66.0	75.0	77.0	83.0	33.0	50.0	83.0	80.0
Poles and fence posts (cubic meters)	10.0	11.0	15.0	20.0	17.0	22.0	22.0	30.0	40.0	43.0	70.0	71.0
Fuelwood (cubic meters)	70.0	77.0	104.0	150.0	130.0	170.0	190.0	250.0	300.0	340.0	410.0	530.0
Processed wood products												
Sawn timber (cubic meters)	21.0	21.0	19.0	23.0	23.0	25.0	26.0	28.0	10.0	25.0	30.0	29.0
Particle/chip board (cubic meters)	-	0.0	0.0	0.1	-	-	-	-	-	-	-	-
Plywood and block board												
Board (cubic meters)	14.0	150.0	130.0	145.0	80.0	398.0	400.0	500.0	180.0	450.0	600.0	680.0
Paper boxes (cubic meters)	720.0	750.0	700.0	800.0	180.0	190.0	-	-	-	250.0	350.0	410.0
Matches (small size) [cartons]*	9.0	9.0	9.0	10.0	12.0	2.5	-	-	-	-	-	-
Matches (large size) [cartons]**	-	-	-	-	1.6	1.7	-	6.0	7.0	8.0	15.0	15.0
Charcoal & other forest products (tons)	27.0	27.0	28.0	30.0	35.0	37.0	38.0	40.0	45.0	57.0	70.0	73.0

* *Cartons of 10 gross small-size match boxes each*

** *Cartons of 200 large-size match boxes each*

Source: Ministry of Planning and Economic Development: Background to the Budget 1989-90, July, 1989; Ministry of Planning and Economic Development: Background to the Budget 1985-86, June, 1985; IBRD, Vol II, Table 15

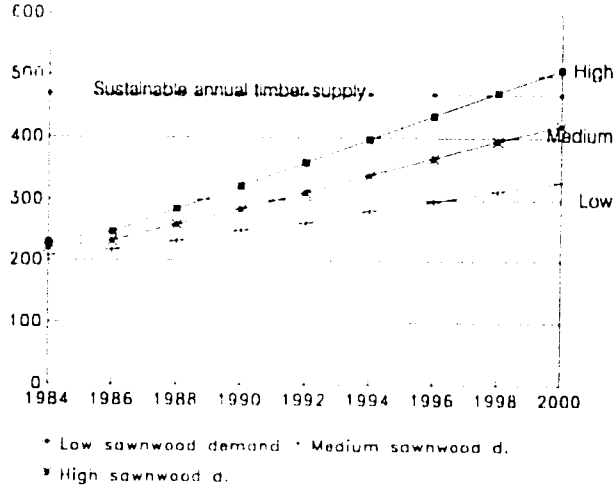
to cream the forest for the best species. The low conversion efficiency rates attained by pitsawyers made them selective in the species and sizes of logs cut. Plans are being considered to make the forest industry more efficient, and this should result in improvements in utilization.

While the estimate of sustainable annual timber supply of 470,000 m^3 is expected to come from coniferous plantations, the recent aphid attack on these resources means that accelerated salvage harvesting must be carried out over a relatively short period of time. The implications of the infestation for long-run sustainability of industrial roundwood supplies are significant **(Box 3.2)**.

3.2.3.4 Pitsawing

Pitsawing in Uganda's forests began in the early 1900s. However, with the importation of sawmill and plywood mill machinery and equipment and the granting of long-term concessions the practice of pitsawing was progressively discouraged.

Figure 3.5: Supply and demand for sawn wood



Source: Sackman, E. Future requirements for forest products in Uganda. UNDP/FAO/Ministry of Agriculture and Forestry (1985) [Requirements for 1984 assumed as 1985]

Table 3.4: Number of licensed pitsawyers

	1983	1984	1985	1986	1987	1993
Licences issued	285	225	295	493	467	264
Allowed saw/licence	4	4	4	4	4	4
Saw cut/d	1140	900	1180	1972	1868	1156
Sawyer/2 saws	2280	1800	2360	3944	3736	2312

Source: UNEP 1988 and other sources

Following the 1972 exodus of Asians who dominated the sawmilling industry, pitsawyers started up again in large numbers in 1976. In 1983, a total of 285 pitsawing licences were issued, and this increased to 493 in 1986. It is believed, however, that there are many more pitsawyers operating

illegally. Furthermore, pit sawyers are difficult to monitor and control, and the Forest Department officials admit they have no figures of the amount of logs and timber cut by these illegal operators. **Table 3.4** shows the number of licensed pitsawyers for the period 1983 to 1987 and for 1993. Pitsawing is inefficient, realizing low product recovery rates in both plantations and natural forests, leaving a large amount of usable material. Where they are operational in natural forests, pitsawyers tend to "cream" the forest, harvesting only the premium-value species.

3.2.4 Deforestation and degradation

Rapid deforestation and degradation are adverse impacts resulting from the lack of sound management of forests. Deforested and degraded sites often are associated with serious erosion problems. The annual cost of deforestation in Uganda has been estimated at US $ 3.8-5.7 million[47]. A number of factors are usually responsible for deforestation and degradation. Chief among them are excessive harvesting, poor harvesting and silvicultural practices, government policy, land pressure, poverty, macroeconomic uncertainty, and the breakdown of law and order.

Box 3.2

Aphid infestation in softwood plantations in Uganda

According to the Kenya based International Institute of Biological Control (IIBC), the three aphids which are attacking softwood plantations were first identified in South AFrica in 1986. The aphid infestation spread rapidly throughout Cypress growing areas of Africa, with Uganda being one of the recent victims

Uganda's 13,381 hectares of softwood plantations are being attacked by *Pinus pini, Eulachnus viley* and *Cinara cupressi*, the latter is considered to be the most damaging. These aphids are said to infest softwood trees at an altitude of more than 2000m above sea level

The most severely infested plantations are: Mafuga plantation covering 1,386 ha with trees as old as 40 years, and muko plantation occupying 162 ha with trees ranging from 13 to 36 years old. Both plantations are found in Kabale district in southwestern Uganda. A fresh outbreak of *Cinara cupressi* has been recorded in Bugamba, Cherhima, Rwoho, Oruha, Lendu and Kapchorwa. The only way to salvage the endangered trees is to fell them, and this is already being done at mafuga and Muko plantations. The aphids, however have been found to be resistant to chemicals like Ambush, Sumathion and Diazonon. The International Institute of Biological Control under the AFrican Forest Pest Management Program is seeking natural enemies of the pest would then be imported and quarantined at the Kenya IIBC Station.

The project being supported by the Canadian International Development Agency (CIDA), the British Overseas Development (ODA) and the United Nations Food and Agricultural Organisation (FAO), is intended to ensure that the participating countries have facilities, information and training

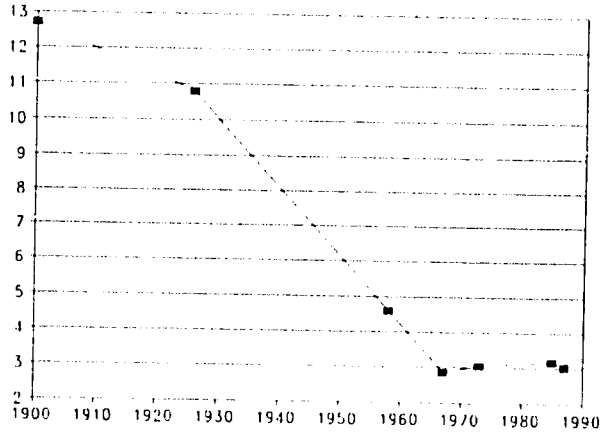
Figure 3.6 shows the long term trend in the decline of tropical high forest cover from 1900 to 1987. During this time, tropical high forest cover declined from 12.7% of total land area in Uganda in 1900 to about 3.0% by 1987. It should be noted that there is rampant deforestation and degradation outside protected areas, and that the extent of this is not known.

It has been suggested that logging methods practised in Uganda's forests contribute to the degradation of the forest estate[48]. In THFs, less than 50% of the tree is often actually removed during harvesting. The practice of tree-length skidding and the clearing of vegetation during construction of logging roads produce erosion tracks. In plantations the tree-length skidding and construction of logging roads are the main causes of degradation of the estate.

To some extent, misguided policy directives have also contributed to the degrading of the country's forest resource base. For example, previous governments degazetted official forest reserves and re-

allocated the land to individuals, a tribal community, and the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF). A total of 10,686 ha were degazetted (**Table 3.5**).

Figure 3.6: Decline in Uganda's THF cover



Source: NEAP Secretariat, Task Force No. 5 (1992)

Table 3.5: Forest land areas degazetted for settlement and other activities

RESERVE	DEGAZETTED AREA (ha)	RECIPIENT
Bukaleba	4686	MAAIF
Mt. Elgon	6000	Individuals (Ndorobo tribe)

Source: Forest Department

In districts with relatively high rural population densities, reserves of natural forests have been encroached upon in an attempt by the local communities to expand areas under cultivation. Also between 1971 and 1986, when there was a complete breakdown of law and order with the judiciary fearful of punishing violators, gazetted forest reserves were encroached upon while forest products were mined in disregard of sustainability. In terms of macroeconomic uncertainty, the declines in the world prices for Uganda's principal agricultural export, coffee, encouraged diversification. New crops were introduced, some of which were grown on encroached forest areas.

The extent of encroachment on individual forest reserves and the location of those reserves is shown in **Table 3.6**. When all areas were combined, approximately 80% of the forests were essentially undisturbed, ranging from zero or minimal for Sango Bay and Mt. Rwenzori to about 30% for Mabira. The most affected areas were Mt. Elgon, Mabira and south Busoga. Otherwise, nationwide, less than 100,000 ha of forest reserves have been encroached upon. About 10,000 ha consisting of small forests, each with an area of less than 20 ha and previously managed by local governments, have disappeared. Most were near townships and urban centers and mainly plantations. A few consisted of grass and woodland savanna and were mostly located in the war-ravaged north (eg. forest reserves of Aswa, Ageli and Agoro-Agur in Kitgum District and Napak, Kadam, Nyangea and Napara in Moroto District). Although these forests are known to have been encroached upon, it is difficult to establish the exact hectarage because of insecurity. Several reserves in Moyo and Arua districts have been encroached upon by recent returning exiles and the influx of southern Sudanese refugees. As

yet, estimates of the extent of these encroachments have not been made.

All natural high forests are now reported to be clear of large-scale encroachment with the eviction of the remaining 900 encroachers occupying 2,000 ha in the southwest of Kibale Forest Reserve. A total of 98,200 ha of forest has been cleared of illegal farming and is now being regenerated by nature or through re-planting[49]. A large proportion of encroachers have been resettled elsewhere, although not always without serious disputes over compensation for lost property.

3.2.5 Forest management

Sustained yield management is the principal goal of forest management practices worldwide. Furthermore, it is also recognized that forests, especially natural forests, provide multiple products and services for the benefit of humans. The problem lies in the adoption of appropriate management practices to ensure sustainability and conserve terrestrial biodiversity. Consequently, forest management activities involve both production and protection. Implicit in these activities is the need to carry out periodic inventory assessments of the state of the forest capital. Also, socioeconomic studies should be carried out to help guide management decisions and their impacts on people.

Table 3.6: Extent of encroachment on severely affected forest reserves

AREAS(Forest reserve	YEARS	ENCROACHED (ha)	DISTRICT
Mabira	1989-90	10000	Mukono
S. Busoga	1989-90	6000	Iganga
Bukaleba	1980-90	4500	Iganga
Mt. Elgon	1989-90	25000	Mbale + Kapchorwa
Mt. Elgon	1983	6000	Sebei
Kiboga	1989-90	2000	Kiboga
Bwezigola Gunga	1989-90	3500	Kiboga
Kibale	1989-90	500	Kabarole
Nile Bank	1989-90	300	Jinja
Kagoma	1989-90	300	Jinja
Kisangi	1989-90	1000	Kasese

Source: F. Kigenyi pers.comm.

The Forest Department is charged with the responsibility of managing and protecting forest reserves. The protection and management of this important natural resource is handled by about 202 professionals (with degrees in Forestry), 215 foresters (holding diplomas), 315 forest rangers (certificate holders), and 600 forest guards.

3.2.5.1 Plantations

The management of the existing coniferous and hardwood plantations is relatively straight forward. The plantations are managed for the production of industrial roundwood, fuelwood, posts and poles,

on a specified rotation of 25 years for the coniferous plantations and about 5-10 years for eucalyptus woodlots. These plantations are monocultural tree farming operations with well specified management procedures. From the time Uganda embarked on plantation forestry, management practices have hardly changed. However, the need to mix tree species in plantations is beginning to emerge following recent aphid attacks, which concentrated on *Cupressus lustanica and Pinus sp.* There are also proposals to encourage involvement of the private sector in plantation establishment and management.

3.2.5.2 Natural forests

Management of the natural forests is a different matter. The forest policy of 1948 which addressed natural forest management was clearly conservation oriented. Forest management practices of the time consisted of gazetting and maintaining the boundaries of forest reserves in water catchment and mountainous areas. As time went by, the timber values of natural forests began to gain prominence. It became clear that the markets for wood products were very selective. Timber from species such as Mvule (*Chlorophora excelsa*), Mahogany (*Entandrophragma cylindricum* and *Khaya anthotheca*), Elgon olive (*Olea welwitschii*) and Nkoba (*Lovoa brownei* and *Lovoa swynnertonii*) were selectively cut leaving behind large volumes of what were at the time considered "undesirable" or "weed" species. Management practices used to enrich or refine natural forest areas consisted of poisoning the undesirable ones. Enrichment planting consisted of removing undesirable or weed species, in most cases converting the wood into charcoal, and planting the cleared area with seedlings of the more desirable timber species. It was the responsibility of the Forest Department to manage the forest estate while timber licence holders had no responsibility for silvicultural operations on their concession areas.

The problems of insecurity and the general breakdown of law and order during the period of 1971 to 1986 meant that the Forest Department could not effectively manage Uganda's forest estate. Furthermore, the deterioration in the remuneration of Forest Department staff, like in other institutions, also meant there was very little incentive to enforce departmental regulations. As elsewhere within the Civil Service, management became weak, with some forestry staff becoming involved with illegal felling activities themselves[50].

While the problem of inadequate staff remuneration remains, since 1986, the security situation in the country has improved. Furthermore, some of the macroeconomic uncertainties that contributed to poor management of the forest resources have also been eliminated. After these improvements, the Forest Department is concentrating on promoting better management systems in line with the principles of Agenda 21. Coincidentally, it was also around this time that the public's concerns about the environment came to the fore and became an international political issue resulting in the Earth Summit in Rio de Janeiro. These developments meant that the previous management practices in Uganda's TFFs were no longer acceptable and that more environmentally-sound forest management practices are needed.

A Natural Forest Management and Conservation Program (NFMCP) was initiated in Uganda in 1988. Over the last few years the program has concentrated on eliminating encroachment on tropical high forest reserves, however, its objectives are much more comprehensive (**Box 3.3**).

THFs can no longer be managed on the basis of being either "protective" or "productive". For example, the Forest Department proposes to plant a "live" belt of fire resistant tree species of about 10m width around all THF reserves. Furthermore, the Department is to designate 20% and 30% of its natural forest estate as Strict Nature Reserves (SNRs) and buffer zones, respectively.

BOX 3.3

NATURAL FOREST MANAGEMENT AND CONSERVATION PROGRAM (NFMCP)

- Part of Forestry Rehabilitation Program, funded by several western donors, principally EEC, under the auspices of the World Bank;
- Major objectives of the program are to:
  - assist the Forest Department to regain full management control over its Forests Reserves, 737 in number, totalling 1.4 ha (7%of Uganda's land area),
  - restore productivity of encroached and degraded areas through planting fast growing local tree species;
  - develop long term sustainable management systems for the conservation and preservation of the natural forest (including savanna woodlands) and its unique ecosystems,
  - provide sufficient timber, fuelwood and other forest resources on a sustained basis to meet part of the country's requirements for them,
  - maintain the forest's unique contribution to the environment by protecting soil and water resources and to conserving biodiversity and gene pool conservation.

Source: UNDP World Tourism Organisation (1993)

3.2.5.3 Changing focus

While the immediate management concern in coniferous plantations is to salvage trees infested by aphids, the intermediate and longterm strategy is to expand the areas under tree farming and cover. The rationale behind this increased afforestation effort is that as more and more restrictions are applied to the exploitation of THFs, the plantations would become substitute sources of timber and other forest products.

Having recognized the risks inherent in the practice of establishing monocultural tree plantations, the new management focus is to identify and wherever feasible promote the establishment of plantations with mixed species. The newly-established Tree Seed Project is an initiative in this direction. Also, the previous years of insecurity and macro-economic uncertainty have clearly shown that the government is not well equipped to undertake long-term investments in plantation forestry. Therefore, the focus has changed to encourage individuals and communities to be responsible for the ownership, establishment, management and harvesting of new plantations.

Finally, cognizant of land use pressures in some parts of the country, the Forest Department in conjunction with the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), the International Center for Research Agroforestry (ICRAF) and non-governmental organizations is encouraging the intensification of management on the small holdings of rural farmers through the practice of agroforestry.

3.2.6 Agroforestry

The homesteads of Uganda's subsistence farmers have traditionally included fruit and shade trees as well as crop and livestock areas. The characteristics of these holdings were mostly based on custom and tradition. Now in some parts of the country, there is scarcity of additional land for crop production and livestock grazing. Furthermore while fuelwood used to be readily available from nearby public lands, this is no longer possible in many parts of the country. Severe shortages of fuelwood, poles and timber at the farm level are common.

Agroforestry, the practice of integrating tree and crop or livestock production on a given piece of land, is a refinement of traditional homestead practices the world over. It is a modern scientific farming discipline and a systematically-managed agricultural practice that is new in Uganda[51]. Agroforestry is a landuse practice which improves agricultural productivity and enhances environmental protection. There are three main categories of agroforestry: agri-silviculture (trees and crops interacting); agro-silvi-pastoralism (trees, livestock and crops interacting); and silvi-pastoralism (trees and livestock interacting).

By combining the production of food crops with trees on the same piece of land, the unit yield from an area can be greatly increased. The selection of suitable multipurpose trees can supply organic fertilizer to the soil, provide additional food for the household consisting of fruits and nuts, fodder for livestock in zero-grazing dairy operations, poles for housing construction, and fuelwood. Once widely adopted, the practice of agroforestry should help alleviate the problems of encroachment on forest lands.

Agroforestry was introduced in Uganda through the USAID-funded and ICRAF-co-ordinated agroforestry research networks for Africa (AFRENA) project in 1987. This project is supporting experiments at five different sites: Makerere University Research Institute, Kabanyolo near Kampala, Mpigi District; Namulonge Agricultural Research Institute (near Kampala, Mpigi District); Bushenyi District Farm Institute (Bushenyi District); Kachwekano District Farm Institute (Kabale District); and Kalengyere Highland Research Station (Kabale District)[52].

There are also various other agroforestry projects being carried out in Uganda, principally by CARE-USA and ICRAF.

One of the key features of agroforestry is the identification of tree species that yield multiple products and services, commonly known as multipurpose trees (MPTs). At present, there are eight screening trials that have been established at five sites in Uganda for upper-storey MPTs. There are twenty two species and provenances that are being evaluated.

Despite its importance, there are as yet no formal channels for disseminating results of agroforestry research to the farmers. A package of materials relevant to the Ugandan situation is still being assembled. Furthermore, most of the formal research on agroforestry is so far limited to only three agroecological zones.

3.2.7 Peri-urban plantations

Formal forest development and management has been underway in urban and peri-urban areas in Uganda since the early years of the Uganda Forest Department.

Areas of land in and around urban areas were acquired to supply indigenous forest produce. In the Kampala-Entebbe locality, plantation work began after the First World War to produce sawntimber and fuelwood. In the 1930s, areas originally planted with indigenous species were gradually converted into eucalyptus fuelwood plantations. Eucalypts were also planted in other urban centers to drain swamps and eliminate mosquito breeding grounds. Eucalyptus plantations were also established along the Tororo-Kampala railway line to supply locomotive boiler fuelwood. Overall, some 10,500 ha of hardwood, mainly eucalyptus, plantations were established in Uganda in urban and peri-urban areas.

Under a NORAD (Norwegian Agency for International Development) project, interest in re-establishing and perhaps expanding peri-urban plantation has been revived. While the initial plantations were mostly planted with *Eucalyptus saligna* and *Eucalyptus grandis*, the following species are now also being tested.

Acacia mangium
Acacia alliculiformis
Aerocarpus fraxinifolia
Azadirachta indica
Cassia siamea
Eucalyptus citriodora
Eucalyptus cloesiana
Eucalyptus maculata
Gliricidia sepium
Grevillea robusta
Markhamia platycaly
Melia azardirach

The NORAD project is being implemented in urban centers in six districts. Planting of trees is being carried out either directly by the Uganda Forest Department or by private individuals and organizations. The extent of development at the six peri-urban plantation sites as of June 1993 is shown in

Table 3.7: Progress in establishment of peri-urban forest plantations in selected districts of Uganda, 1993

DISTRICT	FOREST DEPT. PLANTINGS (ha)	PRIVATE WOOD FARMERS	
		AREA PLANTED (ha)	NO. OF FARMERS
Arua	240.1	33.0	20
Mbarara	104.7	41.0	40
Mbale	252.0	40.0	22
Tororo	155.5	-	20
Kampala	144.0	67.5	60
Jinja	150.0	164.0	50
TOTAL	**1046.3**	**345.5**	**212**

Source: D.N. Byarugaba (1993)

3.2.8 Forest policy

3.2.8.1 History

The current forest policy was revised and gazetted in 1987. The revised policy re-emphasises the importance of protection and conservation values of the forest resource. Its implementation, however, poses a number of problems particularly as regards the management of forest resources outside forest reserves and handicaps in areas of human resource development. It is also important that it be interpreted into local languages that are understood by the local communities who must be

involved in its implementation.

3.2.8.2 Current policy

A new forest policy was introduced and gazetted in 1987 as shown in **Box 3.4**. It places greater emphasis on the protection and conservation of the forest resource. In terms of environmental protection, this is an improvement. However, the future success of the current forest policy is not guaranteed: the policy does not cover the problem of who has authority over private forests, more professionals need to be trained for forest extension services; the present Forest Act is not fully supportive of these policies; and the forest policy is not understood by the local people and needs to be translated into local languages[51]. For the current approach to be successful, its implementation should be improved. For example, the current efforts of the Forest Department in leasing out forest land for private development (strictly tree planting) are moves in the right direction.

3.3 Wildlife resources

3.3.1 Introduction

Of all the countries in Africa, Uganda enjoys some of the greatest diversity in animal and plant species[54], principally because of its location in a zone of overlap between the ecological communities characteristic of the dry East African savanna and those of the West African rainforest[55]. Uganda stands astride the migratory routes of animals between the west and the east, and between the north and the south of the continent[56]. In the west of the country, there are species associated with west and central Africa such as gorilla, chimpanzee, red colobus and the forest elephant. In north-eastern Uganda, there is Oryx, lesser and greater Kudu, Klipspringer, Grants gazelle, Cheetah and birds associated with arid areas of Tanzania, Kenya and Somalia. The forests of Uganda, some of which are included in national parks and game reserves, are the only locations where species common to both West African and East African savanna are found.

The plains of the country, which form the bulk of the country's national parks, game reserves and other animal wildlife conservation areas, are populated by antelopes. The inhabitants of tropical open or woody grassland range from eland to the diminutive dikdik. Crocodiles and hippopotami are found in the rivers, lakes and swamps. Carnivores such as the lion, hyena and jackal are also present. Larger mammals include elephants, buffalo, water buck, topi and hartebeest[57]. Unique plant species are also found in the wildlife areas.

Wildlife, therefore, represents an important resource for Uganda. It is valued as a source of food and materials, but also for recreation, tourism, nature study and scientific research. It also has customary and sometimes religious and ethical values. While management of this resource was relatively efficient up to 1970, between 1971 and 1986, its status was seriously undermined through indiscriminate commercial poaching and encroachment on protected animal wildlife areas, among others. However, since 1986, with improvements in security and the restoration of order, the conservation of wildlife has been improving.

3.3.2 Protected Wildlife Areas

Protected wildlife areas consist of national parks, game reserves, controlled hunting areas and game sanctuaries.

A national park is defined as an area that has been accorded the highest conservation status in a country, protecting natural and scenic areas of national and international scientific, educational, and recreational use[58]. In Uganda's national parks, prohibited activities include settlement and other forms of land use and extractive resource use (unless permitted by the Uganda National Parks Board). There are, at present, ten national parks in Uganda, occupying an area of 11,023 Km^2 (**Table 3.8**).

Box 3.4

Current forest policy

The current forest policy of Uganda was gazetted in 1987. It is as follows:

The maintain and safeguard enough forest land so as to ensure that:

- sufficient supplies of timber, fuel, paper, pulp, poles and other forest products are available in the long-term for the needs of the country, and where feasible for export,
- water supplies and soil are portected, plants and ,animals (including endangered species) are conserved in natural ecosystems an forest are also available for recreation, research and tourism.

To manage the forest estate so as to optimise economic and environment benefits to the country by ensuring that:

- the conversion of the forest resource into timber, charcoal, fuelwood, poles, pulp and other products is carried out efficiently,
- the forest estate is protected against encroachment, illegal tree cutting, pests, diseases and fire,
- the harvesting of timber, charcoal, fuel, poles and other products applies appropriate silvicultural methods which ensure sustainable yields and preserve environmental services and biotic diversity,
- research is undertaken to improve seed sources for planting stock and silvicultural and protection methods needed to regenerate the forest and increase its growth and yield. Also that research is carried out into new and existing forest products, including tourism and education,with the object of maximising their utilisation potential, research is undertaken to monitor and promote the preservation of environmental services and conservation of biotic diversity.

To promote an understanding of forests and trees by:

- establishing extension and research services aimed at helping farmers' organisations and individuals to grow and protect their own trees for timber, fuel and poles and to encourage agro-forestry practices,
- publicising the availability and suitability of various types of timber and wood products for domestic and industrial use, and publicising the importance of environmental services provided by forests,
- holding open days at regular intervals in all districts to demonstrate working techniques and raise attention to the positive benefits of forestry,
- promoting scientific research, environmental tourism, education and related activities inside the forest estate.

Source: Makerere University Institute of Environment and Natural Resources (MUIENR). The World Resources Institute (WRI). 1992.Uganda-Environmental and Natural Resources Management Policy and Law: Issues and Options. II Documentation. 89p.

Table 3.3: The National Parks of Uganda

NATIONAL PARK	YEAR ESTABLISHED	AREA (KM2)
Queen Elizabeth	1952	1978
Murchison Falls	1952	0860
Kidepo Valley	1962	1442
Lake Mburo	1982	260
Rwenzori Mountains	1991	996
Mgahinga Gorilla	1991	25
Bwindi impenetrable	1991	330
Semliki Forest	1993	220
Mt. Elgon	1993	1146
Kibale Forest	1993	766
Total Area		11023

Source: Uganda National Parks (1993)

Game reserves are set aside principally for administration and research. Prohibited activities include travel, grazing of livestock, cultivation and/or settlement[7]. Uganda has eleven game reserves covering a total area of 9,282 km^2 (**Table 3.9**)

Table 3.9: Game reserves of Uganda

GAME RESERVE	AREA (KM2)
Ajai	88
Bokoa corridor	2056
Bugungu	520
Karuma	820
Katonga	208
Kibale Forest Corridor	560
Kigezi	330
Kyambura	157
Mathenuko	1604
Pia Upe	2414
Toro	884.88
Total area	9281.88

Source: Table 7, P. 30, NEAP Secretariat Task Force No. 5 (1992)

Activities that are permitted in game sanctuaries and controlled hunting areas include: human settlement, cultivation, domestic livestock grazing and the sustainable use of resources. Hunting is authorized by special permit in game sanctuaries and controlled hunting areas under special circumstances such as to maintain stable wildlife populations[8]. There are eight game sanctuaries (**Table 3.10**) and twelve controlled hunting areas (**Table 3.11**) in Uganda.

Table 3.10: Controlled Hunting Areas of Uganda

NAME	AREA (KM2)
Buhaka	17 73
East Madi	1749 4
Kaiso Tonya	226 56
Kanema	240 61
Katonga	2272 97
Lipan	898 56
Napak	224 51
North Karamoja	16676 04
Sebei	2530 84
Semliki	503 19
South Karamoja	8971 64
West Madi	831 23
Total area	**35143.28**

Source: Table 8, P 20, NEAP Secretariat Task Force No 5 (1992)

Table 3.11: Game sanctuaries of Uganda

NAME	AREA (Km^2)
Dufile, Otze & Mt Kei	489
Entebbe	52
Jinja	8
Kazinga	207
Malaba	31
Zoka forest	207
Total area	**966**

Source: UNP 1991 Elephant Conservation Plan for Uganda Table 9, P. 31; NEAP Secretariat Task Force No 5 (1992)

3.3.3 Pressures on wildlife areas

Pressures on protected wildlife areas of Uganda include

- *Poaching* (both traditional and commercial) which in the past threatened elephants, hippopotamus, buffalo, crocodile and topi populations.
- *Encroachment:* Although encroachment on the older parks has been minimal, some encroachment may be expected, due to population pressure in certain areas
- *Fishing villages within existing protected areas:* This results from expansion of settled areas. Problems include collection of fuelwood and some poaching
- *Breakdown of administration and law and order:* Prevalent from 1971 to 1986, this is no longer a major concern

- *Consumptive uses* such as hunting, cropping and fishing,wildlife ranching and farming and export of wild animals These uses can be controlled with the current improvements in administration, protection and conservation

The pressures on the protected wildlife areas resulted in major reductions in species populations, some to total extinction as shown in **Table 3.12** This occurred despite the fact that there were available on the books of the respective authorities clear directives on enforcement These directives are still in force and with improved conditions for proper administration, enforcement should improve There are 40 species of animals that are not to be hunted or captured except by ministerial permit (see **Box 3.5**) Based on new surveys, it seems the elephant population in protected areas is slowly recovering.

Box 3.5

Animals not to be hunted or captured throughout Uganda except under minister's permit

Gorilla	Black Rhinoceros
Chimpanzee	Cranes (all species)
Roan Antelope	Martial Eagle
Greater Kudu	Fish Eagle
White Rhino	Crowned Hawk Eagle
Ostrich	Hornbill (all species)
All species of Heron	Turaco
Egrets (all species)	Plantain Eaters
Whale-headed Stork	Louries (all species)
Saddle-bill Stork	Bee eater
Greater Flamingo	Sunbirds
Lesser Flamingo	Serval cat
Vultures (all species)	Aard Vark
Ground Horn Bill	Caracal
Giant Eland	Hydrax (all species)
Aardwolf	Bat Eared Fox
Pangolin (all species)	Leopard
Colobus monkey (all species)	Pelican (all species)
Cheetah	Python
Giraffe (all sub-species)	Lammergeyer

3.3.4 Management of protected wildlife areas

The Uganda National Parks (UNP) is the authority charged with the management of the country's national parks The Game Department is responsible for the management of game reserves, controlled hunting areas and game sanctuaries

Overall, the basic principle underlying the management of protected wildlife areas is that of sustainability In the national parks, preservation is also a key management objective To a large extent, previous management activities were essentially extensive in character and placed greater emphasis on enforcement A new management focus is now in place and is intensive in its approach Under it, for example, each of the national parks is operated in accordance with a management plan. The principal objective of each plan is to sustain the national and international values of each of the parks

For example in:

- **Queen Elizabeth National Park**: Several types of use zones are to be established within the park consisting of areas reserved exclusively for tourism (prime scenic and wildlife localities), zones in which tourism is combined with other activities, and zones in which no tourism development is to be permitted

- **Murchison Falls National Park**: The management plan identified five zones to be established Falls area, intensive use zone, tourism zone, conservation zone and buffer zone. There is a plan to nominate the Falls and adjacent stretches of river and river bank as a UNESCO World Heritage Site

- **Kidepo Valley National Park**: At least six zones have been identified for management purposes including: intensive zone, tourism and fire management zone, law enforcement zone, intermediate use zone, conservation zone, and buffer zone.

All the three plans recognize an additional policy zone - the "transitional area". This zone starts on the Park boundary but with no definable outer limit. The transition area concept revolves around the theme of cooperation with the local people and other government agencies and is aimed at helping protected areas to integrate with their surroundings. A park needs to participate in the development of the region to which it belongs.

3.3.5 Wildlife policy

For a long time, there was no officially gazetted policy on wildlife conservation. Partly, as a result of the lack of a clear policy, the stewardship of the resource has historically been under pressure from non-sustainable activities such as poaching, degazetting of wildlife areas for other human activities, and illegal expansion of agricultural areas into wildlife conservation zones.

More recently, it has been suggested that the policy of the Government of Uganda towards wildlife conservation should be to conserve it as a natural heritage and as a resource of economic value for the benefit of the present and future generations, thereby highlighting the commercial, recreational, scientific and other values of wildlife resources, while limiting consumption. To a large extent, the tourism potential of wildlife as represented by the commercial and recreational values has had a greater focus than conservation of biodiversity but this is now changing.

A draft report on wildlife and national parks policy and legislation has recently been produced. It recommends that policy and legislation

- safeguard Uganda's national heritage for present and future generations
- increase the benefits to local communities from wildlife and national parks
- develop wildlife and national park-based tourism
- improve coordination between ministries
- plan for the development of wildlife and national parks.

- improve the state of knowledge of wildlife and national parks.
- adhere to international standards for wildlife and national parks.
- improve the organizational structure and legal foundation for wildlife and National parks"[1]

Implicit in these policy statements are important improvements for better conservation of wildlife resources, including

- widening conservation to cover natural, scenic, historic and scientifically valuable areas.
- public participation in the management of wildlife resources and provision of benefits to local communities including incentives
- development of market-oriented or market-specific tourism
- greater involvement of the private sector in tourism management
- the need for an intersectoral approach and coordination between the various relevant government departments
- better reflection of wildlife conservation in overall national planning
- improved public awareness of the need for wildlife conservation
- increased autonomy to wildlife management and conservation institutions"[2]

As drafted, the proposed wildlife policy and legislation document is quite comprehensive. However, adherence to the principles and the adoption of appropriate management practices are still in need of further development. Management effectiveness is a function of availability of scientific and managerial talent, adequate and consistent levels of funding, and commitment by the government and the surrounding communities. Past experience suggests that these prerequisites will take time to develop.

Table 3.12: Selected examples of population changes in the mammalian fauna of the Queen Elizabeth and Murchison Falls National Parks

SPECIES	QUEEN ELIZABETH N.P.		MURCHISON FALLS N.P.	
	1960s-1970s	1991	1960-1970	1991
Hippotamus	15000 +	2500	14000	7600
Elephant	2500	225	13550	308
Buffalo	16000	5000	25000	1600
Topi	4500	500	n.a	n.a
Giraffe	n.a	n.a	200	80
Black Rhino	n.a	n.a	200	0
White Rhino	n.a	n.a	16	0

n.a = not available because species not found in the area

Source: The Queen Elizabeth National Park (1990) and the Murchison Falls National Park (1992) management plans. R. Olivier, Uganda National Parks, Kampala

3.4 Tourism

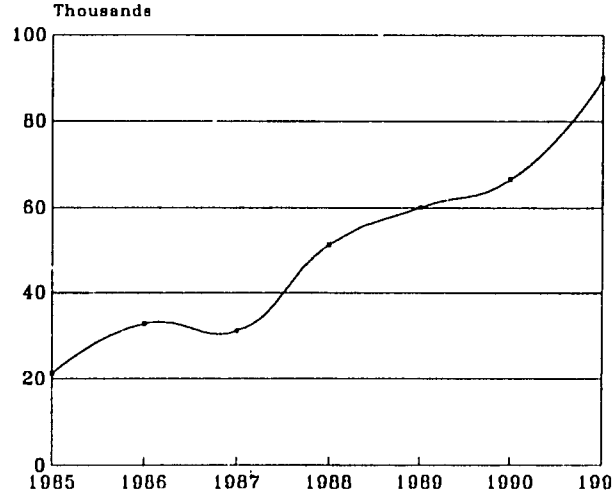
By 1970 tourism was Uganda's third largest earner of foreign exchange, behind coffee and cotton. Between 1971 and 1986, the level of tourism activities declined drastically as a result of insecurity and the breakdown of law and order.

Although Uganda has tourist attractions, including its beautiful capital and a number of historical sites, the principal reason why foreign tourists came to Uganda was its terrestrial biodiversity represented in the forests and protected wildlife areas. While there has been degradation of THFs and reductions in wildlife populations, the potential for tourism based on terrestrial biodiversity still remains high. **Figure 3.7** shows tourist arrivals in Uganda from 1985 to 1991. It has been observed that unlike many countries where active promotion is carried out, tourist visits in Uganda over the period 1985 to 1991 were largely the result of the country's past reputation as a unique tourist destination. There was minimal marketing effort[4].

In addition to net incremental foreign exchange earnings, wildlife-based tourism generates other important economic benefits, including national income, government revenue, and employment. **Table 3.13** shows the economic impact of tourism in Uganda in 1991. **Figure 3.8** shows projections of visitor arrivals by purpose of visit. It must be noted that the projection started at a low base of 68,000 visitors while the Uganda Travel and Tourism Magazine reported the number at 90,000 for the same year. Nonetheless, the number of visitors coming to Uganda solely for the purpose of holidaying and tourism was projected to increase from 9,900 in 1991 to 66,500 by the year 2002. Most of these holiday/tourism-related visitors will come to see Uganda's parks and wildlife.

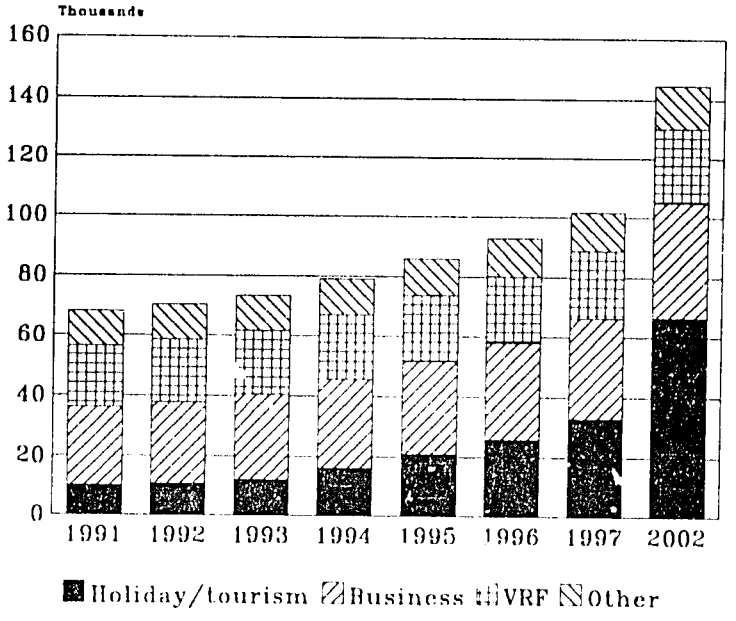
For the purpose of better management of Uganda's tourism potential, areas of attraction have been ranked into primary, secondary and tertiary zones. All primary tourism zones are those in forest and protected wildlife areas. Except for the capital region of Kampala, the secondary tourism zones also belong to forest and protected wildlife areas. Similarly, excluding Ssese Islands, the tertiary tourism zones also represent protected areas. These tourism zones are described in **Box 3.6**.

Figure 3.7: Tourist arrivals in Uganda, 1985-91.



Source: Uganda Travel and Tourism, July-Sept, 1992

Figure 3.8: Projections of visitor arrivals by purpose of visit 1991-97 and 2002



Source: UNDP World Tourism Organization (1993) Summary Table 1, P. 5

Table 3.13: Estimated arrivals, revenues and employment from international tourism in 1991

Visitor arrivals (no.)	68000
Average length of stay (nights)	14.8
Average daily expenditure (US $)	25
Gross Foreign exchange earnings (US$ million)	25.2
Net foreign exchange earnings* (US$ million)	15.1
National income generation** (US$ million)	8.8
Government revenue*** (US$ million)	6.5
Employment: Full time jobs (no.)	6500

* *import multiplier from tourist expenditure (direct and indirect effect) is estimated to be 0.4*
** *income multiplier of tourist expenditure (direct and indirect levels) is estimated to be 0.35*
*** *the direct and indirect revenue multiplier as a result of tourism expenditure is estimated to be 0.26*

Source: UNDP World Tourism Organization Vol III, Table 2.4, P. 26

Box 3.6

A. Primary Tourism Zones

1. Rift Valley Zone: 1 Queen Elizabeth National Park, Rwenzori Mts , Semliki and Kibale Forest Reserves and the game reserves of
   - Kibale Forest Corridor, Toro, Kyambura and Kigezi)
   - general game viewing in the forest and at Ishasha
   - boating and angling on the lakes and waterways
   - bird-watching and eco-tourism on the lakes, waterways and in the forests
   - trekking and mountaineering in the Rwenzori

2. Murchision Falls Zones: 2 (Murchison Falls NP, Budongo Forest Reserve, and the Game Reserves of Bugungu and Karuma together
   - with the adjoining Controlled Hunting Aea,
   - Chimpanzees viewing in the forests of Rabongo and Budongo
   - angling on L. Albert and the Nile at Chobe
   - boating on the lake and launch trips on the Nile
   - white-water rafting at Karuna and Chobe
   - bird-watching rafting at Karuma and Chobe
   - bird-watching and eco-tourism on the Nile and in the forests

3. Kidepo Valley Zone: 3 (Kidepo Valley NP, the Zulia Forest Reserve and the Ligan and North Karamoja Controlled Hunting Area
   - game viewing
   - bird-watching and eco-tourism on the Nile and on the forests
   - trekking in Zulia Forest Reserve

B. Secondary Tourism Zones

1. Capital Area Zone :4
2. South-west Mountain Zone: 5 (includes Bwindi Impendetrable Forest, Mgahinga Gorilla NP and Lakes Bunyonvi and Mutanda
   - Gorilla and Chimpanzee tracking in Bwindi and the former Mgahinga
   - water recreation on the lakes
   - mountain climbing and walking in the Mufumbiro and Bwindi
   - bird-watching and eco-tourism on the lakes and at Bwindi and Mgahinga
   - general touring of the whole zone to experience its scenic qualities.

C. Tertiary Tourism zones

1. Lake Mburo Zone: 6 (L. Mburo NP)
   - good game viewing
   - exceptional bird life

2. Mt Elgon Zone: 7 (Mt Elgon, its forest Reserves, and foothills)
   - net climbing
   - hill walking
   - camping

3. Sese Islands Zones: 8
   - paradise for birds
   - habitat for elusive Sitatunga

4.0 AQUATIC AND WETLANDS RESOURCES

4.1 Water resources

4.1.1 Introduction

Freshwater is the essential resource for the creation and sustenance of virtually all life forms on earth; and Uganda is well endowed with it. Uganda's lakes, rivers and springs have provided drinking water, supplied fish, and offered protection to the population for hundreds of years, long before the country as it is known today was carved out. The water bodies continue to provide these services today. But now they face new pressures mainly due to increased population and the country's modernization process.

Modernization, particularly industrial development, is causing a deterioration in the quantity and quality of Uganda's water. Increased population means that there is now greater demand for water in the absolute sense. With a largely-rural population engaged in subsistence agriculture, there is also the adverse effect on water quality from the various non-sustainable uses of land. All these pressures, therefore, require immediate and appropriate remedial management actions.

The principal responsibility for water management has traditionally rested with the government. The political instability and insecurity that characterised the 1970s and early 1980s seriously damaged the ability of government to carry out its stewardship role. The result was that management, assessment and monitoring of water resources were virtually abandoned.

Today, the key environmental issues concerning water resource development and management can be categorized as: knowledge of the available resources (potential) and the demand placed on them by development; optimal allocation of available resources to meet the current and future demand; and determination, control and disposal of negative consequences of development (such as wastes) in such a manner that the ecosystem and development are not compromised in space and time[14].

To address these concerns, there must be an appropriate enabling environment, including a comprehensive policy backed by legislation, and institutional mechanisms with the necessary logistics, funds, and manpower[15].

Table 4.1: Major lakes of Uganda

LAKES (MAJOR)	TOTAL AREA	AREA IN m^2	HEIGHT ABOVE SEA LEVEL	DEPTH (m)
Victoria	68457	28655	1134	82
Mobutu Albert	5335	2913	621	51
Edward	2203	645	913	117
Kyoga and Kwania	2047	2047	1033	7
Salisbury (Bisina)	308	308	1047	-
George	246	246	914	3

Source: NEAP Secretariat Task Force No. 4 Nov 1992

Table 4.2: Statistics on selected major rivers in Uganda, including mean discharge rates

NAME OF RIVER	DISTANCE (KM)	MEAN FLOW (M3/SEC)	PERIOD OF RECORD
Victoria Nile	426	808	1900-1972
Aswa	357	37.5	1949-2968
Dopeth Okok	314		
Pager	232		
Albert Nile	257	900	1905-1977
Mayanja Kato	182		
Katonga	175	0.62	1965-1980
Mpologoma	173	19.50	1949-1979
Kyoga Nile		787	1912-1972
Kagera		185	1958-1968
Semliki		135	1940-1968
Kafu		32.72	1962-1968
Mutano		13.60	1958-1968
Ruizi		8.61	1954-1979
Nyamugasani		8.35	1954-1967
Kibale		6.14	1958-1960
Nkusi		5.07	1970-1978
Muzizi		5.02	1956-1980
Mpanga		4.52	1955-1981
Tochi		3.44	1970-1978
Sebwe		2.05	1953-1968
Namalu		0.376	1959-1976

Source: Strategic resources planning in Uganda, Vol IV, water resources, UNEP, 1987 - NEAP Secretariat, Task Force, No. 4, November, 1992

4.1.2 Extent of water resources

The water resources of Uganda include direct precipitation, groundwater, runoff, evapotranspiration, and the surface waters on major lakes and rivers. Uganda's large lakes, rivers and wetlands in the catchment regions cover about 18% of its total surface area[7]. **Figure 4.1** shows the distribution of major lakes and rivers.

- *Major lakes:* **Table 4.1** shows the size of the major lakes of Uganda. The Ugandan portion of Lake Victoria accounts for over 82% of the total lake surface area within the country. Lakes Victoria, Albert and Edward are shared with other riparian states: Zaire, Kenya and Tanzania. All the major lakes are situated at relatively low elevations with Lake Albert at 621m asl. Of all the major lakes, Lake Edward is the deepest at 117m. Its neighbour Lake George is the shallowest at 3m. Lakes Kyoga and Kwania are the second shallowest at 7m.

- *Major Rivers:* **Table 4.2** shows a listing of the eight major rivers in Uganda, each with an estimated length in excess of 100km. The Victoria Nile and Albert Nile combine to form the longest river system in the country. **Table 4.2** also shows the mean discharge rates of the rivers.

- *Groundwater Resources:* The groundwater resources of Uganda comprise five aquifer

systems. The Gneiss complex has a depth zone of 50-60 meters, Granite a depth zone of 50-60m, Toro 30-50m, Karagwe Ankole 50-60m, and Bunyoro 110-135m. Except for the Toro system where the static water level is much deeper, the rest of the aquifer systems are 8 to 15m deep. The yield of the aquifer systems range from 0.4 to 2.0m^3 per hour. These data are in conformity with the observation that since Uganda lies on the basement complex of pre-Cambrian rocks consisting of schist, marble, granite, gneisses and quartzite, its underground resources are generally poor and occur in limited areas along fissures, cracks and joints of the granite-gneiss formation.

There are an estimated 9,000 natural springs in Uganda. These could become a great source of safe water for Uganda's largely rural population. However, only 2,300 are protected. Most protected springs are in the southwest.

By 1990, about 8,129 boreholes had been drilled to provide water for the recipient population. An estimated 20,000 more may be required to meet future demand. There are also 17 thermal and mineral springs in areas associated with volcanic activity.

- *Precipitation*. Uganda has an average annual rainfall of 600 to 1,600mm. **Table 4.3** shows rainfall in Uganda and other East African countries. Uganda's water resources from precipitation are relatively generous

Table 4.3: Rainfall in Uganda and selected East African countries (% of total area)

ANNUAL PRECIPITATION (mm)	KENYA	TANZANIA	UGANDA	EAST AFRICA
<500	72	16	12	35
500-750	13	33	16	20
750-1250	12	47	72	41
>1250	3	4	6	4

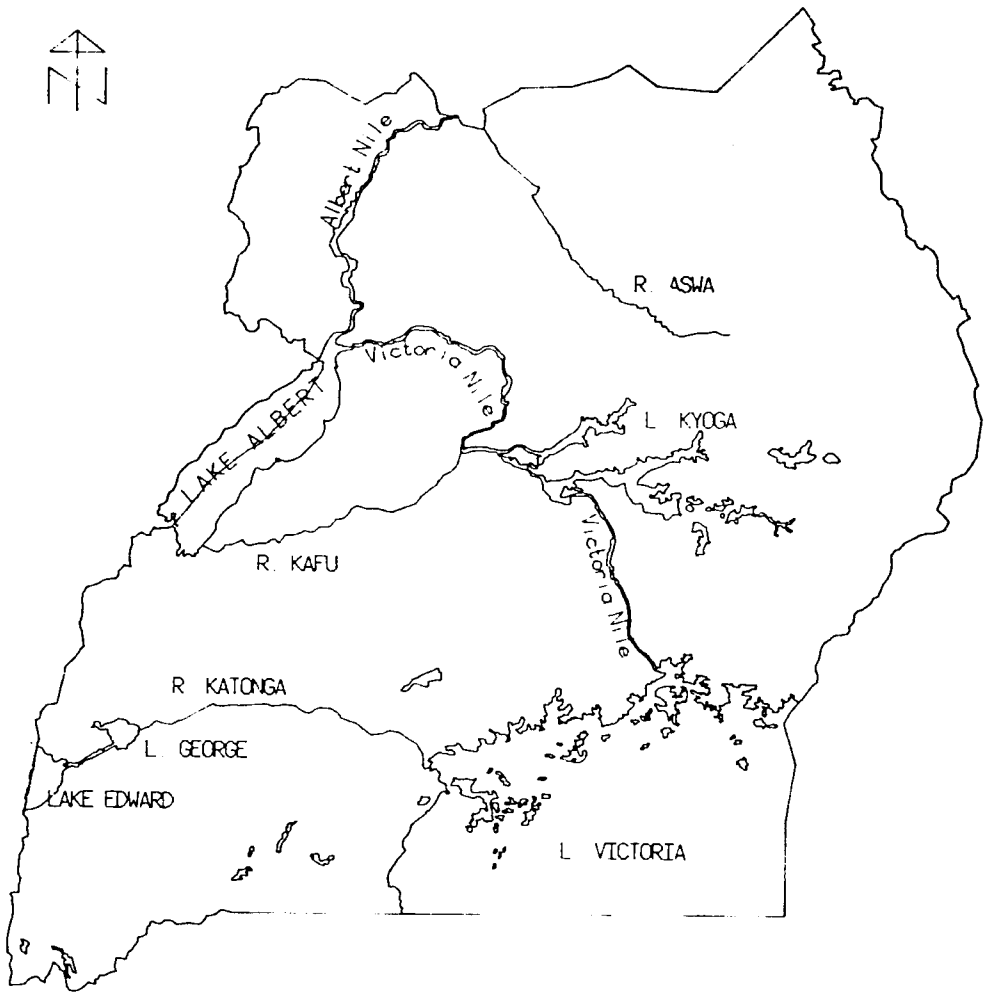
Source: Adapted from Morgan (1975)

The longterm trends of precipitation in Uganda for the period 1930 to 1975 show that the pattern of precipitation shown in **Figure 4.2** coincides with agro-ecological and the farming systems. The figure also highlights the water rich and poor regions

Table 4.4 shows the water balance figures at selected stations. Daily rainfall records from between 90 and 30 years ago were examined from 15 stations throughout Uganda. At all stations, no significant trends suggested a decrease in rainfall. However, all stations showed a high incidence of recurrent drought during these years. Analysis suggests that this type of drought is becoming more common in most parts of Uganda with serious consequences. In many parts of the country, the effectiveness of rainfall is seriously undermined by the relatively high variability of seasonal and annual rainfall.

- *Drainage system*. All of Uganda's water basins eventually drain into the Nile. The land between Lake Victoria and the Western Rift Valley drains either into the rift area or into Lake Victoria, while the Katonga flows continuously between the Victoria Nile and Lake Albert in the Western Rift Valley. This is because since the upwarping of the western side of the Lake Victoria basin, rivers crossing it have partly reversed their directions of flow. The greater part of the Kafu flows eastward to Lake Victoria, while the other part flows northeastwards to the Nile

Figure 4.1



UGANDA

MAJOR RIVERS AND LAKES

50 0 50 100 150 200 KM

SCALE 1 4,000,000

(SOURCE UGANDA ATLAS, 1967)
Digital Map By NEIC

Table 4.4: Water balance at selected stations

STATION	ANNUAL PRECIPITATION (cm)	ANNUAL WATER NEEDED(cm)	ANNUAL WATER SURPLUS (cm)	ANNUAL WATER DEFICIT (cm)	MOISTURE INDEX	HUMIDITY INDEX
Fort Portal	150.0	184.0	0	34.0	-99	0
Mbarara	91.1	141.4	0	50.3	-21.4	0
Mbale	113.0	174.7	0	61.7	-21.1	0
Arua	146.7	174.9	8.2	36.4	-20.8	4.0
Lira	141.6	181.5	5.5	45.4	-11.9	3.0

Note: *Positive values of moisture index represent moist climates while negatives values represent dry climates. Over these areas (the available water) is generally less than the potential evaporation (PE) or water needed. During the rainy seasons the rain that occurs is just about sufficient to meet the water needed (PE) at most places.*

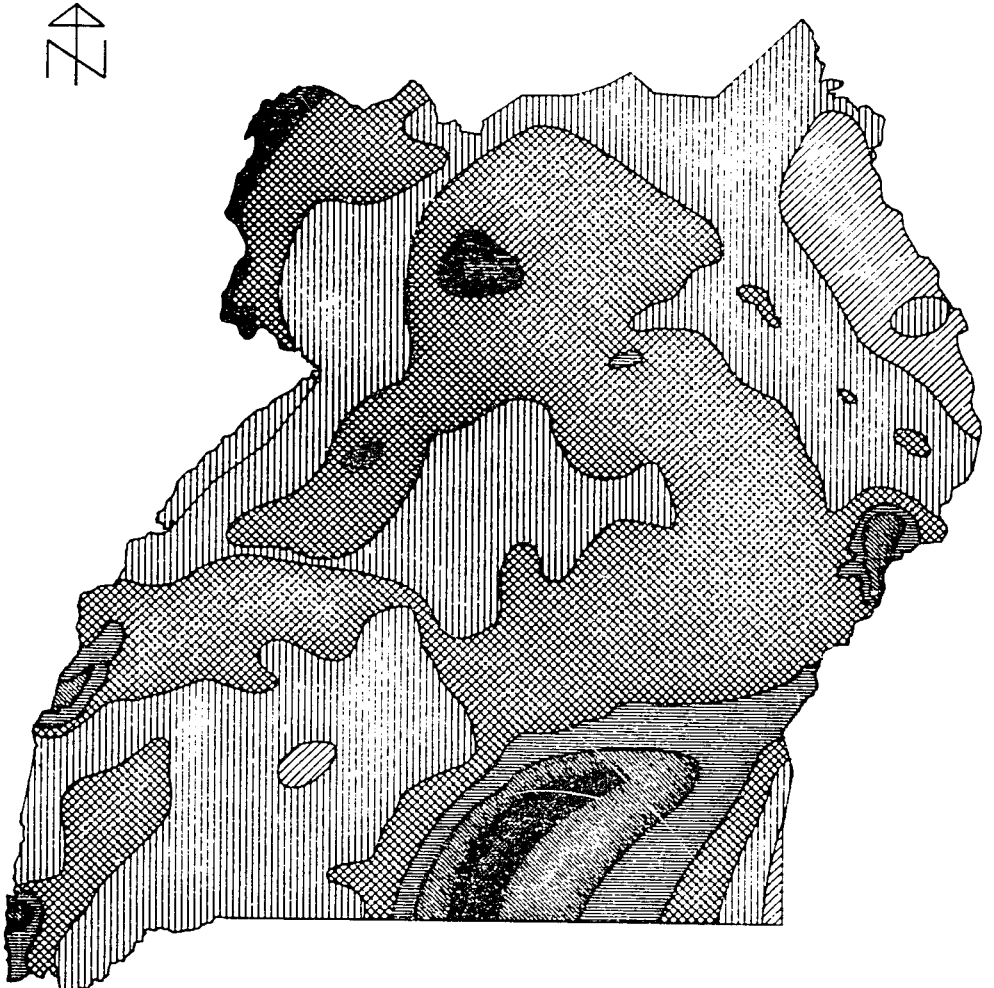
Source: After P.S. Pant et.al, 1975

The northwestern slopes in Uganda drain into Lake Edward via the Ishasha-Chiruruma, Nchwera and Nyamweru rivers, and also via several streams which enter the western flowing part of the Katonga river. The northeastern part of the Virunga range, however, drains directly into Lake Victoria.

The Ugandan slopes of the Rwenzori mountains drain into the westward flowing section of the Katonga and from there to Lakes George and Edward. The plateau immediately to the north of the Rwenzori drains into Lake Albert via the Muzizi river.

The Ugandan slopes of Mt. Elgon and the central highlands along the Kenyan border drain via rivers with swampy areas, valleys or seasonal floodplains into Lake Kyoga. **Figure 4.3** shows the major drainage basins of Uganda and **Box 4.1** shows the groundwater\surface water interactions[69].

Figure 4.2



UGANDA

MEAN ANNUAL RAINFALL

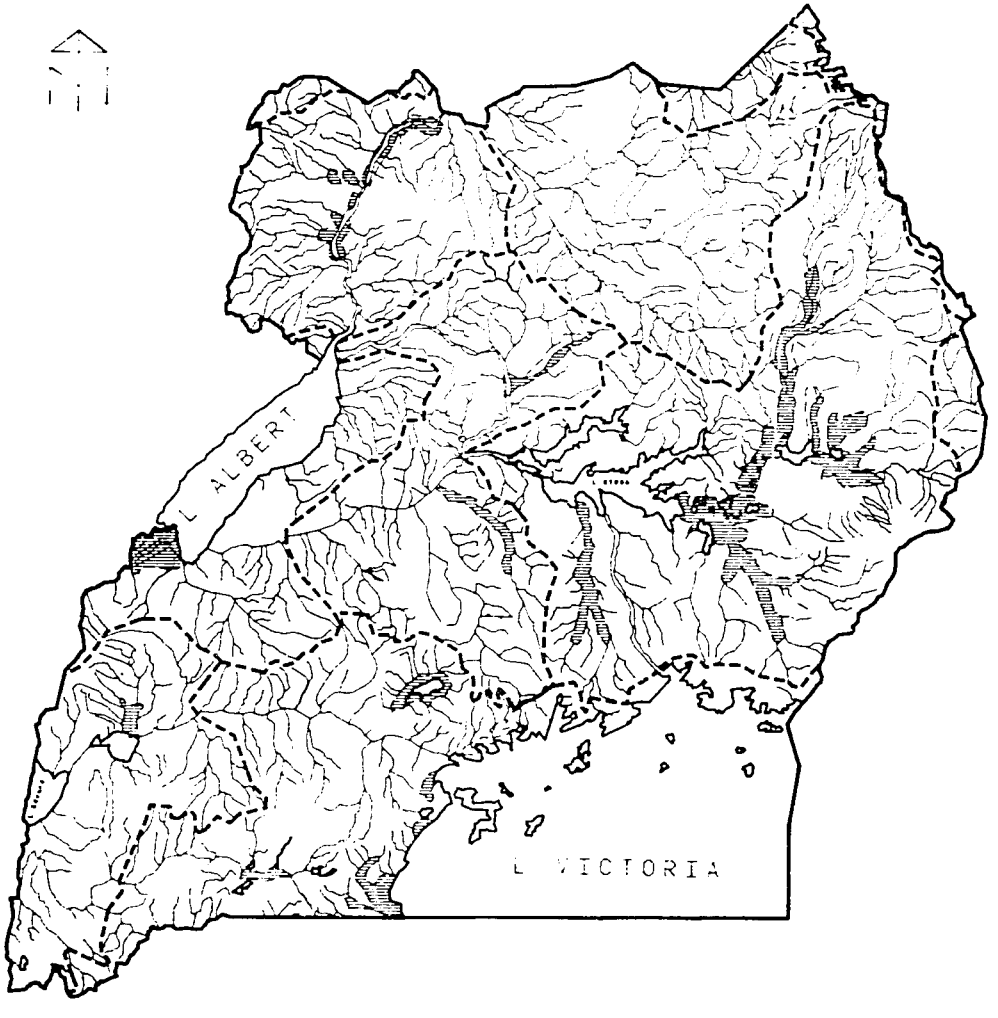
0 - 500mm
500 - 1000mm
1000 - 1500mm
1500 - 2000mm
2000 - 2500mm
> 2500mm

50 0 50 100 150 200 KM

SCALE 1:4,000,000

Digital Map By NEIC
(SOURCE: UGANDA ATLAS, 1967)

Figure 4 3



UGANDA

DRAINAGE AND WETLANDS

INTERNATIONAL BOUNDARY

CATCHMENT AREA BOUNDARY

RIVERS

SWAMPS

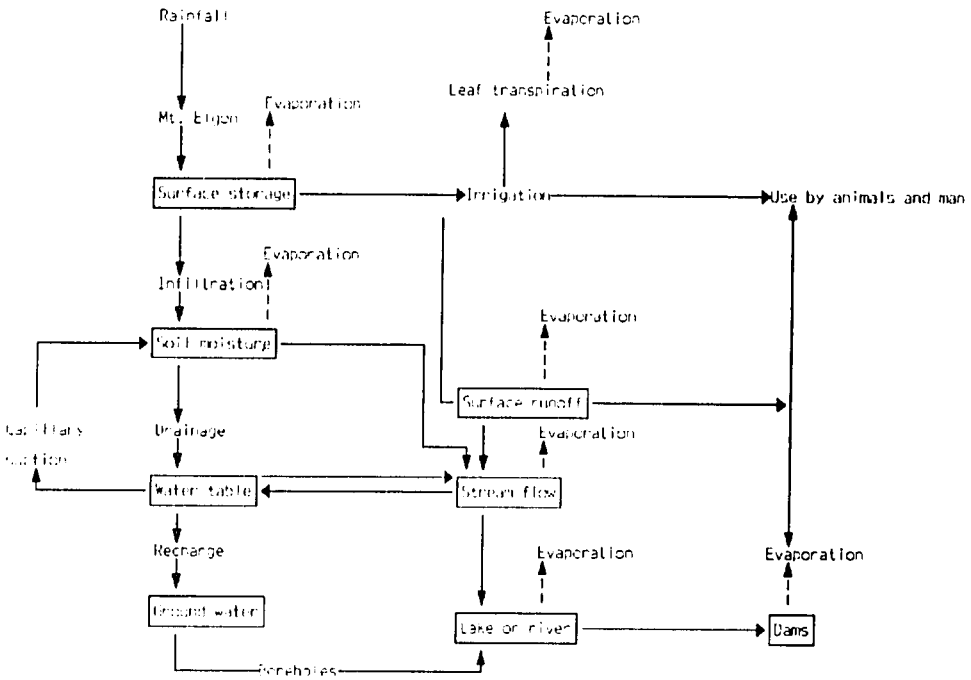
50 0 50 100 150 200 KM

SCALE 1 : 4,000,000

Digital Map Data (SOURCE: UGANDA ATLAS, 1967)

Box 4.1
Ground water/surface water interactions

Groundwater/surface water interactions: The compilation and analyis of the channel water balance (CWB) for specific water reaches and river systems have been carried out and indicate the following interactions: groundwater inflow to the rivr or the lake; seepage from the river or the lake to the groundwater; water discharge to or from bank storage; and sub-channel stream flow and groundwater run-off to streams and rivers.



4.1.3 Water supply problems

The principal water supply problems are drought and floods. Rangelands are the drought-prone areas in Uganda. They have low and erratic precipitation, high temperatures and high evapotranspiration rates. Uganda encountered a long moderate drought in the late 1960s and early 1970s and a short drought in the mid- 1970s.

Localised floods occur regularly during any rainy season. However, the most recent flood of national scope occurred during 1961-62. Flood hazards also exist on rivers draining Mt. Elgon, in southwest Uganda and Mt. Rwenzori and in low-lying peri-urban built up areas such as Kalerwe-Bwaise slums on the outskirts of Kampala. These can cause severe damage to property and even death. The torrential flooding of River Nyamwamba poses a real threat to the towns of Kilembe and Kasese and the airfield downstream. Generally, the incidence of flooding can be attributed to wetlands drainage and deforestation of the catchment areas.

4.1.4 WATER UTILISATION

4.1.4.1 In-stream and off-stream uses

There are many in-stream and off-stream water users in Uganda at present. In-stream water uses include: hydropower, flood water storage, recreation, fishing, transport, ecological functions and disposal of waste. Off-stream water uses include: irrigation and municipal and industrial use. In-stream water withdrawals are returned directly to streams. Consumptive uses such as irrigation may not return directly but through ground water. With expected increases in tourism, recreation could also become significant. Water transport was once a major communication avenue; its relevance could also be revived

As described in **Table 4.6**, and the Energy Section, Uganda has tremendous hydroelectric potential, particularly along the Victoria and Albert Niles. However, thorough environmental impact assessments may show some of the major sites to be undesirable for development. Even if this is the case there are several sites on smaller rivers and streams suitable for small-scale hydro projects

Data on irrigable areas and potential water demands are shown in **Table 4.5**. Irrigation can be a blessing, but unless it is well planned, it can also be a curse. Irrigation projects are usually supported on the grounds that they increase agricultural production. But quite often irrigated crops require other levels of input intensification such as the application of agrochemicals. These chemicals can end up contaminating underground water supplies and the surface waters of connecting rivers and lakes. Furthermore, irrigation projects often end up converting a seasonal floodplain with tremendous biodiversity into a permanent swamp with much less animal and plant life

Finally, as an in-stream use, the wetlands surrounding Uganda's rivers and lakes have appreciable water filtration and storage capacity. The seasonal and permanent swamps of those wetlands provide natural storage capacity for flood waters, thereby mitigating the potentially-adverse impacts of uncontrolled flood water

Table 4.5: Irrigable areas and potential water demand

	TOTAL IRRIGABLE AREA (KM2)					POTENTIAL WATER REQ (M3)			
	AREA	UB	US	LB	LX	UB	US	LB	LX
Lake Albert	45522	593	4801	2118	5138	543	4404	1958	4716
Lake Victoria	154199	1654	31175	8527	33322	1588	30684	8154	32639
Sobat	3881	15	1212	121	1259	16	1295	131	1345
Upper White Nile	27956	289	6991	2498	7203	268	6691	2416	6898
Lotagipi swamp	2074	0	61	0	63	0	78	0	80
Mugasera	26	0	1	0	3	0	1	0	3
Omo	2365	26	567	62	607	30	681	71	698
Aruwm	4	0	0	0	0	0	0	0	0
Oubangui	5	0	0	0	0	0	0	0	0
TOTALS	**236032**	**2577**	**44808**	**13326**	**47595**	**2445**	**43804**	**12630**	**46379**

(1) Total suitable agricultural area

(2) Total suitable area for irrigation

(3) Total suitable for domestic use

(4) Total suitable water for consumption

Source: NEAP Secretariat, Task Force No. 4, Nov. 1992

4.1.4.2 Consumptive uses of water

Overview

As of 1992 ninety percent of the population of Uganda was rural, while the other ten percent was urban. Currently, 30% of the rural and 40% of the urban population have water services (**Table 4.7**). Government plans to provide 75% of rural and 100% of urban households with safe water. Rural households are expected to receive 20 - 25 litres/household/day, while urban households would receive 50 litres/household/day. The attainment of these targets depends upon investment funds and available water resources.

Table 4.6: Selected engineering proposals for water use

WATER USES	EXPLANATION
Hydropower	The identified potential on R. Nile is estimated at 2,700 MW of which 150 MW is already developed at Owen Falls Dam. It is due for development under Owen Falls Dam extension (Department of Energy, 1991). There is potential for small schemes on rivers draining Mt. Rwenzori, in the southwest, West Nile and Mt. Elgon
Hydroelectric projects	Potential for these projects is great. The most recent study of the schemes on the Nile is the power development study of Uganda electricity system, 1984 (Sir Alexander Gibb and partners/Kennedy and Donkin). Owen Falls schemes use the head at the outlet from Lake Victoria. The proposed extension would have an installed capacity of 60 MW with a head range of 17.8 to 21.0 m Bujagali hydroelectric scheme. Bujagali is located about 7 KM downstream of Owen Falls. An installed capacity of 150 MW under a head of 18.5 M was proposed. Ayago is a site roughly halfway between Chobe lodge and Murchison Falls. Two alternative schemes have been identified. Ayago south, a run of river scheme rated at 240 MW for a usable head of 73.5m; and Ayago north rated at 300 MW for a usable head of 43.5m. Murchison, located at the well-known falls just upstream of Lake Albert, is rated for an installed capacity of 480MW under 88m head or for a restricted development of 250 MW under 88m head. Kamdini the fifth site has been identified about 2 KM upstream of the Karuma bridge. This scheme was not included in the 1986 comparison of potential schemes The determining factor for the hydropotential of these schemes will be the water balance of Lake Victoria, which sets the level of the lake and hence flows down the Nile
Small scale hydro-electric development	These exist in rivers draining Mt. Elgon, in the extreme southwest of Uganda, in rivers draining West Nile near Arua, in rivers draining the Rwenzoris. River Kagera (Kikagati) has a 700 KW turbine constructed in 1934 rehabilitated in 1957 but damaged by floods between 1961 and 1964. The River Kagera forms a boundary with Tanzania, and any major development will have international implications. A general review of possible schemes show 500 KW to 1000 KW potential on the Ruizi and Nyakizumba rivers in Mbarara and Kabale areas. A general review of possible schemes on the Muzizi, Mpanga and Rwimi rivers in the Fort Portal area shows up to 10,000 KW. Studies of certain schemes, in particular the Maziba gorge scheme, show a potential of over 1,000 KW.

WATER USES	EXPLANATION
Irrigation development	The need for irrigation in the dams and area of Toro and Ankole in the rainshadow of the Rwenzori's was identified. A recent study by FAO (*Irrigation and Water Resources potential for Africa, Rome, 1987*) has produced estimates of the areas of land in each basin and country of eastern Africa which are potentially irrigable and have made preliminary estimates of the potential water requirements for irrigation. The potential irrigation demand was estimated by use of a general equation assuming 50% irrigation efficiency.
Flood storage	The major lakes in and delimiting Uganda provide natural storage reservoirs for the regulation of the main receivers which flow into or through them. A general feature of these rivers is the existence of seasonal swamps which provide flood storage during the rainy season and thus alternate flood flows.

Source: *World Bank-UNDP RAF 87 030 Sub-Saharan Africa hydrological assessment (HASAD) countries) Final Report Uganda 1989, October, 1989*

Sir Alexander Gibb and partners in association with British Geological Survey and Institute for Hydrology

The *per capita* allowance for water demand seems to vary with whether the population is urban or rural, the size of the population in an urban area, and the stage of development. **Table 4.8** shows that in 1980 the *per capita* daily water demand for towns with up to 10,000 persons was 90 litres. This is expected to increase to 150 litres by the year 2000. Similar increases are also shown for rural areas and other different-sized towns.

Major Urban Centres

By 1990, on average, only 51% of the people in the major urban centres had water services. Mbarara municipality had the lowest level of water service at 26.3%. Entebbe had the highest at 85.4% (**Table 4.9**). The seven major urban centres had a total population of slightly more than 1 million people. Provisions of water services to these centres is the responsibility of the National Water and Sewerage Corporation (NWSC) and Directorate of Water Development (DWD). With the on-going rehabilitation and expansion under the Second Water Supply Project, the NWSC intends to increase its coverage to 76% of the target population.

Small towns (with 5,000 people)

There are about sixty small towns each with populations of more than 5,000 people but smaller than those of the seven major centres. The provision of safe water to these small towns is the sole responsibility of the DWD. Currently about 40% of their population is served with clean water. This is projected to rise to 80% by the year 2000. The demand for water is set to steadily increase. The total population in these towns is an estimated 700,000 people and is expected to increase to 1 million by the year 2000. Of these centres, 25 have existing water supply systems, though in very poor states of operation.

Rural Centres

The provision of safe water in rural centres with populations of less than 5,000 people is also the sole responsibility of the DWD. DWD expects to increase the level of service from the current 20% to 80% by the year 2000.

Rural areas

An estimated 30% of the population in rural areas have access to a potable water supply[70]. Groundwater exploitation is said to represent the main option for rural water supply through boreholes, springs, gravity flow schemes and shallow wells. Rainwater catchment and treatment of surface water supplies have high *per capita* costs[71].

Water supply

The NWSC and the DWD are responsible for the water supply in both urban and rural areas. However, some institutions like Nabbingo Trinity College, some communities like Bwera, Kajansi and Kyotera, and establishments such as the Natational Resistance Army and Ministry of Health, have on a cost-shared basis, contributed to the development of water supplies in their areas

Table 4.7: Present service and planned investment in water supply sector. 1990-2000

GENERAL	RURAL	URBAN
Population (1992)	15M	1.7M
Population ratio	90%	10%
Per capita service target	20-25 l/h/d	50 l/h/d
Service coverage/annual level investment		
1990	20%	40%
1992	26% US 14M	60% US 30M
1995 planned	36% US 30M	75% US40M
2000 planned	75% US 40M	100% US40M

Source: WDD, November, 1992

Table 4.8: Estimated water demand (litres/person/day)

GENERAL	RURAL	URBAN
Population (1992)	15M	1.7M
Population ratio	90%	10%
Per capita service target	20-25 l/h/d	50 l/h/d
Service coverage/annual level investment		
1990	20%	40%
1992	26% US 14M	60% US 30M
1995 planned	36% US 30M	75% US40M
2000 planned	75% US 40M	100% US40

Source: The Republic of Uganda, National Report on Environment and Development (prepared for the UN Conference in Brazil, June, 1992) Ministry of Energy, Minerals and Environment Protection Kampala July, 1991; Strategic Resource Planning in Uganda Vol 6 Water Resources UNEP (1987)

Table 4.9: Levels of service in the seven major towns, 1990

TOWN	POPULATION	WATER DEMAND m³/day	ACTUAL SUPPLY m³/day	SERVICES LEVEL
Entebbe	44000	8200	7000	85.4
Jinja	143000	36400	24000	65.8
Mbale	40400	9000	4600	51.1
Tororo	32300	6300	3100	49.2
Kampala	747000	126000	50000	39.7
Masaka	48200	7600	3000	39.5
Mbarara	41900	7600	2000	26.3
TOTAL	**1097200**	**201000**	**93000**	**51.0**

Source: NWSC, 1990

4.1.5 International water rights

Most of the surface water in Uganda flows through the Nile basin which is shared by nine riparian countries: Egypt, Sudan, Ethiopia, Zaire, Uganda, Kenya, Tanzania, Rwanda and Burundi. All nine countries are, to varying degrees depending on their needs, interested in the waters of the Nile[72]. While the use of the upstream waters affects the quantity and quality of the resource in Uganda, those downstream are also affected by how Uganda uses the Nile waters.

Since 1900 the downstream countries have entered into colonial agreements and developed water regulation plans for the storage and control of the flow of the Nile up to Uganda[73]. It is generally accepted that some of the provisions are probably no longer formally binding. They have adverse environmental and socioeconomic impacts on Uganda and should be reviewed and modified. It is thus impossible to determine Uganda's precise entitlement to international lakes or rivers.

The colonial agreements no longer pertain to today's reality. It is in this context that many feel that there is a strong potential for conflicts over the use of the Nile's waters[74]. Furthermore, there are potential conflicts upstream with the countries which provide the inflow to Lake Victoria. If they choose to use more of the water for themselves, the level of the lake would be affected. Finally, there are international water quality problems associated with sedimentation.

In Uganda, the Ministry of Foreign Affairs is responsible for negotiations and liaison on international treaties and agreements, while implementation is the responsibility of the relevant institutions. For example, the Uganda Electricity Board (UEB) manages the Owen Falls Dam and to some extent regulates the flow of the Nile. DWD cooperates with TECCONILE (formerly Hydromet) with respect to hydrological and hydro-meteorological monitoring. DWD also acts as the Ugandan representative on international bodies and at conferences regarding water resource matters[75].

Egypt and Sudan have a strong interest in the uninterrupted flow of the Nile: the Nile is vital to their existence. Any diversion of the Nile for consumption in Uganda is likely to elicit strong protests from those countries. Uganda must take account of this when designing water projects. International environmental groups also have an interest in the water resources of Uganda, although a minor one when compared to those of Uganda's neighbours.

Agreements over usage of the Nile's water should be imbued with the spirit of give and take and should aim to achieve equitable and beneficial use of the water resource by all countries.

4.1.5 Water quality

With better communications and increasing public awareness, concerns about the quality of drinking water have come to the fore in both developed and developing countries. Many of the contaminants are man-made wastes from industry and agriculture. In the United States over 60,000 potentially-harmful chemicals are generated annually[7]. Uganda is fortunate in generating far fewer. A draft Water Resources Act will address quality issues.

Currently, Uganda has established a Water Quality and Pollution Control Laboratory (WQPCL) under the DWD for water quality assessment. Its main functions are to: monitor the quality of water supplied to consumers, especially in the rural areas; investigate suspected chemical or bacteriological pollution; and develop national water quality standards and guidelines[11].

At present, the main activity of WQPCL is the analysis of drinking water. Samples of drinking water are taken by DWD field staff on a need request basis. Organizations active in water development, such as UNICEF and ACTION AID, also utilize the laboratory. The NWSC analyses its water samples at the WQPCL. TECCONILE used to analyse water quality at four stations in the Nile River Basin. However, this is an international organization, and its mandate relates only to international water bodies.

Soil erosion affects water quality. The control of soil erosion is the responsibility of both the Department of Agriculture in the Ministry of Agriculture, Animal Industry and Fisheries and the Ministry of Natural Resources. **Box 4.2** describes the qualities of the major lakes of Uganda.

Box 4.2
Water conditions of the major lakes

Lake Victoria
More water enters the lake from precipitation, which is heaviest over the Ugandan sector, than from riverine influxes. The Katonga is the largest Ugandan affluent. It is an extremely sluggish stream, more of swamp courses than a river in its lower reaches. Its water quality is deteriorated.

Lake Kyoga
Water temperatures vary from 26-30°C and oxygen concentration are moderate, but may fall to 3.8 mg/l in some of the small lakes. The pH values of L. Kyoga range from 7.6-9.0 and conductivities from 210-365 siemens/cm. Concentrations of the principal ions are sodium 10.8 mg/l, potassium 7.0mg/l, calcium 21.7mg/l, magnesium 13.8mg/l, carbonates 2.2mg/l, chloride 12.0, sulphate 21 mg/l, and silicate 34 mg/l.

Lake George
The water chemistry of L. George is known to have remained fairly consant over the last 40 years, suggesting that the residence time of water in thelake is short and that evaporation does not lead to the concentration of solutes. The surface water temperature of the lakes varies condierablev with a range conceivably in excess of 25-35%. The bottom water is always close to 25.5°C. The water is quite turbid with secchi depth of only 24-26 cm. the pH range is 8.5-9.8, but an extreme reading of 1-4 has been obtained and conductivities range from 210-240/siemens/cm through the year, being highest in the dry seasons. The lake water exhibits a diurnal pattern of stratification but is generally very well oxygenated. When mixing fails to occur during occasional periods of exceptionally calm weather, the bottom water becomes deoxygenated which may result in fish mortalities.

Lake Edward
Water leaving the lake has a temperature of 25-25°C and a pH close to 9.1. The concentrations of the major ions are sodium 110mg/l, potassium 9 mg/l, calcium 12 mg/l, magnesium 48 mg/l, carbonates 9 mg/l, chloride 30mg/l, sulphate 31 mg/l, silicate 6 mg/l. Total dissolved solids amounts to 521 mg/l.

Lake Albert
The Nile water is fresh. However, the main body of lake water, up to 10 km from the delta which the Victoria Nile has built into the lake has a salinity of 6%. The surface temperature is usually within therange 26-29°, and the pH between 8.4 to 9.5mg/l. The concentrations of the principal ions are sodium 96 mg/l, potassium 65 mg/l, calcium 10 mg/l, magnesium 31 mg/l, carbonates 7.3 mg/l, chloride 31 mg/l, sulphate 32 mg/l, and silicate below 1 mg/l.

4.1.7 Water pollution

The major types of water pollution in Uganda are microbial (domestic sewerage), organic wastes (domestic and industrial), toxic and hazardous wastes (industry), suspended solids (agriculture) and nutrients (domestic, agriculture and industry). The main sources of water pollution are described below[78]

- *Sediment contents in Rivers and Lakes*: The serious soil erosion observed in some places has been caused by the destruction of soil covers and cultivation on steep hill sides. Soil erosion causes gullies on land and sedimentation on the beds of lakes and rivers, thereby reducing their storage capacity and flow.

- *Contamination of lakes from breweries*: The breweries, located on the shores of Lake Victoria, produce 5000m^3 of toxic waste per day, discharged into the lake untreated. This waste contains caustic soda generated from bottle wash lines. The caustic soda raises the pH of the run-off to 10.2 - 11.6. Contaminants from other stages of the breweries' operations include yeast, alcohol, fermenting barley and other organic solids. These contaminants have a high Biological Oxygen Demand (BOD) of the order of 3500mg per litre. Brewery waste has already produced fish kills in the waters of their immediate vicinity.

- *Contamination from textile industries*: The four textile factories on the northern shores of Lake Victoria produce waste from printing and dyeing processes. The bleaching agents such as caustic soda and hydrogen peroxide, as well as sodium silicate and a multitude of dyes (azo and diazo compounds mostly) are all well known for their carcinogenicity on mammals. The total waste water from the mills exceeds 2000m^3 per day and is discharged untreated into Lake Victoria and the Nile

- *Contamination from sugar industries*: There are three crystal sugar manufacturing factories, each producing waste water of 500m^3/day. The contaminants include cane wash, cellulose matter, cane juice, molasses waste and alcohol. A preliminary study of these wastes indicated BOD levels of 130,000 mg/litre and 204,000 mg/litre for two of the major factories. The waste water is currently discharged untreated into the rivers closest to the factories. There is evidence to suggest that the current level of organic pollution in these rivers exceeds their capacity.

- *Contamination from leather tanneries*: There is one significant factory on the shores of Lake Victoria. It discharges 420m^3/day of waste water into the lake. The wastes consist of pesticides such as arsenic, DDT, and various dichlorobenzenes. The waste water is highly corrosive and has a high BOD (700 mg/litre) and suspended solids. There is no chemical treatment of this waste to render it inert prior to discharging it into the ordinary public sewer.

- *Contamination from mining*: The solid waste from Kilembe Copper Mines contains cobalt sulphide(1.4%). Over the years, this waste has been stockpiled as tailings at Kasese pending future commercial exploitation. The stockpile is 1,113,000 tonnes of cobalt concentrate which contains other metals (nickel, copper, iron and sulphur). The waste was very finely milled and pumped as a slurry to the tailing lagoons. However, the lagoons were not consolidated, capped and vegetated as they should have been. Consequently the lagoons are susceptible to water erosion. Surface runoff from rainfall has carried some of these materials into the rivers. This

constitutes an uncontrollable discharge of toxic waste into the water bodies. As the water from the rivers in the neighbourhood is used for domestic consumption, it implies that there is human intake of metals like iron, cobalt, copper, cadmium and zinc which may cause health problems.

The nascent small-scale mining and refining of gold operations also raise environmental problems as the prospectors use mercury for extraction of the precious metal.

- *Hydropower Development*: In Uganda, hydroelectric dams do not affect the flow of the rivers in which they are located but they do increase evaporation losses. Flooding caused by the construction of dams and their reservoirs can affect the ecology of the area and displace human populations. They also often conflict with interests such as agriculture, tourism and wildlife.

  There are the following additional concerns about dams. Fisheries resources can be adversely affected by pollution associated with dams. Dams can hinder transport on waterways. Dams can be seriously affected by the water hyacinth. Tourism/recreation operators are interested in an unpolluted aquatic environment in national parks and in the preservation of scenic vistas on water courses[79].

4.1.8 Water legislation and policies

4.1.8.1 Legislation

The existing laws of Uganda regarding water have been reviewed and analyzed in the Water Legislation Study of 1992[80]. While the DWD is responsible for issuing water extraction permits for virtually all uses, an exception exists in the case of mining as specified in the Mining Act. The Department of Geological Surveys and Mines issues permits for water extraction for mining.

The Water Legislation Study has made drafts of a new Water Resources Act and a Water Supply and Sewerage Act with the intention of rationalizing water legislation. A concurrent activity regarding legislation is that of the National Environment Action Plan (NEAP) which involves the drafting of an overall environmental management policy and law. Currently the relevant pieces of legislation dealing with the water sector are the:

- Water Works Act (Cap 135, 1929)
- Mining Act (Cap 248)
- Public Lands Act (1969)
- Public Health Act (Cap 246)
- Urban Authorities Act
- Land Reform Decree 1975
- Fisheries and Crocodiles Act
- National Water and Sewerage Decree
- Inland Water Transport (Control) Act

4.1.8.2 Policies

In Uganda, water and sanitation policies are closely tied together by the existing institutional arrangements within government. The policy objectives in the water sector, defined in the Water and Sanitation Sector Action Plan (1989), were reviewed in the donors meeting on Rural Water Supply and Sanitation sector (June 1990) and by Makerere University Institute of Environment and Natural Resources/World Resources Institute (1990). The plan has broad policy objectives aimed at promoting socioeconomic development.

Overall goals for water management in Uganda

Water development in Uganda aims to sustain socioeconomic development; protect human health; support fisheries and other aquatic life; maintain longterm ecological balance; and protect recreation, transport and tourism. Some key steps to achieve these goals are:

- *Community participation*: Increasing the efficiency of the sector through community participation, decentralisation of services, and use of simple and appropriate technologies consistent with government equity considerations.

- *Responsibility ownership rights*: There should be a review of water rights and institutional and legislative issues.

- *Technology specification*: Maximising the productivity of the commerce and industry sector by providing sufficient water supply and disposal services, and encouraging the private sector to increase productivity of the required national inputs.

- *National Water Resources Master Plan*: National and regional reconnaissance plans to match demand/supply options and prepare development plans for each catchment.

- *Water resources monitoring and assessment for comprehensive planning*: Planning for proper development and utilisation of water resources through relevant studies, monitoring assessments, and development of water quality guidelines.

4.1.3.3 Cooperating institutions

Several institutions are involved in the management, development, regulation and monitoring of Uganda's water. These include:

- *Directorate of Water Development (DWD)* which deals with water quality and water supply, by undertaking development and management of water supply and quality.

- *National Water and Sewage Corporation (NWSC)*: NWSC is responsible for waste water disposal services, treatment of waste and provision of water supplies in major urban areas.

- *The Department of Energy, Uganda Electricity Board (UEB)*: Power generation is a non-consumptive use but it influences the pattern of flows in the rivers. The hydrology of the river remains an important parameter and requires, therefore, the close involvement of DWD.

- *Forest Department*: This department manages forest cover and licences timber cutting. In many cases, it is responsible for the management of watersheds.

- *Meteorology Department* is responsible for recording and forecasting weather and climate patterns and changes, and for disseminating data to specialized users and the general public.

- *Veterinary Services Department*: Their main function is disease control and water supply for livestock. The department is promoting the construction of farm dams and valley tanks for livestock, while DWD is involved in an advisory capacity.

- *Ministry of Health* has a role in the provision of safe sanitation facilities and safe drinking water. It works closely with DWD in the provision of rural water and sanitation, its role being inspection and control.

- *Ministry of Works, Transport and Communication*. The ministry is concerned with water transport and possible underwater installation of telecommunication cables.

- *Ministry of Land, Housing and Urban Development*. The ministry is responsible for land use planning and settlement patterns, both of which have an impact on the use of water resources.

- *Uganda Fisheries Department (UFD)*. This department has an obvious interest in water quality and the build- up of nutrients which may be contributing to the spread of the water hyacinth.

- *Department of Agriculture (DOA)* is involved in management of irrigation schemes with regard to irrigation water supply and quality.

- *Ministry of Local Government* has responsibility for providing guidelines and enforcing proper procedures for emptying septic tanks and disposal of waste, and in certain areas in the east and west of Uganda, the ministry has been involved in rural water supply and sanitation projects.

- *Department of Environment Protection (DEP)* partly deals with monitoring of pollution and environmental conservation.

- *National Environment Action Plan (NEAP)*. The NEAP process intends to provide a broad framework for integrating environment issues into an overall national socioeconomic development plan.

4.2 Fisheries resources

4.2.1 Importance

The fisheries of Uganda, harvested entirely from freshwater bodies, constitute an important resource and contribute to the nutritional welfare of the people. The fisheries sector makes a significant contribution to the Gross Domestic Product (GDP) and generates substantial incomes for the thousands of Ugandans engaged in fish harvesting, processing, distribution and marketing.

Fish is a high quality animal protein, and Uganda has a reasonably abundant supply of this food item. It is now reckoned that fish contribute more than 50% of the total solid animal protein intake for the national population, with average *per capita* consumption estimated at about 13 Kg/yr[81]. It should also be noted that the *per capita* consumption of fish by fisherfolk communities along the major water bodies and by the urban population exceeds the national average. For example, it has been estimated that annual *per capita* consumption of fish in Kampala and the fisherfolk communities around Lake Victoria (Uganda) is of the order of 50-60 Kg/yr[82], almost four to five times the national average.

Household expenditures, export earnings, and institutional purchases provide a steady source of income to those engaged in the exploitation of Uganda's fisheries resources. To the extent that artisanal harvesting, processing and marketing predominate the fisheries industry, at the moment at least, a significant amount of this income flows directly to rural areas. The direct expenditures on fish

by the various consumers also generate multiplier income effects in other sectors. Northern rural households on average spend 5.4% of their disposable incomes on fish purchases, while those in the western region allocate only 2.1%. The Ugandan average household expenditure on fish is about 3.29% of the total disposable income, with 3.33% for all urban and 3.28% for all rural households[83]

The direct household expenditures on fish exceed U.Shs 39 billion (1989/90 basis). Apart from the multiplier impacts generated by these expenditures there also accrue both consumer surplus to the consumers and producer surplus to those engaged in the fisheries industry.

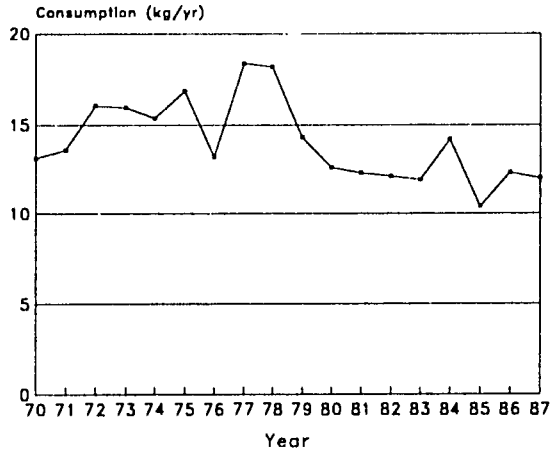
The fisheries resource is known to provide significant employment opportunities, but exactly how many is unclear. One estimate places the number of directly employed persons at 75,000 with an additional 500,000 employed as a result of fisheries activities, giving an employment multiplier of 6.7 times. At another time, it was reported that there were 15,000 canoes in the lakes and rivers of Uganda, supporting at least 40,000 families. Government figures are even reported to have suggested the existence of 20,000 fishermen dependent on lake and river fisheries supporting about 100,000 or more families[84]. Finally, another study has suggested that for rural populations living near lake shores and on islands in the lakes, there are about 73,000 individuals working directly as small-scale fishing unit owners or as crew, with an additional 300,000 people thought to be employed indirectly through secondary and tertiary activities related to fisheries exploitation such as processing, trading, boat building, fishnet making and repairs and the provision of various support services[85].

4.2.2 Demand for fish

Population growth, rapid urbanization and improved transport infrastructure are the main factors contributing to the greater demand for fish in Uganda[86]. **Figure 4.4** shows a historical trend in the annual *per capita* consumption of fish. Over the period 1970 to 1987, annual *per capita* fish consumption varied considerably, ranging from 10.4 Kg/yr to 18.4 Kg/yr. The low consumption of 1985 coincides with the bush war of that year in a region which otherwise has high consumption. The disruptions in transportation presumably contributed to the low *per capita* consumption data. Virtually all the fish consumed in Uganda was from natural water bodies with negligible amounts supplied from aquacultural operations.

The demand for any good or service is a function of its price. On average, Tigerfish has been the most expensive fish while Nile Perch commanded the lowest price. Also, there is a great regional disparity in fish prices. For example, while the national average price for catfish in 1988 was U.Shs 75/Kg, its minimum was at U.Shs 25/Kg in Luwero District and maximum at U.Shs 494/Kg in Kabarole District. The maximum price was almost 20 times the minimum. Generally, consumer prices in major urban fish markets are usually two or three times the ex-canoe price. Also, fresh fish generally costs more than smoked, sundried or salted products. The high prices for particular types and forms of fish correspond with known consumer preferences in certain districts. For instance, *Bagrus* sp. is favoured in Kampala and Mpigi districts while *Clarias* sp. is a delicacy in Masaka and Rakai districts. As expected, areas of high fish production and limited demand have lower price levels: fresh Tilapia is cheapest on Kalangala islands in Lake Victoria[87].

Figure 4.4: ***Per capita*** **fish consumption in Uganda, 1970-87 (Shs/kg)**



Source: FAO (1990)

People living near water bodies tend to prefer fresh rather than processed fish. People in areas remote from the water bodies generally consume fish in processed form. In northern and northwestern Uganda, there is a great demand for salted Lake Albert *Alestes* sp. On the other hand, Tilapia and Nile Perch, whether fresh or processed, are generally readily accepted by the fish-eating population of Uganda.

The districts in western Uganda occupied by the Banyankole, Batoro and Banyoro, and the northeast occupied by the Karimojong, have historically been mainly pastoral areas. These districts account for 25% of the national population[88]. People in these districts have in the past and still tend to avoid the consumption of fish. However, it appears that this resistance is declining, primarily for the following reasons: during the 1971-1986 period, shortages of milk and meat occurred, and yet fish was abundant; the rising cost of living, which resulted in increased prices of meat and chicken; and rural-urban migrations, travel and inter-marriages gradually led to an increase in appreciation for fish in the diets. Campaigns by health authorities on better nutrition, particularly alternative sources of high quality animal protein, also contributed to the increase in fish consumption.

The demand for fish is influenced by the availability of substitute products. Fish competes with beef, pork, goat meat, mutton, milk, poultry and eggs. Fish products are the most consumed of the solid animal protein products at a *per capita* level of 12.0 Kg/yr. **Figure 4.5** shows a trend in the quarterly prices of solid animal protein products covering the period of 1990 to 1993 (first quarter only). The trends clearly demonstrate the price advantage of fish over meat (a collective average) and poultry. While the comparatively low price of fish is the main factor contributing to its preference over other solid animal protein products, the physical and cultural environments of different ethnic communities should also not be ignored. For example, it has been observed that among the lower income consumers of Uganda, the demand for a species locally known as dagaa or mukene (*Rastrineobola argentea* - a small pelagic fish) is quite strong, in central and other parts of Uganda, *Bagrus docmac* and *Clarias mossambicus* are commercially important species during some seasons, *Protopterus* sp. is a prized delicacy among the Iteso of eastern Uganda and the Bakonjo of the Rwenzori region of the west, the demand for salted fish continues to be poor in Uganda except for the north and

northwestern regions; and there has been a slow but increasing demand for fresh chilled fish, filleted or whole[89].

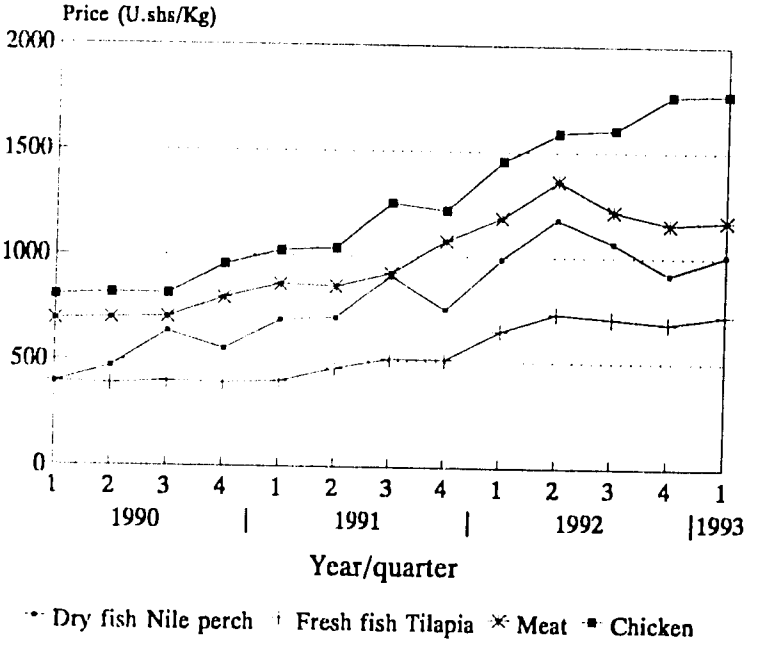
Table 4.10 shows the destination and quantities of a mix of fish products by species exported to various countries in different processed states. The principal market for Ugandan fish exports is Kenya, and the demand consists largely of smoked and sundried tilapia. The second largest export market is western Europe where fresh chilled whole or fillet of Nile Perch and Tilapia are shipped. Zaire is the third largest export market. Products shipped to Zaire consist of salted and smoked tilapia and frozen whole Nile Perch. Large quantities of salted *Alestes* sp. fish from Lake Albert are also known to be shipped into Zaire, although the 1989 data did not record any exports of this category. A recent development is the rapid expansion of the *Rastrineobola argentea* (mukene/dagaa) fishery, harvested at night and easily sundried and packed into gunny bags for long term storage and transport. Good export markets for this product exist in Kenya, southern Sudan and eastern Zaire. However, there are concerns relating to the unsustainable way in which the fish is being harvested.

4.2.3 Fish catch

4.2.3.1 Annual trends

Figure 4.6 shows the annual quantity of fish caught in Uganda's waters for the period 1961 to 1992 (inclusive). Between 1961 and 1989, the fish catch peaked in 1978. Over the last three years, 1990 to 1992, the quantity of fish caught in Uganda's waters has increased, surpassing the peak of 1978.

Figure 4.5: **Comparative prices of solid animal protein products in Kampala, 1990-93**



Source: MEEP (1993)

Table 4.10: Export of fish and fish products, 1989

TYPE OF FISH/PRODUCT FORM	DESTINATION	QUANTITY (KGS)	TOTAL QUANTITY
Tilapia (fresh chilled)	Belgium	265	8065
	Holland	5460	
	UK	2640	
Tilapia (smoked)	Zaire	200	200
Tilapia (smoked/sundried)	Kenya	196500	196500
Tilapia (salted)	Zaire	2000	2000
Nile Perch (fresh chilled fillet/whole)	Belgium	1130	
	Holland	11705	
	UK	3000	15835
Nile Perch (frozen whole)	Zaire	2500	2500
Nile Perch (frozen fillet)	Sweden	12	12
Nile Perch (sundried swim bladder)	Hong Kong	13915	13915

Source: Ohatomwa (1990)

4.2.3.2 Catch by major bodies

Figure 4.7 compares fish catches from Uganda's major water bodies for the years 1961, 1978 and 1992. The data show that in 1961 Lake Victoria supplied 42.1% of the catch; this share declined to only 6.4% by 1978. However, Lake Victoria has now recaptured its dominant position and contributed 49% of the national catch in 1992. This was due to the increased availability of Nile Perch. From a virtually negligible harvest in the 1970s, Nile Perch now constitutes almost 90% of the total catch from Lake Victoria.

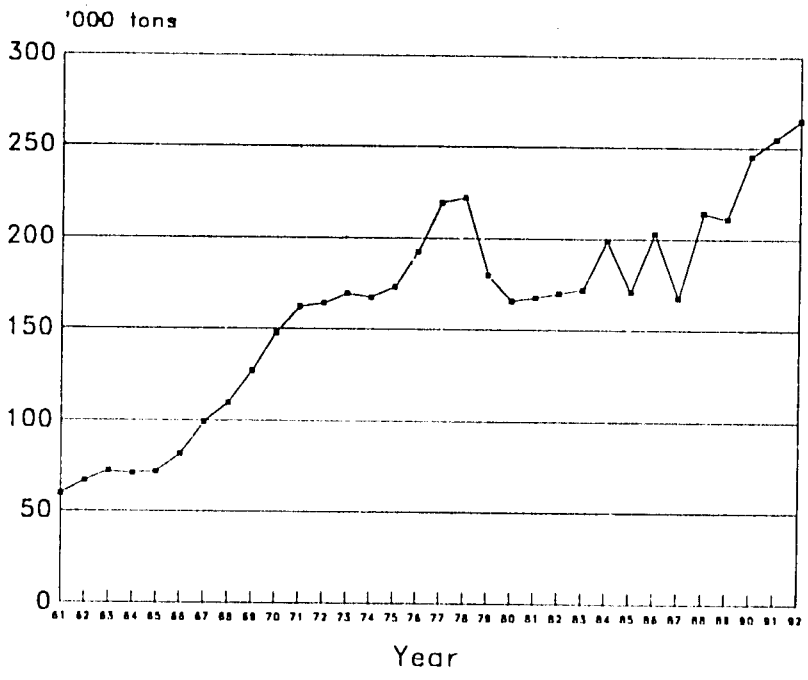
The combined harvest from lakes Victoria and Kyoga accounted for over 87% of the total national catch in 1992. Also noteworthy is that while the combined harvest from lakes George and Edward and the Kazinga Channel contributed 21.0% of the national catch in 1961, this had declined to 2.2% by 1992. In addition, the absolute quantity of fish harvested from these lakes has also declined.

4.2.3.3 Catch by districts and species

Production of fish varies by district, as shown in **Figure 4.8**. The districts of Rukungiri and Kabale produce very little fish, while Mukono District produces over 20% of the national catch as it abuts on both lakes Kyoga and Victoria.

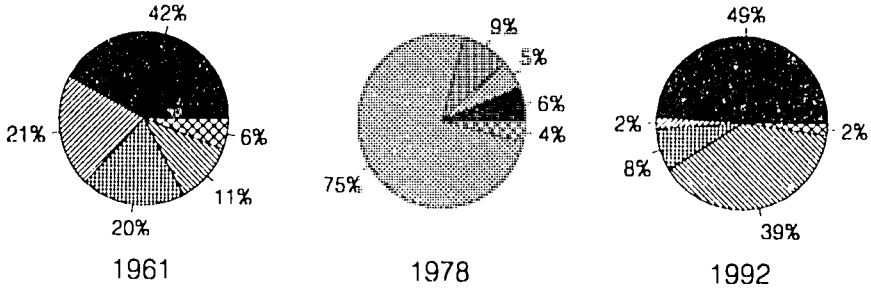
Table 4.11 shows the composition of the national fish harvest in 1988. The data shows that the combined harvest of Nile Perch (*Lates* sp.) and Tilapia (*Tilapia* sp.) represented over 90% of the total catch for 1988. It has been noted that some time back, out of the 750 species that existed, 250 were being harvested. Now, there are only 10 major species harvested, indicating a definite trend towards monoculture.

Figure 4.6: **Annual trends in quantities of fish caught in Uganda's waters, 1961-92**



Source: Ssali, W.M. et al. (1990) for years 1961-1989; and MEEP (1993) for 1990-1992

Figure 4.7: **Composition of annual catches by major water bodies of Uganda, selected years**



Source: Ssali, W.M. et al. (1990) and MEEP (1993)

Table 4.11: Estimated percent share of the quantity and value of fish harvested in Uganda by species, 1988

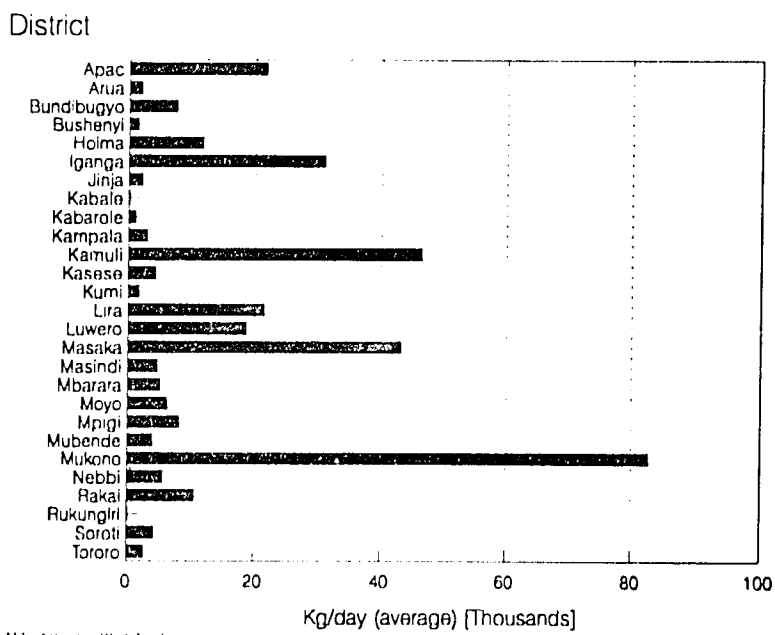
SPECIES	PERCENT SHARES	
	QUANTITY	VALUE
Lates sp	51.05	49.43
Tilapiine sp	39.02	38.87
Hydrocynus	1.90	1.90
Alestes	0.31	0.45
Bagrus	1.26	1.45
Barbus	0.13	0.13
Clarias	1.61	2.86
Protopterus	3.00	3.46
Others	1.71	1.46
TOTAL	**100.00**	**100.00**

Source: Uganda Fisheries Department

4.2.3.4 Fish farming

With Uganda's extensive potential for stocking natural (wetlands) and man-made ponds with fish, supplies of fish from farming operations could be considerable. In Uganda, fish farming, or aquaculture, has been applied both to the classical rearing of fish in ponds for subsistence consumption and to the extensive practice of stocking natural water bodies and reservoirs. The peak development of aquaculture occurred in 1968 when fish farming was carried out in 11,000 ponds covering 410 ha and yielding 800-900 tons of fish that year. The socioeconomic importance of aquaculture in Uganda is also readily apparent when one realizes that this farming practice is currently almost exclusively in the hands of subsistence farmers each with small ponds of 100 to 400 m^2.

Figure 4.8: Production of fish by districts in Uganda, 1988



Source: MAAIF (1989), Table 1

4.2.3.5 Catch effort

Greater demand for fish has in turn led to increased fishing intensity. But the periodic scarcity of fish in the water bodies of Uganda is not a new phenomenon. For example, in Lake Victoria, catches of Tilapia per net dropped from thirty fish in 1921 to six fish in 1928, and then to 1.6 fish per net in 1950[70]. In lakes George and Edward, catches from 1971 to 1978 averaged 11,000 - 13,200 metric tonnes per year. Since then, catches have fallen drastically to around 6,500 tonnes/year due to over-fishing. At the same time, the number of fishing licenses has increased rapidly. **Figure 4.9** shows fishing efforts by major water bodies in 1988. The data indicate low catch rates for lakes George, Edward and Albert at 16-18kg/boat/day, compared to Albert Nile at 88kg/boat/day.

4.2.3.6 Sustainability of catch levels

Data on the annual catch and potential yield for Uganda's major water bodies is incomplete pending more detailed stock assessment and a more accurate recording of fish harvesting results. But even if there were data available to prepare supply and demand balances for each of the water bodies, it must be remembered that such data must be revised frequently to be useful. Changes in the ecology of a water body can profoundly affect the level of sustainable supply of fish over a relatively short period of time. Lake Victoria provides an example. In 1983 the sustainable annual supply from the Ugandan side was estimated at 45,000 tonnes[71]. In 1992, the lake contributed 129,700 tonnes to the annual catch. This expanded level of harvest is probably below a new and much higher level of annual sustainable production for 1993. The increased level of the annual catch and sustainable supply may have been made possible through the greater productivity of the introduced Nile Perch.

Table 4.12 shows estimates of annual catch and potential production in 1983. The data show that harvest levels in all major water bodies were each less than their respective potential yield levels. Overall, in 1983, the catch represented about 53% of potential yield. Principles of sustainability require that annual catch levels should not exceed the annual rate of increase. The 1988 data showed that there was no violation of this principle.

4.2.3.7 Supply constraints

Of all the landing sites in the country, 65% reported the lack of inputs as the main supply constraint. This was followed by poor transportation, insecurity, theft and threats, and lack of markets. Furthermore, the supply of fish has been affected by several other factors: pollution by the water hyacinth especially on lakes Kyoga, Victoria and Albert, which are the three largest fishery areas; over-exploitation, especially in lakes Kyoga and Wamala where tilapia stock levels have not recovered from the time they declined in the mid 1950s; and some industrial harvesting, which is increasing the level of harvest and presenting direct competition to the artisanal fisherfolk[72]. Furthermore, over-capacity of fish plants in Kenya has a direct bearing on fish supply in Uganda. Substantial quantities of fresh fish caught in Ugandan waters seem to be making their way informally into Kenya through smuggling. This frustrates the ability of the Uganda Fisheries Department to manage the resource on a sustainable basis.

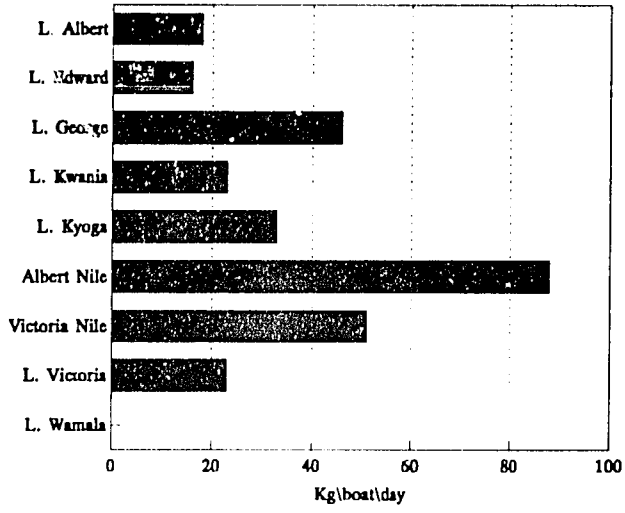
4.2.4 Harvesting

4.2.4.1 Artisanal harvesting

Early fishing technology in Uganda was artisanal. Indigenous fishing gear included basket traps, hooks, spears and seine nets of papyrus or other reeds. It was operated by wading through the very shallow in-waters[73]. This early technology was not sufficient to supply the rapidly increasing demand for fish and the commercialization of fishing. As a result, dug-out canoes and sewn plank boats were

soon used to extend the reach of the artisanal fishermen futher offshore.

Figure 4.9: Fish catch efforts (kg/boat/day) by major water bodies of Uganda, 1988



Source: MAAIF (1989), Table 3a

Table 4.12: Fish catch and potential yield, 1983

FISHERY	ANNUAL PRODUCTION (tons)	POTENTIAL PRODUCTION (tons)
Lake Albert	6000	12000
Lake Edward/George	6500	11000
Lake Kyoga	35000	65000
Lake Victoria	22000	45000
Lake Wamala	2000	4000
Albert Nile	4000	6000
Minor waters	2000	4000
Aquaculture	200	3000
TOTAL	**77,700**	**150,000**

Source: FDRI (1983), and FAO (1990)

To further increase the efficiency of harvesting, gill nets replaced traditional fishing gear. Imported flax gill-nets were introduced into Uganda in 1910 and first used in the waters of Lake Victoria[94]. When the efficiency of the gill-net was realized, locally made varieties of khaki sewing-cotton ones became available on the market. This was then followed by the introduction of the more efficient[95] and longer lasting synthetic fibre (nylon) gill-nets in 1952.

While fishing gear was being modified, fishing craft were also being improved[96]. The fishermen's supply area was further expanded by the introduction of the frame-and-plank canoes which could be constructed in a bigger size and were more durable and stable. With the introduction of outboard engines in 1953[97] fishermen were able to expand their harvesting zones still further offshore.

Data on artisanal fishing inputs are presented in **Table 4.13**

4.2.4.2 Commercial harvesting

There is a very limited use of commercial harvesting technology in Uganda's water bodies. A major reason for this is the disappointing results that have been associated with such operations from as far back as the 1940s. Currently, the Sino-Uganda Fisheries Joint Venture uses a paired-boat trawler operation.

4.2.5 Processing

Processing is widely practised and has been stimulated within the last 10 to 15 years due to the general improvement in communication infrastructure and the dramatic increase in fish harvests from Lake Victoria[98]. There are two fish processing systems in Uganda: traditional and industrial.

4.2.5.1 Traditional processing

This is well known in the rural areas of Uganda, and there are at least four traditional methods of processing fish:

- *Sun-drying* is of limited importance, but is commonly applied to the small pelagic species and juvenile tilapia.

- *Salting* is a common practice carried out particularly in the western lakes, especially Lake Albert. Salted fish has a stronger market in eastern Zaire than Uganda. While originally confined to western Uganda, this practice is now gradually gaining popularity in the Lake Victoria fishery, especially on the islands, where Nile Perch is abundant.

- *Frying* is commonly used to preserve Nile Perch and Tilapia. Fried products are popular in the markets of the urban centers.

- *Hot-smoking* has been observed to be the most popular and provides the best returns to the processor. Unfortunately, it consumes a lot of fuelwood. It adversely impacts on the environment, causing deforestation.

In general, where access is very difficult, more fish is processed than is sold fresh. Smoking and frying demand great quantities of fuelwood, and inevitably an increase in demand for this traditional processing will lead to greater fuelwood requirements. Since the 1950s, localized shortages of fuelwood due in whole or in part to the activities of fish processors have been noticed in some areas[97], such as on certain islands of Lake Victoria and the fishing settlements of lakes George, Edward[105] and Albert.

4.2.5.2 Industrial processing

These technologies were introduced into Uganda as early as the 1950s, although the early ventures failed for various reasons. The current industrial fish processing plants are new and modern, some operators even claiming 100% pollution-free operation[101]. In the industrial plants, the fish is either transformed into fillets or chilled whole piece. All filleting plants have chilling and ice-making facilities so as to keep the products fresh.

If Ugandan consumers could accept, and perhaps even prefer, chilled or frozen fillets and whole fish to traditionally processed products, the country would realise substantial fuelwood savings, thereby

easing the pressure on wooded areas on public lands.

Table 4.13: Uganda, fishing inputs, 1988

	NUMBER
Fishermen	20223
Boat builders	514
Mechanics	141
Workshops	192
Boats	10168
Dugout canoes	1872
Boat engines	1029
Gill nets	193568
Hooks	132245
Traps	10389

Source: Ministry of Agriculture, Animal Industry and Fisheries (1989) Table 3a

4.2.6 Fishing communities

The UFD is presently carrying out socioeconomic surveys of fisherfolk communities. This exercise is not complete, but some important conclusions can be drawn based on initial data. From the socioeconomic survey carried out among the fisherfolk communities of Lakes Victoria and Albert[102] the following observations can be made:

- **Settlement patterns**: Fisherfolk communities are either dispersed around the general area of a landing more tightly clustered or nucleated at or near a landing. The latter pattern of settlement is much more prevalent and may be permanent or temporary. The number of houses in a fisherfolk community ranges from only a few to as many as 500. Many fisherfolk communities have been formed through spontaneous encroachment on private (Lake Victoria) or public (Lake Albert) land and hence lack security of tenure. The fisherfolk communities have well organized informal administrations in contrast to rural farmers.

- **Community growth and development**: There is strong growth in settlements adjacent to good fishing grounds, where landing sites have ready access to markets and when communities have good discipline in place. At the Lake Victoria landings, 94% of the communities are very poor or poor with either no reliable transport or road access. The lack of social services in fisherfolk communities was also reported to hinder growth and socioeconomic development.

- **Women in fisherfolk communities**: In the Lake Albert communities, women make up the majority of the population. The opposite is true for Lake Victoria, nevertheless the number of women is increasing. The female population is engaged in a number of income-generating activities (**Box 4.3**).

- **Sanitary facilities and health problems**: Accessibility to clean water is vital for a healthy life, however, about 90% of fisherfolk households lack this essential facility. They depend on lake water for drinking, washing and waste disposal. The most common health problem is malaria, followed by diarrhoea, then dysentery. These arise from the fisherfolk's way of life.

- **Social characteristics**: Inhabitants of the fisherfolk communities include fishermen, fishmongers, fish processors, petty traders and casual labourers. In both the Lake Albert and Lake Victoria communities, household heads are predominantly male. In the Lake Victoria region, the age of household heads ranges from 13 to 75 years of whom 80% are below 40 years of age. In the Lake Albert region there is relatively less ethnic diversity than in the communities along Lake Victoria. The population of the Lake Albert communities is relatively stable. Inhabitants of the Lake Victoria communities are highly transient, with over 65% having had residency of less than four years at a given landing site.

- **Living standards**: Income levels of household heads in the communities around Lake Victoria range from U Sh 1,000 to over 50,000 per month. Less than 20% of the households have monthly incomes in excess of 50,000; about 50% earn 20,000 to 50,000, and 30% have an income of less than 10,000. These income levels are slightly better than the Ugandan rural household average, but less than that of the urban. In most cases working capital for the fisherfolk is limited due to lack of formal credit facilities. The three highest household expenditure items are food, education and medical care. The three major welfare problems are low incomes, recurrent health problems, and lack of basic social services.

- **Fisherfolk diets**: In the Lake Victoria communities about 51% of households practise subsistence farming for food for home consumption. The main crop is cassava. Food shortage is relatively rare in the Lake Albert communities. However, those around Lake Victoria experience occasional shortages due to dry seasons, low fish catches leading to low incomes, and impassable roads during the rainy season. In communities on both lakes, the staple food is cassava served with fish sauce.

- **Energy availability**: The principal source of energy is fuelwood (firewood and charcoal). Households are primarily responsible for the collection of firewood. The next most important source of fuelwood is sellers. Communities around Lake Albert are experiencing fuelwood scarcity.

4.2.7 Fisheries management

- **History**

  Management of Uganda's fisheries resource has passed through several phases in its history. The key management issue during the early days of subsistence fishing was how to catch fish with rudimentary gear and no craft. Fish were in plenty. In the 1920s, however, localized overfishing became a reality. From then onwards, the overriding management issue became how to contain over-exploitation of fisheries resources. As a result of the findings of a survey of Lake Victoria, Graham in 1929 made four principal recommendations with regard to future management: prohibit the use of gill-nets with a mesh size of less than 127 mm (5 inches) stretched, institute sustained research on the fisheries resources, set up fisheries statistics collection to monitor the fishery, and establish a lake wide authority to oversee the collection of statistics and enforce fishery regulations[7].

Box 4.3

WOMEN INCOME GENERATING ACTIVITIES IN L. VICTORIA FISHING COMMUNITIES

The women population in the fishing villages has been increasing over the last five years. They move to the landings in search of a source of income or with their husbands. The survey indicated a participation of women in various income generating activities such as gear ownership, fish processing and mongering, selling of cooked food and other retail items. Some women are involved in net repairing and other minor related activities. The distilling and selling of local brew (Uganda Waragi, Maize beer, Banana beer) is a very popular occupation for women and it is a major source of initial capital for fishery business. The women are also involved in subsistence farming mainly for home consumption. Scarcity of land limits the level of farming and in many cases borrowed land is used.

Few landings have women directly involved in fishing as gear owners due to the high capital investment. The majority of women do fish processing and mongering and in this line of business alone can depend on fish credit from the fishermen.

Source: Kitakule J.S et. al (1991) P.9 & 10

Before Graham's study, the management of Uganda's fisheries resource was the responsibility of the Game Department. It employed Fish Guards whose duties were primarily the compilation of catch statistics, general control and limited experimental investigations involving the use of gill-nets. Today, the management of Uganda's fisheries resources rests with two organizations, one dealing with research, the other with the administration of fisheries regulations. The Uganda Fisheries Department (UFD), the body charged with monitoring the fisheries resource and enforcing applicable regulations, is relatively new when compared to sister organizations such as the Forest Department and the Department of Agriculture. The Fisheries Department was formed in 1961. The Uganda Freshwater Fisheries Research Organization (UFFRO)now known as the Fisheries Research Institute (FIRI) is responsible for research into the fisheries of the country.

The traditional view of fisheries management has been the administration of fisheries regulations and the provision of extension work[104], performed by the Uganda Fisheries Department. However, this view of management is no longer effective. A living and renewable yet fragile and finite resource system such as fisheries involves a diverse, complicated and not always compatible mix of elements and events, and any meaningful approach to management must comprehend all of them[105]. Below is a summary of the key management issues relating to fisheries and their rational utilization[106].

Fisheries resource base

- *Aquatic environment*, including the physical and chemical environment as well as the limnology of the water bodies. For example, the appearance of the water hyacinth (*Eichhornia crassipes*) weed is a major management concern.

- *Fish resources*. In some of the major waterbodies, the previous multi-species composition is no longer present. This suggests that previous stock information is now of little value. Furthermore, fish species introduced into lakes Kyoga and Victoria are still undergoing a process of adjustment within an ecosystem that is itself in a state of flux. More information and more current data is needed for the purposes of management planning.

Rational utilization

- *Fisherfolk, fishing gear and equipment*. Major concerns are the current predominance of artisanal fishermen and the growing influence of commercial fishing operations. It appears that mechanized fishing is not compatible with artisanal fishing operations and cannot easily co-exist with them.

- *Fish processing and marketing practices* also raise management concerns, particularly about the proportion of fish sold fresh, cross-border smuggling of Ugandan fish into neighbouring countries, traditional processing and its influence on woody biomass, and industrial processing (icing, freezing)

- *Fish exports* generate concerns about monitoring. There are no records of fish smuggled into neighbouring countries, which results in understated harvest levels. There is also currently no weighing of quantities of processed fish shipments at Customs Posts which contributes further to underestimates of exports. Finally, the impact of fish exports on local consumers and on the fisheries resource have not been adequately studied

These concerns require more efficient research, enforcement and monitoring by the agencies responsible for the sustainable management of the fisheries resource. Effective management of the fisheries resource will require better coordination between UFFRO and UFD, more adequate and reliable funding arrangements, the separation of control and extension functions, and decentralization, increased workers' morale and improved staffing procedures[107]

4.2.8 Policies and legislation

4.2.8.1 Fisheries policy

In independent Uganda's first development plan for 1961-62/1965-66, the government fisheries policy was spelt out

> *"Recognizing the value of fish for the health of the people, and as an export commodity for which there is a ready market in surrounding countries, the Government aims to achieve the maximum economic exploitation of the country's extensive natural fish resources consistent with the preservation of these resources for future operations. It also aims to increase the fish resources wherever possible by artificial means, such as the stocking of fish ponds and to contribute to the development of the tourist industry by the encouragement of sport fishing"*[108]

As outlined in the Manual of Organization of Government Ministries (1989)[109], the Uganda Fisheries Department has five long-term goals: to step up production of fish and raise the *per capita* consumption and nutritional status of the people, to raise the incomes and standards of living of fishermen; to improve processing, handling, marketing and quality control of fish and fish products in order to minimize post-harvest losses, to develop and manage the fisheries in such a way that the future exploitation of the resource is not endangered, and to increase foreign exchange earnings through the export of fish products and crocodile skins[110].

In implementing its policy, the UFD works in collaboration with a number of other government departments, including:

- *The Public Health Department* of the Ministry of Health which issues the licences to fishmongers and to fish stalls while the UFD issues the wholesale licences. The Public Health Department also controls quality of the water from fish factories that is returned into the lakes or rivers. The Department of Public Health does not allow anyone to discharge water where the public obtain its domestic water unless they have the permission from the **National Water and Sewerage Corporation**, which controls the quality of water for public consumption.

- The Fisheries Department works with the **Uganda National Parks (UNP)** to control poachers where fishing grounds are contiguous to conservation areas.

- The **Ministry of Works** is responsible for opening the roads to the landing sites[111].

While there are general problems that make implementation of policy difficult, certain obstacles are specific to the Uganda Fisheries Department. First, it is not easy for the UFD to convince fisherfolk that conserving fish is in their interest. This is because the staff working on controlled lakes are both the extension workers and the enforcers of the fisheries regulations, extension work is difficult. Second, it is sometimes difficult to obtain the regional cooperation necessary when a body of fishing waters is shared with a neighbouring country. For instance, it has been difficult to obtain the cooperation of Zaire in the case of lakes Edward and Albert, fishing gear is controlled on the Ugandan side but little is done on the Zairean side. Third, there is a risk of pollution of Lake George by Kilembe Mines with environmentally dangerous minerals like copper, cobalt and nickel: what enters the lake is not known precisely. Finally, among the offenders of the fishing regulations are members of security organizations, who are difficult to arrest and charge for infractions[112].

4.2.8.2 Fisheries laws and regulations

The fisheries of the country are provided for under the laws of Uganda through the **Fish and Crocodiles Act** (Chapter 228, Revised Edition, 1964) and the **Trout Protection Act** (Chapter 229, Revised Edition, 1964).

The Fish and Crocodiles Act (1964) makes provision for the control of fishing, the conservation of fish, the purchase, sale, marketing and processing of fish, the catching of crocodiles, and the sale and control of crocodile skins. The principal management tool is the licensing system, and the strategy is through control of fishing gear.

In addition, the fisheries resource is also regulated through **Administrative Orders**. The Minister responsible is given wide powers to impose extra controls and restrictions as he or she deems fit. The Minister may prohibit the use of a particular fishing method if it is likely to be unduly destructive. The Minister may declare specific periods of the year to be closed to fishing in any area specified in an order. However, these orders do not carry the force of law and are thus not actionable in court. Often, the refusal to renew annual fishing licences is used to enforce administrative orders. One actionable issue was the restriction on gill-net size. However, this law was repealed in 1956 and nothing has since been done to replace it. This has left fisheries administrators with few other tools for direct control of fishing[113].

4.2.9 Fisheries maaagement for sustainability

- **Sustainability**

To ensure the rational management of the fisheries resources, the UFD is mandated to provide guidelines and advice to artisanal and industrial fishermen and fish farmers. It is also mandated to carry out the following activities aimed at controlling harvesting: controlling licensing for each body of water, based on the scientific information available, monitoring the amount of fish being taken from the waters; restocking of water bodies, controlling the importation of live fish; providing extension services to primary producers; and re-introducing fish farming[114].

- **Control of pollution**

Fisheries are under threat from four principal sources of pollution: eutrophication, degradation of the fringing vegetation, the water hyacinth, and climate change[11].

Eutrophication occurs when nutrients enter a water body and nourish the microflora in the water. The microflora grows vigorously producing excess phytobiomass which soon starts to decay. The bacteria that are responsible for the decay process use large quantities of oxygen, thus depriving fish of this essential element. Eutrophication is already a serious problem in Lake Victoria.

Fringing vegetation refers to the wetlands. Once degraded, the wetlands are rendered incapable of filtering waste and protecting the fish resources.

With respect to climate change, the threat to fish arises from the stratification of water bodies into cold and warm layers without the two having a chance to mix. The lower cold-water layer can be deficient in oxygen and become inhospitable for fish.
Finally, the water hyacinth is perhaps currently the most visible and well-publicized pollution problem threatening Uganda's fisheries resource. The pervasive nature of the water hyacinth pollution problem can be put into perspective when one considers that one square meter of surface area of the vegetation can produce great quantities of biomass per year.

- **Better coordination and consultation between agencies**

  - Ensure that policy formulation and review is conducted on a more consultative and consensual basis especially between UFFRO and UFD.

  - Support the move to have all UFFRO - and UFD - based fisheries research under the direct control of NARO (National Agricultural Research Organization).

  - Promote better direct UFFRO-UFD linkages by convening joint workshops on semi-annual or quarterly schedule.

  - Promote communications between all fisheries personnel and fisheries-related agencies and parties through a modest newsletter type of publication.

- **Better Performance**

  - Devolve greater authority to the Regional and District levels adminstration, thereby shortening lines of communication, fostering more initiative among out-post staff, and reducing the delay in implementing administrative measures.

  - Provide for higher levels of support in terms of work-related allowances and opportunities for career development/training centers.

  - Consider ways and means of paring back on superfluous staff within the fisheries administration hierarchy.

- **Continued and improved regional cooperation**

  - Recognize the sharing of the fisheries resource base in lakes Victoria, Edward and Albert with other riparian states, and continue to improve upon regional cooperation in management initiatives.

  - Promote lake-wide cooperation on research with other riparian states.

  - Actively participate in the support of organizations such as Committee on Inland Fisheries for Africa (CIFA).

4.3 Wetlands resources

4.3.1 Definition and importance of Uganda's wetlands

Uganda's wetlands include all those areas where plants and animals have become adapted to temporary or permanent flooding[116].

Virtually every country in the world has some wetland resources. Uganda's wetlands are extensive, complex, and relatively unstudied and uninventoried. They are particularly important for the following reasons:

- The wetlands support a wide variety of plant and animal life, from floating water plants to marsh vegetation, and from fish to grazing mammals. The biological diversity of the wetlands is great[117]. Uganda's wetlands contain important populations of less common plants, eg. *Syzigium* sp. The wetlands also offer refuge to some rare species of fauna, including the Sitatunga, and are important habitats for threatened bird species like the shoebill stork, crowned cranes and swamp warbler. In addition, Uganda's wetlands are important habitats for crocodiles which are also threatened in most of their ranges.

- Uganda's major wetlands are unique because they are interconnected with complex boundaries.

- There also exist many small wetlands, apparently not connected at all to a river or to a lake. These small wetlands are usually surrounded by communities and the biggest interaction between people and the wetlands takes place there. Many of the small wetlands contain swamps called "Dambos", which receive water from surrounding hills, but have no outlet[118].

- Until very recently, swamp and other forms of wetlands were not viewed as important natural resources in their own right, but only as potential agricultural land if drained and reclaimed. It is now fully appreciated that swamps and wetlands occupy an essential and important place in the maintenance of water regimes and climatic patterns.

- Excessive drainage of swamps in some places of Uganda has led to the soils, both in the reclaimed land and their surroundings, to become undesirably dry which in turn has led to reductions in productivity. Most of this has occurred in areas where arable land is scarce. Also in some parts of Bushenyi and Kumi districts, it is felt that extensive reclamation of swamps has contributed to the reduction in rainfall amounts and adverse changes in rainfall patterns[119].

- Two of the major ecosystems, forests and wetlands, are interrelated and are responsible for the stabilization of climate, water supply and the conservation of soils and nutrients. Some of the natural functions of wetlands include water supply to rural and urban areas such as Bushenyi and Masaka towns. Uganda's wetlands are also large sinks for stripping sediments, nutrients and the retention of toxins e.g. the Nakivubo Channel and Luzira swamps near Kampala. During the dry season, some of the wetlands are grazing and watering grounds for livestock[120].

4.3.2 Size, distribution and diversity

4.3.2.1 Size

With respect to the entire African continent, eastern Africa is estimated to have about one third of all wetland areas **(Figure 4.10).** Within eastern Africa, Sudan is reported to have about 75% of the region's wetland area while Uganda has close to 10%. These estimates correspond to 1990-91 coverage at which time it was reported that Uganda had 14,200sq km of wetlands[121]. The Uganda Ministry of Natural Resources has since revised this figure to 23,000sq km[122], based on a more comprehensive concept of wetlands. Using the revised figure, the wetland areas of Uganda comprise approximately 10% of the country's land area.

However, using the Langdale-Brown, *et. al.* (1964) vegetation classification, Uganda's wetlands occupy 30,000 sq km. to which an additional 1,300sq km of papyrus wetland and 500sq km of seasonal wetlands could be added for a total of 31,389 sq km[123]. Unfortunately, perhaps due to lack of a comprehensive inventory, there is yet no clear consensus as to how much area Uganda's wetlands occupy. In this report, the estimate of 30,000sq km is adopted as being the best.

4.3.2.2 Distribution

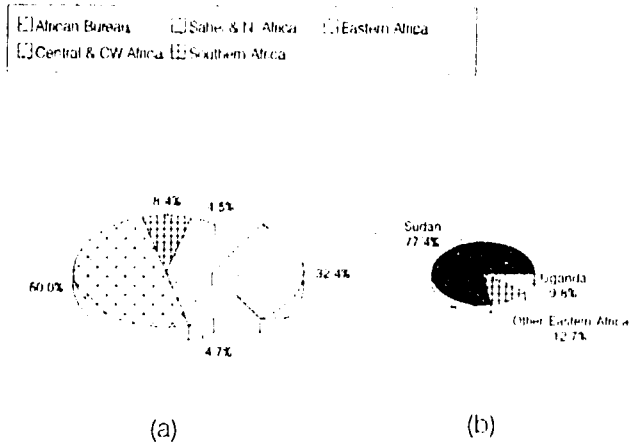
The wetlands of Uganda are found in almost all parts of the country. There are two broad distributions of wetland ecosystems[124]. Natural lakes and lacustrine swamp wetlands include: Lake Victoria region; the Kyoga/Kwania Lake/Swamp Complex, Lake George area, Lake Edward wetlands; Lake Albert area; the Bunyonyi Lake/Swamp complex, the Kijanebalola Lake/Swamp Complex, the Bisina and Opeta lakes area, the Lake Wamala area, and wetlands associated with minor lakes. **Table 4.15** describes features of major Ugandan wetlands.

The riverine swamps and flood plains wetlands include: the Okere System, the Kafu system, and the Nile area.

Another important feature is that some of the lakes associated with these wetlands are along international borders (Lake Victoria is shared with Kenya and Tanzania, while Lakes Albert and Edward straddle the border between Uganda and Zaire). There is a clear need for international cooperation in their management[125].

A description of the characteristics of selected wetlands associated with the lakes, rivers and flood plains is shown in **Table 4.15**. The detailed descriptions of Ugandan wetlands in **Table 4.15** reveal ecosystems of great diversity in flora and fauna and of growing importance to the Ugandan economy.

Figure 4.10: Comparison of Africa's wetlands distribution



(a) (b)

Source: World Resources Institute. Natural Resources Indicators for Africa - 1992. September 30, 1992.

4.3.2.3 Diversity

Of the 30,000sq km. of wetlands in Uganda, 69% represent sites with impeded drainage, 30% are swamps, and the remainder are classified as swamp forests

4.3.3 Natural functions and values of Uganda's wetlands

Often poorly appreciated, yet perhaps more important than biological diversity, is the value of wetlands to human society[126]. Globally and for individual countries, the value of wetlands is significant For example, fish species which spawn in tidal zones and then swim to open sea account for two-thirds of the world's fish harvest The US Army Corps of Engineers recommended that the most cost-effective means of flood control on the Charles River in Massachussetts was to protect the existing wetlands In India the City of Calcutta used a series of salt lake wetlands for decades to treat sewage and also to support fish farms with annual production of 6,000 tons[127]

In its classification of the world's wetlands, the IUCN World Wetlands Program recognizes at least eleven major functions. Uganda's wetlands are known to support seven of these (**Table 4.14**).

4.3.4. Current uses of wetlands

Ugandans are currently using the wetland resources in a number of ways, some environmentally benign and others deleterious. Eight of the major uses are presented in **Table 4.16,** together with the likely problems caused by each of the uses

In a survey of people in selected districts in Uganda, over 70% who lived near wetland areas stated that they used the resource for cultivation, hunting, grazing livestock, and collecting building materials[128]. Similarly, over 70% of the respondents believed that swamp and forest clearance in their area resulted in lack of building materials, lower rainfall, and more water shortages. **Table 4.15** also describes the major human impact and utilization associated with each wetland.

Table 4.14: Principal functions of Uganda's wetlands

	FUNCTION	EXAMPLE OF WETLAND
1	Ground water, recharge and discharge	Kiruruma valley, Kabale Rwenzori montane bogs
2	Sediment and toxins retention	Lake George wetland Bushenyi and Masaka towns wetlands
3	Nutrient (effluent) retention	Nakivubo and Luzira swamps, Kampala
4	Biomass export	Lake Victoria, Lake George and Lake Kyoga swamps
5	Micro-climate stabilisation	Kabale district valley swamps
6	Water transport	Affluent arms of Lake Kyoga (fishing)
7	Recreation & tourism	Lake George wetlands

Source: Taylor, A.R.D. (1991) Table 2, P.15

4.3.5 Major threats to Uganda's wetlands

Unlike many developed countries where large areas of wetlands have been lost[128], the threat to Uganda's wetlands is currently largely limited to the small closed or seasonal wetlands, being subjected to drainage. This is hardly surprising since until recently, official government policy supported and even encouraged the drainage of swamps - termed reclamation - for agriculture and other uses[129]. The Ugandan policy was similar to that of other African inland countries where many freshwater ecosystems, particularly in seasonal rainfall areas, were subjected to large-scale human over-exploitation, including water regulation and land development schemes[130]. The following categories can be considered as the major threats to Uganda's wetlands: unplanned agricultural conversion; drainage activities, industrial pollution, and excessive harvest of natural products[131]

Table 4.15: Major uses of wetlands in Uganda and associated problems

WETLAND DESCRIPTION	FLORAL AND FAUNA	HUMAN IMPACT/ UTILIZATION	CONSERVATION STATUS
A. LAKE VICTORIA WETLAND			
The innumerable bays and inlets of the lake margin occupy valleys of pre-lake system, and they differ in ecology from inlet to inlet and from inlets to the main lake. Much of the margin is swampy. There are numerous islands especially the 18 Ssese island and 5 Kome islands, 5 islands in Roseberry Channel, Buvuma and Bugaia islands, Diguli and Lolui islands and the 3 Sagitu islands. Permanent papyrus swamps with some patches of swamp forest occur around the Ugandan lake shore. Such swamps are well developed around the mouths of the Kagera and Kibale rivers. Other swamps occur on the lake shore encompassing Lake Nabugabo and at the Katonga river mouth in two major blocks and further east along Salisbury Channel where many short streams enter the lake through a deltaic zone. Smaller swamps are situated near Port Bell and near Ntanzi. An extensive seasonal floodplain is situated behind the swamps at Sango Bay. Also, separated from Lake Victoria by a sand bar is Lake Nabugabo which is fringed by dense swamps, while the northwestern shore is forested with areas of sandy beach.	Principal swamp fish species include Clarias mossambicus, C. werneri, Protopterus aethiopicus. In terms of flora the lacustrine swamps of Lake Victoria are dominated by papyrus, however in places there are arborescent associates, chiefly Bridelia micrantha, Ficus verruculosa and Phoenix reclinata. On the fringes of the papyrus, in areas less deeply inundated, there are strips and patches of swamp forest.	The shores of the lake are fairly densely populated. The lake is fished commercially using trawlers, and by artisans using seines and lines from beaches and canoes. The effluent river, the Victoria Nile is dammed at Owen Falls.	Small sanctua areas have been set aside at Entebbe (5,200ha) and Jinja (800ha), the rest of the Ugandan shores is unprotected.
B. THE LAKE GEORGE WETLANDS			
The principle affluent streams draining the eastern slopes of Rwenzori mountains enter the lake through extensive swamps which occupy some 2,600 ha. The Mpanga also enters these swamps from the eastern edge of the Rift Valley. Other swamps occur to the north and south of the small western basin of the lake, and another is situated on the central southern lakeshore. There are three large islands close to the western shore, one of which almost blocks the channel connecting the main basin with a smaller basin in the northwest.	The peripheral swamps are dominated by Cyperus papyrus rich in climbers such as Cyratia ibuensis, Opomea rubers and Melanthera scandens but these are dense patches of arborescent species including Ficus verruculosa and Phoenix reclinata. Vossia cuspidata is common along the outer fringe of papyrus. Some shallowly flooded shores sustain communities of Cyperus articulatus and C. latifolius with sprawling Commelina diffusa and Spilanthes oleracea. elsewhere, Hydrocotyle ranunculoides is common in shallow water. Paspalidium geminatum occurs on the sandy eastern shores of the islands. Some 32 species of fish have been identified to date in the lake and wetlands areas. Crocodiles survive in the afluent rivers and there are large numbers of piscivorous birds including Haliaeetus vocifer, Pelecanus oriocrotalus, Phalacrocorax carbo and various herons and Kingfishers. There are also many storks and ibises. Important mammals include Atilax paludinosus, Hippopotamus amphibius, Kobus ellipsiprymnus, Loxodonta africana, Lutra maculicollis, Redunca arundinum, Syncerus caffer and Tragelaphus spekei.	The lake supports an important fisheries. A railway line crosses the swamp on the north side of the lake, and since the embankment inhibits drainage, it has led to the development of open water areas in the swamp on the north side, with Cladium mariscus and Nymphaea sp.	The Rwenzori National Park abuts most of western and northern shore of the lake while the south shores is included in the Kyambura Game Reserve. the Kazinga Channel is protected in the Kazinga Sanctuary. The Rwenzori Park was established as the Queen Elizabeth Natinal Park in 1952 with an area of 198,600 ha encompassing all the land between Lake Edward and Lake George. Heavy poaching has occurred in the park reducing the elephant population to 150 in 1981. This wetlands is a designated site under the Ramsar Convention.

WETLAND DESCRIPTION	FLORAL AND FAUNA	HUMAN IMPACT/ UTILIZATION	CONSERVATION STATUS
C. THE BUNYONYI LAKE/SWAMP COMPLEX			
Lake Bunyonyi was formed when a steep sided dendritic valley system was blocked by volcanic activity. It covers about 6,100 ha and by numerous affluents from the surrounding hills. Swamps extend back up the Kiirita for 8 Km and are present at the heads of 25 of the little arms of the lake. In total, these cover about 1,500 ha. Lake Bunyonyi drains sluggishly from its northern and to the Ruhuhuma (Ruvuma) swamp which coveres a little more than 4,000 ha at an altitude of 1,940 m. The eastern part of the swamp drains by a short stream to the swampy upper course of the Ishasha river, which rises in Rwanda and flows north and northwest to Lake Edward and the Nile. A strip of permanent swamp, 40 Km long and about 1 Km wide, accompanies the Ishasha from the Rwanda border northwards to a point just beyond the confluence with the effluent from the Ruhuhuma swamp, so that a permanent wetland of 4,000 ha is situated. The western part of the swamp drains into Lake Mutanda, which contains one large Island. It discharges from the southwestern corner via the Kako river and the Tshengere swamp in Zaire, to the Rutshuru river and thence to Lake Edward and the Nile. Lake Muanga is situated just to the east of Lake Mutanda. It is ringed by high hills, but drains to Lake Mutanda through a papyrus swamp at its southwestern corner.	There are floating swamps of Cyperus papyrus and Cladium mariscus in the shallow sheltered bays of Lake Bunyonyi, with Phragmites australis present in the narrow strip on steep exposed shores. Potamogeton and Nymphaea spp. dominate the floating leaved vegetation in front of the papyrus have other associates of Hydrocotyle ranunculoides, Polygonum salicifolium, Pycostachy coerulea, Thelypteris squamigera and Utricularia sp.. Typha domingensis is present along affluent streams. Oreochromis niloticus was introduced and still persists in the lake. The most common fish, however, is a species of Haplochromis. Local fishermen also take a species of Clarias.	The lake was stocked with fish earlier this century, but recently there have been mass fish mortalities. These have been attributed to violent mixing of cold de-oxygenated water with warm water layers. There is an artisanal fishery.	Unprotected.
D. RIVERINE SWAMPS AND FLOODPLAINS			
1. THE OKERERE SYSTEM WETLANDS: Okerere is studded with lakes and merges into permanent swamps at its southern extremity. The flooplain is continuous from 110 Km below the Okuk/Okerere confluence and above it from a further 29 Km up the Okuk and 46 Km up the Okerere. It has a total high water area of approximately 80,000 ha, including the numerous lakes of the lower reaches.	Cyperus papyrus, Phragmites mauritianus and Typha domingensis all occur along the river, with various arborescent species in shallowly inundated places. These include Acacia tortilis, Borassus aethipum, Ficus spp, Phoenix reclinata and Syzgium guineense	Cattle are grazed on the floodplanis during the dry seasons.	Unprotected.
2. THE KAFU SYSTEM: The Kafu river flows east from a swampy watershed to the Nile, and west from the same watershed as the Nkusi to Lake Albert. Along the east flowing section it receives two tributaries on its right (southern) bank, both of which flow through extensive permanent swamp systems. These are the Mayanja, which traverses a 30 Km papyrus swamp with an area of 13,5000 ha and the Lugogo which flows through a continuous strip swamp for 82 Km above its confluence with the Kafu. This latter swamp has an area of 24,600 ha.	The flood plains are important grazing areas for wildlife during the dry season when they may be visited by a variety of large mammals. Acimonyx jubatus and Panthera leo are found here.	Not available.	Not available.
3. THE NILE: The Okole river, a right bank tributary of the Victoria Nile, traverses a continous swamp belt of 16,000 ha for 52 Km above its confluence. Further downstream the delta swamps in Lake Albert occupy some 6,500 ha and below Murchison Falls the Albert Nile traverses a swamp 115 Km long and some 5-10 Km wide, with an area of about 52,000 ha.	Not available.	Not available.	Not available.

Source: *Ministry of Environment Protection: National Environment Action Plan Proposed National Wetlands Policy Working Document No. 1 March, 1991; Paul Mafabi*

- *Kibimba Rice Scheme* - production began in 1974 with 538ha under rice, of a total of 650ha available field area. This scheme replaced a mixture of wetlands types (seasonal wetland and permanent papyrus swamp).

- *Doho Rice Scheme* - production was begun in 1976 and the scheme was projected to cover about 1,250ha. In principle, the scheme was a good idea, set up to control floods from River Manafa. However, it was inadequately planned in that it changed a wetland that was seasonally flooded into an irrigated paddy rice field that is protected from direct river inundation, resulting in several negative environmental impacts.

- *Olweny Swamp Rice Project* - which involves the conversion of a swamp to paddy rice production. Uganda has substantial cultivable area available for the expansion of the agricultural land base. However, because of considerations such as location and the specific requirements of new or non-traditional crops, the threat to wetlands from agricultural conversion remains real. **Table 4.17** shows the uses to which reclaimed wetlands are put by the smallholder farmers of Uganda.

Table 4.17: The uses to which reclaimed wetlands are put by the smallholder farmers of Uganda, 1992

	ROOT CROPS (%)	VEGETABLE (%)	LIVESTOCK (%)	RICE (%)	BANANAS (%)
National	41	33	25	15	8
Kabale	99	99	0	0	0
Rukungiri	24	9	69	0	0
Ntungamo-Kajara	91	61	80	3	3
Bushenyi-Ruhinda	97	10	74	1	0
Nebbi	10	14	3	0	27
Gulu	48	56	1	35	44
Mpigi	6	5	0	0	1
Iganga	0	45	0	85	0

Source: MUIENR, 1992

There is a long-standing misconception that drained wetlands provide superior and sustainable returns to crop production. To correct this misconception will require increased public awareness through environmental education. Examples of such previously misconstrued drainage activities include the

- *Kirurumu valley in Kabale* - drained to provide forage production for dairy enterprises. Although technically sustainable, such drainage may lead to a reduction in the access to the wetland by smallholders and others and render the desirable multiple use of wetland impossible to achieve.

- *Masaka town* - the water supply for Masaka town is obtained directly from a wetland at one end while sewage from the town is discharged directly into a wetland at the other end. The effluent treatment wetland has been partially drained to allow for the growing of horticultural crops. This exposes farmers to the risk of being infected with untreated sewage, and the municipality with an obligation to invest in sewerage treatment facility.

- *Nakivubo channel swamp and Luzira swamp, Kampala* - the situation is similar to that in Masaka, except that the destruction of the filtering capacity of the swamps down-stream of

Bugolobi Sewage Works will lead to contamination of the Inner Murchison Bay at Gaba from which all of Kampala's water supply is drawn.

4.3.5.2 Industrial pollution

Although wetlands help to stop floods, their capacity to do so is not unlimited. Industrial discharges can damage wetland ecosystems, impairing their natural functions. The wetland system of Lake George, designated by Uganda to the Ramsar Convention in March 1988, is estimated to cover an area of 20,650ha. The wetland lies almost completely within the boundaries of Queen Elizabeth National Park. One of the affluent rivers traversing the wetlands and discharging into the Lake originates from the Kilembe mines area. Its water contains high concentrations of dissolved copper cobalt and iron. Also on a site draining into this river is an unstable stockpile of cobalt sulphide ore. This stockpile has been shown to be contaminating the life systems in the park, including the more than 57 fish species, wildlife and human life through the food chain.

The government of Uganda is currently encouraging increased industrialization. If the location of industries follows the present pattern, the wetlands of Lake Victoria face increasing industrial pollution unless environmentally benign designs are incorporated into the establishment of manufacturing enterprises. If the decision is to decentralize industrial development, Uganda's wetlands risk pollution in other localities as well.

4.3.5.3 Other industrial impacts upon wetlands

There is paucity of data on the quantities of effluent discharged by industries into the wetlands. It is true that wetlands have great capacities to strip effluent discharged by industries. However, the amount of effluent that Uganda's wetlands can sustainably strip is not known. Furthermore, some industrial activities such as brickmaking render wetlands ineffective through the mining of clays and removal of vegetation. New industries are likely to be established in the country, and the demand for bricks in the construction sector is growing. These developments, collectively, pose a threat to the wetlands system in the country.

4.3.5.4 Excessive harvest of natural products

Many products are derived from the biomass produced in wetlands. These include papyrus reeds, poles and posts for housing construction, fuelwood, and bark and other vegetative material for traditional medicines. Some species of fish are also harvested from wetlands. Increased demand for all these products is likely to generate pressure on the ability of wetlands to supply on sustainable basis. Lubigi swamp, on the outskirts of Kampala, shows signs of over-harvest of papyrus for screen making. Only papyrus of the correct diameters of 2-3cm is suitable for the production of mats and screens. The harvesting of papyrus is currently being carried out after very short intervals of about three months. However, preliminary studies indicate nine months as a suitable interval for sustainable harvesting of papyrus.

4.3.6 Factors affecting wetlands management

4.3.6.1 Ownership

The single most important factor affecting the management of wetlands is its ownership. In other words, who has ownership and disposition rights over the resource?

In Uganda, ownership of land is represented by a number of tenure systems, some colonial in origin (customary tenure, mailo land system, freehold and leasehold). The Land Reform Decree of 1975 attempted to convert all land tenure systems into a uniform leasehold type. However, the decree was not well implemented and Uganda is currently reviewing its land tenure policy with a view towards a uniform freehold system. But until then, customary land tenure is the predominant form of land ownership in Uganda, followed by mailo/freehold and then leasehold.

- *Customary land tenure* is inconvenient for the purposes of rational management of wetlands. Under this system, wetlands are a common property resource with no defined responsibility for their maintenance and conservation. The nature of the tenure does not easily lend itself to interventions such as statutory regulation. Furthermore, local custom is ineffective in addressing the challenges posed by modern needs of conservation or prevention of wetlands reclamation[132].

- *Mailo/freehold tenure* represents private ownership of land where both ownership and disposition rights are clearly spelt out. Unfortunately, in the absence of stringent regulatory measures, wetlands conservation on privately held lands is difficult in that the government does not have authority to intervene.

- *Leasehold tenure* makes wetlands management easier. It allows the attainment of both conservation as well as development goals by the inclusion in a lease agreement of public lands conditions. These have the effect of balancing and integrating the seemingly contradictory phenomena of conservation and development. At present, leasee agreements for public land carry a general condition that the leasee shall not allow the land to be impoverished[133].

A significant proportion of Uganda's wetlands are associated with streams and rivers. For these wetlands, the government has the sole right to them as stipulated under the Public Lands Act (Cap 30). The use and management of streams and rivers (and therefore including wetlands) is vested in the Urban Authorities under the Urban Authorities Act (Cap) 31[134].

4.3.6.2 Fisheries development

Wetlands provide significant and sustainable annual catches of fish. The two important fish species are *Clarias* (Male) and *Dsozi Protopterus* (Maruba).

Swamp wetlands are important breeding grounds for some fish species[135]. Furthermore, the swamp wetlands also represent some of the most suitable sites for fish farming. As part of its objectives, the Fisheries Department of the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) is charged with: facilitating better standards of living for fishing communities, and facilitating fisheries and environmental conservation to ensure the rational exploitation of the resource. Therefore, the main role the Fisheries Department could play in the development of sustainable fish farming in wetlands is to assist with developing appropriate management techniques and the fisheries resource itself with respect to species selection. It can also train fish farmers.

4.3.6.3 Policies and institutions

Through appropriate policies, the wetlands of Uganda can be managed wisely to provide a sustained supply of a multiplicity of goods and services. On the other hand, inappropriate policies can lead to the deterioration of wetlands thus limiting their abilities to provide the range of goods and services demanded by society. The rice growing schemes of Kibimba and Doho were intended to increase

agricultural production and contribute to Uganda's self-sufficiency in rice production. Unfortunately, this attempt to "reclaim" wetlands resulted in the loss of wetlands while, at the same time, the expected returns became questionable (yields at Kibimba Rice Scheme were 1.7 tons/ha against a projected rate of 4.9 tons/ha).

4.3.6.4 Developers

Any development in the country is likely to impact on the wetlands, whether it is in the construction, agriculture or manufacturing sectors. In response the Department of Environment Protection has produced a set of guidelines which developers are required to follow[136]. Key features of the guidelines are:

- environmentally-sound management.
- sustainable use of wetlands.
- any change of use of a wetland must allow those traditional uses to continue without exclusion of the people.
- users of a wetland must ensure that its overall water balance is maintained.
- no fish species may be cultured that is not indigenous to the wetland.
- fish ponds constructed within a wetland should be constructed on the sloping sides of the wetland, making use of a gravity flow of water.
- no fungicide, pesticide or fertilizer may be present in the waste water from a fish pond unless with prior consent by the Department of Environment.
- grazing of cattle in wetlands, particularly seasonal ones, is permitted provided that no fencing is erected to exclude the local community and their cattle.

4.3.7 Institutions, research and awareness

4.3.7.1 Institutions

The government and parastatal organizations concerned with, interested, in and responsible for wetlands management are

- *Department of Environment Protection* in collaboration with the World Conservation Union (IUCN) launched a National Wetlands Conservation and Management Program which aims to assist the Government of Uganda develop a national policy for conservation and management of wetlands. The program has been working with 15 ministries and/or departments.
- *Department of Fisheries.* The program on water environment is basic to fisheries research especially in ecosystems that are likely to be affected by impacts such as aquatic pollution, overfishing, foreign species introduction, and water hyacinth infestation.
- *Forest Department.* The wetlands are being managed in a joint effort with other institutions focusing on the impact and trend of devegetation of marginal wetlands. For example, along River Nile and northeastern shores of Lake Victoria, wetlands are being replaced by gardens. The Forestry Department is also concerned about the impact of brickmaking on wetlands.

- *National Environment Action Plan (NEAP)* recommends that the Department of Environment and National Wetlands Program should carry out a full inventory of wetlands to determine their location and status and also to determine the human values. NEAP intends to provide a broad framework for integrating environmental issues into the overall national socioeconomic devel opment plan.

- *Department of Agriculture* wetlands component is concerned with the reclamation of wetlands for agricultural (cultivation) activities, eg. for growing of potatoes, rice and yams; and including drainage of valleys for dairy farms in Kabale, Bushenyi, Kumi, Pallisa districts.

- *Department of Animal Industry* is concerned with water availability and quality; pasture in the wetlands for livestock consumption; and disease and pest control in those areas suitable for sustainable livestock production;

- *Uganda Freshwater Fisheries Research Organization (UFFRO)* now known as the Fisheries Research Institute (FIRI). This organization has embarked on studying the impact of environmental factors like pollution and water hyacinth on Lakes Victoria and Kyoga. UFFRO has also made a study on some water quality related problems on Lake George, Kazinga Channel and Lake Edward. UFFRO is in a position to collaborate with national partners in conducting research on biodiversity. Recently under NARO, UFFRO has received a new mandate and set of responsibilities and is now known as the Fisheries Research Institute (FIRI).

- *Makerere University Institute of Environment and Natural Resources (MUIENR)* is engaged in education on environmental and natural resource issues for sustainable development in the country.

- *National Water and Sewerage Corporation (NWSC)* is involved in the management and monitoring of sewage discharge to the effluent swamps eg. wetland on the southwestern side of Masaka town and the Inner Murchison Bay area in Kampala. It is concerned with quality of water in the wetlands affected by sewage/waste discharge.

- *Uganda Electricity Board (UEB)*. The consumption of hydroelectric power is also influenced by use of alternative sources of energy particularly biomass fuel (woodfuel) which exists in wetlands.

- *Uganda National Parks (UNP)* is concerned with conservation of endangered species found in wetlands and control of hunting of endangered species and burning

- *Department of Energy* is looking into the use of alternative sources of energy from papyrus and particularly the harvesting of woodfuel from swampy areas. The National Biomass Study is expected to improve upon the availability of data on potential and actual biomass supply for energy needs

The long list of government departments, institutions and other organizations responsible for management of Uganda's wetlands demonstrates the complexity of the issue. Collaborative arrangements must be put in place to ensure coordination.

4.3.7.2 Research priorities

The realization of the important role wetlands play and the increased focus on their wise use is

relatively new for Uganda. Previously, wetlands were seen largely as areas to be "reclaimed" for the expansion of agricultural production. Hence, there is very little data on their extent, functions, diversity and economic values. This is not to suggest that there was no research done on Uganda's wetlands. Far from it: such work was carried out as early as the 1950s [17].
Research is urgently needed into Uganda's wetlands. Priority areas include:

- a comprehensive inventory to determine the size, distribution and ecological diversity of the wetlands.
- the functions of wetlands.
- resource accounting to determine wetland values.
- crane counts and water fowl surveys.
- socioeconomic impact assessments of wetlands management scenarios and policy options.

4.3.7.3 Government/public awareness

To ensure the efficient utilization of Uganda's wetlands, both public servants responsible for their management and users of wetlands need to be made aware and kept informed of the range of values. All government sectors, particularly those at the district level, need to be provided with technical guidance to assist them in evaluating wetlands development.

The public, including user communities, developers, opinion leaders and environmental groups should, also be provided with information about wise use of wetlands and encouraged to develop wetlands sustainably. Such information is to be made available in the form of leaflets, posters, radio and television. Also the "Guidelines for Developers" information should be made freely available.

5.0 POPULATION, HEALTH AND HUMAN SETTLEMENT

5.1 Population

5.1.1 Introduction

The impact of population growth on development has been debated for centuries[148]. Emphasis is now shifting from focusing solely on short term economic growth to long-term sustainable development which requires economic growth, conservation of the environment, and an understanding of population dynamics.

In Uganda, the human population impacts on the environment in four ways

1. *Population size* - Each person added to the country's population increases basic needs for food, energy, shelter, water, social services and infrastructure as long as he/she lives; these needs are met by harnessing the environment

2. *Multiplying factors* - Each individual's impact on the environment is multiplied by (i) his/her level of consumption of natural resources (closely related to one's standard of living) and (ii) the level of technology used to support that level of consumption [137a]

3. *Density* - Increasing concentrations of people can limit the ability of renewable natural resources to replenish themselves and can cause fragile areas to be overused and destroyed. Increasing population density can also lead to the use of fewer resources, such as land in cities, and lead to opportunities for managing wastes and reusing and recycling resources

4. *Economic consequences* - When human populations grow so large or so rapidly that they overwhelm the ability of natural systems to absorb wastes and to replenish themselves, the incremental cost to society of supporting additional people becomes much greater than previous costs, and the environmental damage is greater

Population, however, is not static. Uganda has undergone rapid changes in population size, growth, distribution and urbanization. Most of the people continue to live in rural areas and work on the land. In the following sections, changes that will greatly influence development are highlighted.

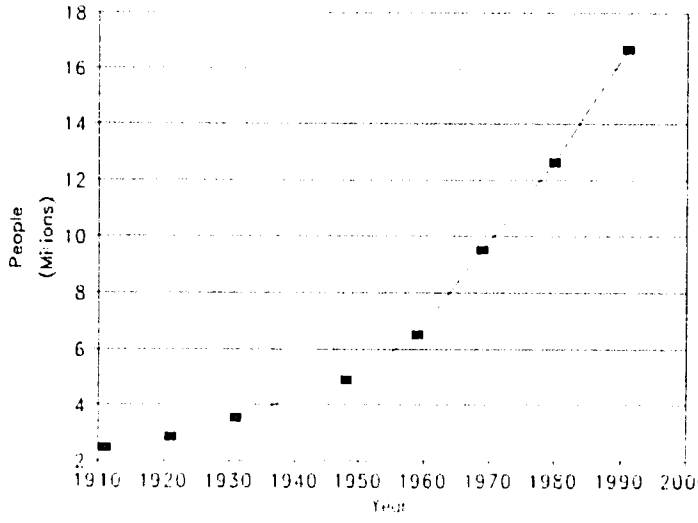
5.1.2 Population size and growth

The demographic data of Uganda goes back to 1911. However, the early censuses were not as detailed as the latest ones. For this reason, inter-temporal comparison of some demographic variables is limited (**Table 5.1**). Most of the information on earlier censuses of 1911, 1921 and 1931 were head counts and not quite precise. According to the 1921 census, the recorded African population was 2,847,700. By 1931 it had increased to 3,536,260. In 1991 Uganda's population was 16,671,700, having risen from a population of 2,463,900 in 1911, an increase of 576.7%[c] (**Figure 5.1**)

[a] *These variables yield the basic formula* [137]
Environmental impacts = Population size x Level of Affluence x Level of Technology

[c] *The population quoted for 1931 is only African. Foreigners were very few.*

Figure 5.1: Population trend, 1911-91



Source: Population Censuses of Uganda

Table 5.1: Demographic indicators of Uganda, 1911-91

YEAR	POPULATION	INTERCENSAL GROWTH RATE % p.a	SEX RATIO	TOTAL FERTILITY RATE	BIRTH RATE	MORTALITY RATE	POP. DENSITY people per Km² land	URBAN %
1911	2,463,400	-	-	-	-	-	-	-
1921	2,847,700	1.5	-	-	-	-	14	-
1931	3,536,200	2.2	-	-	-	-	18	-
1948	4,917,500	2.0	100.03	5.9	42	25	25	-
1959	6,536,100	2.5	99.25	5.9	49	20	33	4.8
1969	9,535,100	3.8	101.9	6.9	50	19	48	7.8
1980	12,636,200	2.7	98.2	7.1	50	17	64	8.7
1991	16,671,700	2.5	96.5	7.1	50	20	85	11.3

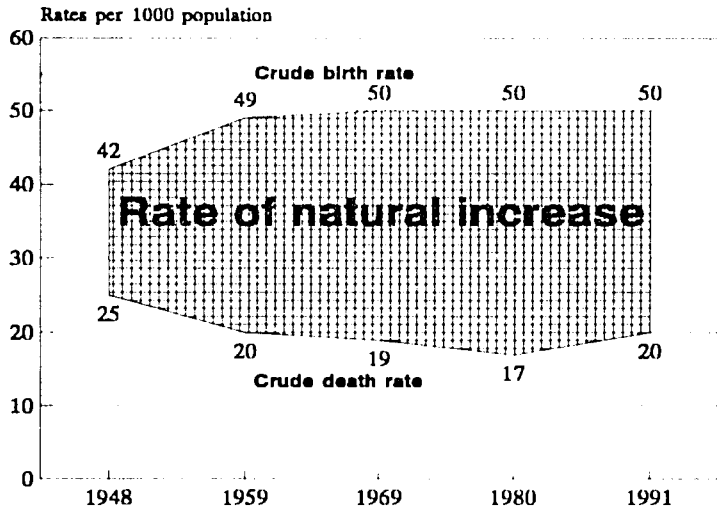
Source: Population Census Results, 1911, 1921, 1959, 1969, 1980, 1991

5.1.3 Changes in fertility

National population growth is largely determined by the difference between birth and death rates over time. **Figure 5.2** shows the components of natural increase in Uganda since the late 1940s. The upper line traces the annual number of births per 1000 population or the birth rate. What it reveals is that the birth rate has been high and stable for a long period of time. The current rate of about 50 births per 1000 population each year is among the highest in the world. It is higher than the weighted birth rate of 46 births per 1000 for Sub-Saharan Africa (SSA)[14].

By contrast, in 1991, the crude death rate stood at 20 per 1000 population. This rate is twice the average for low income countries and substantially above the SSA average of 16 per 1000. The number of deaths per 1000[14] population declined steadily from the late 1940s until the early 1970s as a result of improved health services and hygiene.

Figure 5.2: Birth rates, death rates, and rates of natural increase 1948-1991



Source: Population Census Results 1948, 1959, 1969, 1980/1991. Uganda Demographic Survey, 1988/89

From the 1970s to the mid-1980s, however, the decline in death rates slowed down due to the political turmoil in the country. In recent years, AIDS, which is now the leading health problem of adults, has emerged as another source of out-of-the-ordinary mortality. Still, the rate of natural increase of the population - the difference between birth and death rates - rose over time to about 3.1% in 1991. Thus a continuing high birth rate and a high rate of growth are fundamental population characteristics of Uganda.

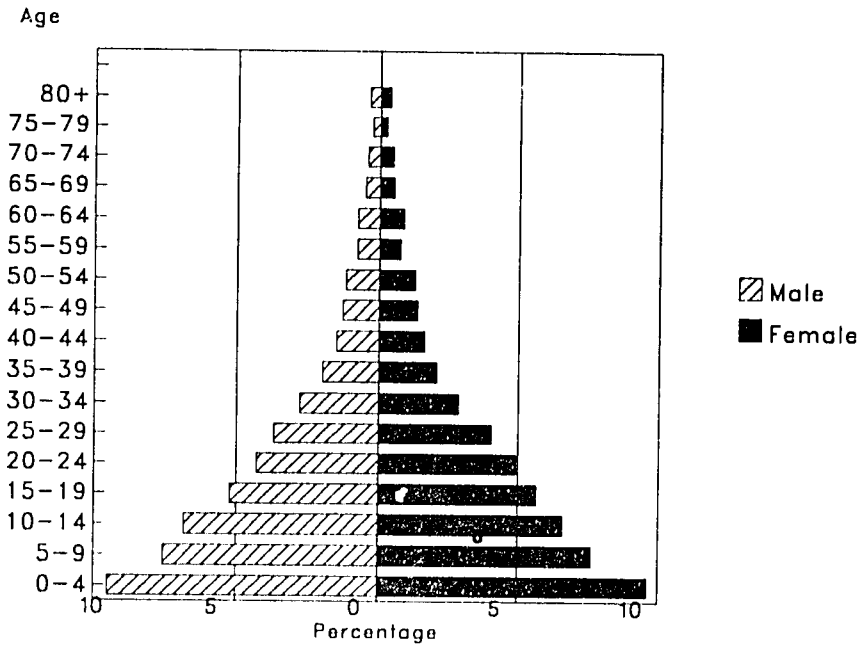
As Uganda aspires to achieve sustainable economic development, population growth must be managed. Evidence suggests that the population of Uganda is going to grow larger no matter what happens to the birth rate in coming years. Before the population can stop growing, two things will have to happen. First, the fertility rate of about 7.1 births per woman will have to drop to at least the replacement level fertility or slightly over 2 births per woman.[3] Uganda's total fertility rate is the highest among 10 SSA countries in which a Demographic and Health Survey was carried out in the late 1980s and the fourth highest among the 120 countries included in the World Bank database.[4]

During the interval that would be required for the fertility to decline to replacement level, the population would still be increasing. A major factor contributing to high fertility is that 54% of women marry before they reach 18 years of age.[5] Polygamy is also common in Uganda. 33% of married women report that their husbands have other wives. This practice declines with higher levels of education.[6] Contraceptive prevalence rate is only 5% compared to 43% and 27% for Zimbabwe and Kenya respectively.[7]

Should fertility decline to replacement levels, the population would still continue to grow for several decades. Limiting the number of births to two children per woman means that eventually the population would reach a zero growth rate, however, a long delay exists between the time families limit themselves to, on average, two children and the time population stops growing. This lag of about 40 to 50 years is due to the present age composition of the population.[8]

Figure 5.3 shows that the number of people entering their reproductive years is greater than the number leaving them. In addition, the number of children who have not entered their adolescent years is even larger.

Figure 5.3: Population age pyramid



Source: MFEP, Final Results of the Population and Housing Census, 1992

5.1.4 Development needs of a growing population

In the meantime, the implications of a growing population for sustainable economic development are many. Uganda will have to continue investing in programs to control population growth. Furthermore, because of the high dependency ratio of 102.6% (the ratio of 0-14 year olds and people aged 65+ to the population aged 15-64)[148], investment in social services (education and health) must be of priority. The dependency ratio is expected to be even higher between 1995 and 2000 due to AIDS[149]. The large numbers of young workers entering the labour force and looking for employment, a function of the youthful age structure of the population, will continue to place considerable strains on the economy. With high fertility maintained, the annual number of new jobs required to accommodate the growing number of workers will have to rise from the present 210,000 to 360,000 in 2008 and to 590,000 in 2018[150].

The rapid growth of the population affects the attainment of fundamental goals in the agricultural sector. It can undermine the ability of the country to alleviate rural poverty by raising agricultural incomes. For example, overall production is much less than it was in the early 1970s. The combination of declining agricultural productivity and a rapidly increasing rural population has meant that the agricultural GDP *per capita* declined precipitously. Based on 1966 constant prices, agricultural GDP *per capita*, the amount of agricultural wealth generated by the economy for every rural inhabitant in the country, fell from about Shs. 420 in 1970 to about Shs. 244 in 1988.[151] If agricultural production

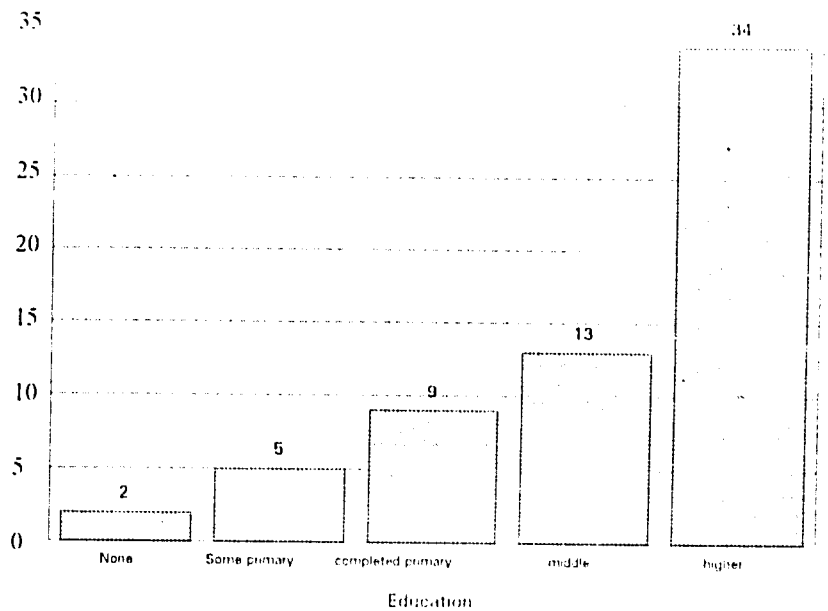
were to increase by 5% per year, with current fertility levels, the agricultural GDP *per capita* would reach about Shs. 441 in 2018 which would only then be equal to the 1970 level[f].

5.1.5 Family planning

At present, 8 out of 10 married women have heard of family planning, but only one in 13 is currently using a recommended family planning method[152]. Family planning use varies greatly by area of residence, from 18% among urban women to only 4% among rural women. Contraceptive prevalence is 25% in Kampala, 7% in western region, and 5% or below in other regions. Similarly, large disparities in contraceptive use are found among women with different educational backgrounds. 34% of married women with a higher-level education use contraception compared with 2% of those with no education (**Figure 5.4**)[153].

Family planning needs to address two important immediate constraints: lack of awareness and religion. These two account for 33% and 20% respectively of the non-use of family planning (**Figure 5.5**). The long term solution lies in education for women and awareness for men.

Figure 5.4: Use of family planning by education (married women 15-49)



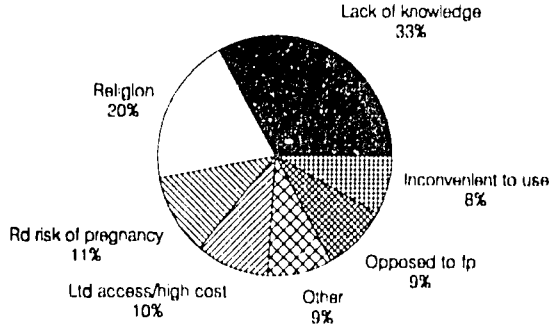
Source: Uganda Demographic and Health Survey 1988-89

The government has recognized the need to gradually increase the appreciation of the social, economic and demographic inter-linkage in local and national planning[154]. To integrate population into planning the government set up a Population Secretariat within the Ministry of Finance and Economic Planning. Its main function is to coordinate the population activities of sectors at national level as well as at the grassroots and to assist government to define population policy in relation to

f The 5% assumed here is equal to the rate of growth achieved over the 1965-70 period, the most rapid period of agricultural expansion in the history of independent Uganda.

development planning. However, it is the National Population Council, made up of high-level policymakers, which advises government on all population matters and is responsible for overall policy coordination, monitoring and evaluation[55]. This council has just completed a national population policy which empahsizes the need to balance population size with natural resource productivity.

Figure 5.5: Reasons for non-use of family planning, 1988-89



fp = family planning
rd = reduced
ltd = limited

Source: Uganda Demographic and Health Survey, 1988-89

Recently, the government has approved decentralized planning through the Local Government (Resistance Councils) Statute, 1993. The District Development committee has the responsibility to prepare, monitor and evaluate plans at the local government level. This committee will be fed by a technical committee which includes the district population officer, the district agricultural coordinating officer and the district physical planner. It is hoped that these and other members to be co-opted will be able to capture the relationship between population and natural resource base and also the relationship between the environment and physical planning.

5.1.6 Population projections

Population projection of Uganda is surrounded by unanswered questions. First, the 1980-91 population growth rate of 2.5% per annum was much lower than the expected 3.0% per annum. Second, the effect of AIDS on population growth cannot be determined with any precision. In 1988 a national survey showed HIV prevalence to be about 9.4%. By the year 2018, the population is projected to be 36.4 million or 43.6 million, depending on whether HIV prevalence is high or low. At the medium prevalence, population is projected to be 40.8 million. The three scenarios all assume that high fertility is continued. The projections are based on the 1988 Demographic and Health Survey.

5.1.7 International migration

Between 1959 and 1969, Uganda experienced net immigration from Zaire and Rwanda and to a lesser extent from the then Tanganyika, Sudan and Kenya. The number of migrants rose from 680,000 in 1959 to 750,000 in 1969. This migration was partly economic in nature, with migrants seeking cash

employment in Uganda, and partly political, with migrants entering Uganda as a haven of peace and stability from surrounding areas of uncertainty and violence[159]. As for the non-African population, over half of this population was found in Buganda (Kampala and Entebbe). A further one-fifth was in Jinja. In 1959 non-Africans represented about 1.3% of the total population. Approximately 73% of non-Africans were Indians. Up to 40% of this population participated in trade, commerce and banking. The period from 1971 to 1986 witnessed a reversal of migration streams because of the expulsion of about 60,000 Asians in 1972 and the political uncertainty that followed. As a result of political stability and the government's decision to return the Asian property which was nationalized in 1972, a good number of Asians are returning to Uganda.

Ugandans have emigrated to neighbouring countries and beyond. Many emigrants from Uganda have been economic migrants with high levels of education. The numbers are not easy to determine, and the number returning cannot be ascertained. The remittance of Uganda emigrants is also not known. The loss of skilled workers represented a severe haemorrhage of human capital.

5.1.8 Internal migrations

Internally, tribes have been moving among districts for various reasons. Migration into Buganda has been going on for decades, largely for cash employment. Buganda experienced economic growth because of its geographical attributes and its early contact with the British. The latter introduced cash crops and established the first administrative centers in Buganda. Another area which has attracted people by virtue of its being relatively developed is Tororo and Mbale in the eastern region. These areas have tended to be more prosperous than the rest of the country. Bunyoro is reported second in receiving migrants, particularly the Bakiga, between 1959 and 1969. While migration into Buganda showed greater bias towards males of working age, Bunyoro experienced agricultural migration of whole families. One of the environmental consequences of rural migration is that people without economic opportunities often move onto marginal lands or into remaining forest areas[160]. The migration of the Bakiga from the then Kigezi district to other rural areas in western Uganda presents itself as an interesting case study of population responding to shortage of land.

The economic consequences of the Bakiga migration is that they got more land. By owning a single piece of land, they no longer had to travel long distances to cultivate their fragmented plots. Besides, they started growing cash crops such as tobacco and tea in Northern Kinkizi, in present day Rukungiri district. They also provided labour in the Kilembe mines and on the estates in Toro or present day Kabarole district.

Despite some of these benefits, migration to new areas is not a permanent solution to population pressure. Nor does it seem to promise overall long-term net benefits. This is because sociocultural variables that result in uneconomic land fragmentation, methods of land utilisation, and diversifying of economic activities do not change when people migrate (**Box 5.1**). The period 1969-80 saw the dislocation of urban services in all of Uganda. During the military rule of 1971-79, many of the urban centres became insecure. As a result, people left some urban areas and took refuge in the countryside. Further, the liberation war which ousted Amin's government in 1979 saw a complete destruction of three urban centres, namely Mbarara, Masaka and Arua. The 1980 census revealed a small growth rate in urban centres, ie. 3.3% for towns with populations exceeding 2000 people.

5.1.9 Population distribution

In Uganda, population distribution is explained by historical, physical, environmental and economic

factors. As it can be seen in **Table 5.2**, the highlands, especially the volcanic ones (Kabale and Elgon), have been favourable for settlement because of the fertile soils and because malaria was not a threat due to coldness associated with high altitude. This explains why these areas support high rural population densities. Nevertheless, despite their soil fertility, these regions have been experiencing out-migrations for decades mainly because of land shortage. On the other hand, the plateau regions of the west and central Uganda carry lower population densities and have been the receiving areas for the migrants.

Box 5.1

Is rural-to-rural migration a panacea to population pressure on land?

A Case Study of Bakiga in Kibale Game Reserve and Corridor

A distinctive feature of settlement in the Kibale forest reserve/game corridor area is the social homogeneity of the population. Virtually all of those settled are Bakiga from the southern portion of the former Kigezi district. Most of the early Bakiga settlers were allocated land by the Batoro chiefs but outside the protected areas. Those who followed them settled in the reserve because of customary tenure systems prevailing elsewhere in the region. These prohibited the granting of land to persons not belonging to the local ethnic group. No such restrictions applied to the reserves. Until recently, there had been little or no official resistance to settlement in the game corridor, despite the fact that large scale settlement began in the corridor in the late 1950s. At the time of the eviction in 1992, the principal mechanism for securing land in the corridor was inheritance.

The Bakiga's migration was caused by land shortage in Kigezi. Land shortage, plus inheritance rules which subdivided family land among all surviving adult sons, had resulted in severe land fragmentation. As far back as 1930s, deterioration of land in Kigezi had been detected by the administration and agricultural officers. In 1943-44, a drought brought to light the urgency for action to reduce population pressure on land. A committee to find out possible areas that would accommodate surplus population from S Kigezi was set up in the Department of Agriculture.

Between 1946 and 1970, government implemented a number of resettlement schemes around Uganda. It is estimated that 100,000 Ugandans were settled on organised resettlement schemes during this period and about 80,000 of these were from Kigezi. Between 1959 and 1964, several hundred Bakiga were resettled in Rumi, Kibaro and Kasenda, areas on the edges of the game reserve. Further, by the agreement between a Bakiga chief and the Batoro king in the mid- 1940s, the Bakiga were permitted to settle at Nyabubale, about 40km southeast of Fort Portal and near the eastern border of the game reserve.

Both the push factor of land shortage and the pull factor of resettlement contributed to further Bakiga migration from Kigezi. With time, problems arose because by 1989, 10% of the land area of the forest reserve and nearly 100% of the game corridor had been converted to settlement and agricultural land use. Kibale Forest Reserve, established in 1932, covers 39,866 hectares. The total area of the game reserve/corridors is 33,915 ha. The forest reserve and the game reserve share an overlapping area of approximately 13,400 ha. The principal function of the game reserve/corridor is to provide an undisturbed link for seasonal wildlife migration between the Kibale forest and adjacent areas in the north of Kabarole district and Queen Elizabeth National park.

In 1991, the Forestry Department wanted to return the forest reserve to its original intended uses. But as many as 60,000 people had settled within the reserve. The great majority (42,000 - 57,000) were settled in the game reserve/corridor. They have now been evicted. About 30,000 of these have been resettled in Buganganzi Resettlement Scheme with assistance from international NGOs.

It is clear that encroachment in reserves and national parks is symptomatic of more fundamental problems affecting land use and resource management in Uganda. People must learn to invest in the land they hold and maximise returns from such land with improved technology rather than think that output can only be increased through new land openings. Besides it appears that most areas to which people migrate are marginal in supporting agriculture.

There is also evidence to suggest that countrywide yields of some crops are much lower than in the past. The resting period of land has also been considerably reduced, affecting the condition of soil fertility. The migrating Bakiga in this case did not change their practices of land fragmentation nor did they change their reproductive patterns. Each family was found on average with fifteen people in 1989. The growth of tourism in the 1960s and the revenue derived strongly favour a case for conservation rather than agriculture. It is still too early to establish the costs of evictions. But in summary, migration that is not accompanied by socioeconomic transformation offers no permanent solution to population pressure.

[1] Kabera J B. Demographic Patterns in Uganda and their consequences for Natural Resources Utilization and Management. *A paper presented to a workshop on Renewable Natural Resources, Ecology and conservation 23-24 April, International conference Center, Kampala.*

***Source**: Makerere Institute of Social Research, Makerere University, Uganda and Land Tenure Center of University of Wisconsin, Madison, USA (1989). Settlement in forest reserves, game reserves and national parks in Uganda. A study of social, economic and tenure factors affecting land use: deforestation in Mabira forest reserve, Kibale forest reserve and Kibale game reserve-corridor.*

Furthermore, altitude has strong influence on temperature and this has had a bearing upon crops grown and population distribution. Northern Uganda, which is lower in altitude, has a day temperature averaging 30°C maximum and is dry and less populated than southern Uganda where temperatures do not exceed 27.5°C[161].

Rainfall distribution is another physical factor which affects population distribution in Uganda. The western rift valley region, northeastern Uganda and parts of south central Uganda are areas of low rainfall. In a country where most parts receive over 1000 mm mean annual rainfall, areas with lower amounts are locally considered dry. Such areas have generally not attracted dense populations. Most of the dry areas, however, receive between 500 mm and 1000 mm per annum which is sufficient to support agriculture if the rainfall is judiciously used.

In contrast, areas with over 1000 mm mean annual rainfall support high populations. They include areas close to Lake Victoria, around Mt. Rwenzori, around Mt. Elgon, the Kigezi and Ankole highlands and the West Nile highlands.

Rainfall alone cannot explain population distribution. The biotic factor, particularly the spread of trypanosomiasis which started towards the end of the 19th century and continued up to the first quarter of this century, is another important factor. The disease occurs between 14°N and 20°S in tropical Africa, and affects humans and their domestic animals especially cattle. It is transmitted by tsetse flies. All tsetse flies belong to the genus *Glossina* and, of the 22 species which are known, 8 occur in Uganda[162]. Consequently, some areas which are still infested with tsetse flies are sparsely populated. They include Kabarole, Hoima, Masindi, parts of Mbarara and northern Uganda.

The development strategies begun during the colonial rule also set in motion forces which continued to influence internal migration and population distribution during the post-independence period. This explains why there is higher population density from Masaka to the western shores of Lake Victoria and along the northern and northeastern shores covering the southern half of Buganda and Busoga regions. These areas were the first to be introduced to cash crops, to start large-scale industrialization and to witness urbanization. Another relatively developed area which has high population density is Tororo and Mbale in eastern Uganda.

5.1.10 Urbanization

The concept of a city arrived in Uganda with colonial rule. The establishment of cities and their locations had more to do with colonial politics and extra-territorial economic concerns than it did with local geography, politics and economic development. Kampala was established as the political capital upon independence. It became the primary magnet for rural to urban migrants because of employment opportunities, business attractions and industrial growth. Urbanization in Uganda has resulted in Kampala (774,241 people) becoming more than ten times larger than the next largest city, Jinja (65,169 people). Jinja is larger than the inter-immediate towns whose populations range from 25,000 to 55,000 people (**Table 5.3**).

During the 1969 census, Uganda's urban population was defined as people living in centers of 1,000 persons or more and, according to this definition, 8.4% of the population was urban. When a 2,000 population definition was used, 33 major urban centers emerged with a total population of 668,264 or 7% of Uganda's population. Almost half of these lived in Kampala (330,700 people). The other major towns were Jinja (52,509 people), Mbale (23,544 people); and Entebbe (21,096 people). With

the 1991 census, 1,889,622 or 11.3% of the population was defined as urban[g]. The low level of urbanization is a constraint to development and employment because it limits markets for rural produce and industrial products. Uganda is among those countries with very low urban populations. In comparison, Kenya and Tanzania are 24% and 33% urbanized. The weighted average for SSA is 29%[163].

Table 5.2: Population density by region/district: 1969, 1980, 1991 censuses

REGION/DISTRICT	POPULATION ('000)			AREA (Km2)		POPULATION DENSITY (Per Km2, Land)		
	1969	1980	1991	TOTAL	LAND	1969	1980	1991
CENTRAL								
Kalangala	6.8	8.6	16.4	9340	432	16	20	38
Kampala	330.7	458.5	774.2	181	169	1957	2713	4581
Kiboga	75.7	138.7	141.6	4004	3872	20	36	37
Luwero	315.2	412.5	449.7	9198	8539	37	48	53
Masaka	451.2	622.6	838.7	6986	5531	82	113	152
Mpigi	513.5	661.2	913.9	6278	4514	114	146	202
Mubende	255.3	371.6	501.0	6308	5949	43	62	84
Mukono	541.0	634.3	824.6	14241	4594	118	138	179
Rakai	182.6	274.6	383.5	4973	3889	47	71	99
TOTAL	**2672.0**	**3582.4**	**4843.6**	**61509**	**37489**	**71**	**96**	**129**
EASTERN								
Iganga	470.2	643.9	945.8	13114	4823	97	134	196
Jinja	196.3	228.5	289.5	734	677	290	338	428
Kamuli	278.3	349.5	485.2	4348	3332	84	105	146
Kapchorwa	64.5	74.0	116.7	1738	1738	37	43	67
Kumi	190.7	239.5	236.7	2861	2457	78	97	96
Mbale	421.1	556.9	711.0	2546	2504	168	222	284
Pallisa	202.2	261.2	357.7	1956	1564	129	167	229
Soroti	379.9	476.6	430.4	10060	8526	45	56	50
Tororo	324.9	407.2	555.6	2597	2336	139	174	238
TOTAL	**2528.4**	**3237.4**	**4128.5**	**39954**	**27957**	**90**	**116**	**148**

[g] The population in those areas classified as urban ranges between 774,241 people for Kampala at maximum and 549 people for Rakai Town Board at minimum.

REGION/D	POPULATION ('000)			AREA (KM2)		POPULATION DENSITY (per Km2, LAND)		
	1969	1980	1991	TOTAL	LAND	1969	1980	1991
NORTHERN								
Apac	225.4	313.3	454.5	6488	5887	38	53	77
Arua	369.6	472.3	637.9	7830	7595	49	62	84
Gulu	223.7	270.1	338.4	11735	11560	19	23	29
Kitgum	240.1	308.7	357.2	16136	16136	15	19	22
Kotido	105.6	161.4	196.0	13208	13208	8	12	15
Lira	278.9	370.3	501.0	7251	6151	45	60	80
Moroto	164.7	188.6	174.4	14113	14113	12	13	12
Moyo	90.0	106.5	175.6	5006	4668	19	23	38
Nebbi	204.1	233.0	316.9	2891	2781	73	84	114
TOTAL	**1902.2**	**2424.2**	**3152.0**	**84658**	**82099**	**23**	**30**	**38**
WESTERN								
Bundibugyo	79.4	112.2	116.6	2338	2097	38	54	56
Bushenyi	410.7	524.7	736.4	5396	4906	84	107	150
Hoima	112.7	142.2	197.9	5908	3563	32	40	56
Kabale	288.6	328.8	417.2	1827	1695	170	194	246
Kabarole	328.0	519.8	746.8	8361	8109	40	64	92
Kasese	164.1	277.7	343.6	3205	2724	60	102	126
Kibaale	83.7	152.1	220.3	4302	4208	20	36	52
Kisoro	114.8	126.7	186.7	662	620	185	204	301
Masindi	155.5	223.2	260.8	9326	8458	18	26	31
Mbarara	450.5	688.2	930.8	10839	10587	43	65	88
Rukungiri	244.6	296.6	390.8	2753	2584	95	115	151
TOTAL	**2432.6**	**3392.1**	**4547.7**	**54917**	**49551**	**49**	**68**	**92**
UGANDA	**9535.1**	**12636.2**	**16671.7**	**241038**	**197096**	**48**	**64**	**85**

Notes: Where district boundaries have been changed 1969 and 1980 census figures have been adjusted to 1991 boundaries
Hence these totals do not agree with those given in earlier censuses
Small discrepancies between totals and the sum components are due to rounding

Source: Final Results of the 1991 Population and Housing Census (pre-release)

Table 5.3: Urbanization: Population and growth rates of major urban centers in years(3000 or more in 1980) 1959-91

	URBAN CENTER	TOTAL POPULATION				GROWTH RATES		
		1959	1969	1980	1991	1948-59	1969-80	1980-91
1	Kampala	115,483	330,700	458,503	773,463	10.5	3.1	4.9
2	Jinja	29,867	47,872	45,080	60,979	4.7	-0.6	2.8
3	Masaka	4,782	12,987	29,123	49,070	10.0	7.8	4.9
4	Mbale	13,569	23,544	28,039	53,634	5.5	1.7	6.1
5	Fort Portal	8,317	7,947	26,806	32,627	-0.5	11.7	1.8
6	Mbarara	3,844	16,078	23,255	40,385	14.3	3.5	5.1
7	Entebbe	9,941	21,096	21,289	41,638	7.5	0.1	6.3
8	Kabale	10,919	8,234	21,469	27,905	-2.8	4.7	2.4
9	Tororo	6,365	15,977	16,707	27,013	9.2	0.4	4.5
10	Soroti	6,645	12,398	15,048	40,602	6.2	1.9	10.0
11	Gulu	4,770	18,170	14,958	42,841	13.4	-1.9	10.0
12	Lugazi	8,105	-	10,439	13,668	-	-	2.5
13	Iganga	3,146	5,953	9,899	19,911	6.4	4.9	6.6
14	Kasese	1,564	7,213	9,917	18,559	15.3	3.1	5.9
15	Arua	4,645	10,837	9,663	21,957	8.5	-1.1	7.7
16	Lira	2,929	7,340	9,122	27,143	9.2	2.1	10.4
17	Busia	593	1,146	8,663	27,745	6.6	19.4	11.2
18	Moroto	2,082	5,488	8,129	10,367	9.7	3.8	2.2
19	Hoima	1,056	2,339	6,923	4,536	7.9	10.4	-3.8
20	Mubende	1,877	6,004	6,629	8,192	11.6	0.9	1.9
21	Mukono	450	3,565	5,783	7,446	20.7	4.6	2.3
22	Kilembe	3,825	-	5,686	-	-	-	-
23	Bombo	895	583	5,573	10,603	-4.3	21.7	6.0
24	Kitgum	3,454	3,242	4,961	8,177	-0.6	4.1	4.6
25	Masindi	1,571	5,226	4,958	10,529	12.0	2.9	4.3
26	Mpigi	577	3,401	4,577	7,282	17.7	2.9	4.3
27	Luwero	71	715	4,190	10,917	23.1	17.0	9.1
28	Kisoro	177	1,068	4,122	7,489	18.0	13.5	5.6
29	Kamuli	1,867	2,916	3,903	5,693	4.5	2.8	3.5
30	Njeru	-	4,637	3,880	-	-	-1.7	-
31	Nebbi			3,576	6,970		-	6.3
32	Mbikko		3,458	3,435	-	-	-0.1	-
33	Magamaga	-	4,818	3,417	-	-	-3.3	-

Source: The 1991 Population and Housing Census. Statistics Department. Ministry of Finance and Economic Planning. November, 1993.

5.1.11 Family size and household composition

The National Household Budget Survey of 1989-90 regarded the household as a basic socioeconomic unit that supplies and demands goods and services[h]. The household is a relevant unit for analyzing issues of sustainable natural resource management, sustainable economic development and population growth and distribution. Most important decisions concerning production, investment and consumption take place within the household. It is also a place where the gender division of roles is strong, where reproductive decisions take place and where the impact of sociocultural factors is greatly felt. For example, in Uganda there is a patrilineal system which makes a man the head of the family. The inheritance of property, especially land, also favours boys. Female-headed households are estimated to be 29% of the total households[164]. All these considerations have a bearing on sustainable natural resource use in today's Uganda.

On average, the rural household is larger than the urban household. Due to the absence of previous studies, it is not possible to document the trends in family formation. However, given the fact that the number of people entering their reproductive years is higher than the number of people leaving those years, the population and hence the number of households will continue to rise. Usually household size declines and household numbers increase faster than population. This raises the need to plan for suitable housing facilities, their locations and social services.

5.1.12 Orphans and street children

There is a growing number of orphans in the country. The results of the 1991 Housing and Population Census suggest a total number of 1.48 million orphans or 18% of children below the age of 19 years. Many are found in:

Mpigi	90,192	20% of all children in the district
Rakai	58,339	26% of all children in the district
Masaka	102,542	20% of all children[165] in the district

There are 70 children's homes in Uganda, caring for 2,900 children, many of whom are orphans. These cater for about 0.2% of all orphaned children. Another recent development in Uganda is street children. According to Ministry of Labour and Social Welfare, there are about 2,000 street children (Kampala 1,000; Mbale 300, Busia, 100; Lira 100; Lyantonde 200; and others 300)[166]. The causes include poverty, hunger, broken homes, family disruption due to armed conflict and civil strife[167].

5.2 Income, labour and education

5.2.1 Income and *per capita* expenditure patterns

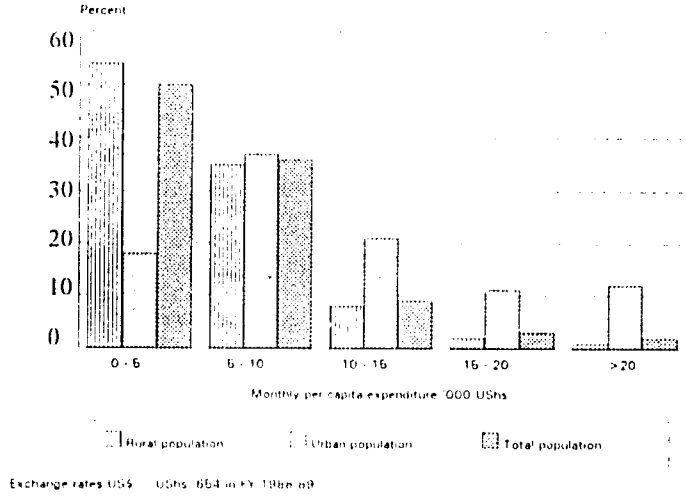
One of Uganda's greatest challenges is to improve the incomes of the poor, who are both agents and victims of environmental degradation. The World Bank has defined two relative poverty lines for Uganda. At the first line of US $110 *per capita* per year, 55% of Ugandans are defined as being poor. Those falling below the second one of $55 *per capita* per year are the poorest and constitute 19% of the population. Generally, the population in urban areas is better off than the rural population. Figure 5.6 shows distribution of persons by monthly per capita expenditure.

According to the World Bank, the sum needed to bring every Ugandan up to or above the poverty line of $110 per year is about $ 5.8 million per month at the 1989-90 average exchange rate[168]. There

h The household here, is defined as a group of persons who live, cook and eat together or a single person who lives alone and eats independently. Going by this definition, there maybe more than one household residing in a house.

is evidence that the country's natural resource base can support economic activities that generate over and above that amount of money. For example, if exports for coffee, cotton and tea were restored to their past peak levels, the earnings that would be generated is $ 192 million annually at 1993 prices and assuming all is bought. This is almost three times the amount the World Bank has estimated as being required to bring every Ugandan above the poverty line. But according to the same source, this amount would not be sufficient to provide everyone with access to basic social services.

Figure 5.6: Distribution of persons by monthly *per capita* expenditure, 1988-89



Source: Household Budget Survey, 1989-90

For a country like Uganda, whose GNP *per capita* in 1993 is estimated at under US $170, the importance of reducing poverty cannot be overemphasized[169]. With such low incomes, it is not surprising that much of the household expenditure is used to satisfy basic needs. **Table 5.4** shows an inter-country comparative analysis of the structure of household consumption. It is clear that Ugandan households are still preoccupied with satisfying the need for food. Compared to other countries, Ugandan households' investment in medical care and education is very low.

Table 5.4: Inter-country comparison of the structure of household consumption in percentage, 1992

ITEM	UGANDA	TANZANIA	KENYA	ZIMBABWE	MAURITIUS	USA	JAPAN
Foods, beverages & tobacco	69	64	53	40	24	13	16
Clothing & Footwear	6	10	7	11	5	6	6
Gross Rent, Fuel & power	6	8	12	13	19	18	17
Health & medical care	1	3	3	4	5	14	10
Education	2	3	9	7	7	8	8
Transport & Communication	3	2	8	6	11	14	9
Others	12	10	22	20	29	27	34

Source: MPED [1991] Report on the National Household Budget Survey - for Uganda. World Development Report 1992 - for other countries

Poverty in Uganda is largely a reflection of the fact that the economy failed to achieve sustained growth for a quarter of a century (1965-90). During this period, Uganda's GDP *per capita* declined at an average annual rate of 2.4%, compared to a weighted average annual growth of 1.7% for low-income countries.[170] Uganda consequently has a low human development index (HDI) (**Table 5.5**). UNDP uses HDI to rank countries using a combination of three indicators - life expectancy, literacy, and living standards as measured by GDP *per capita*. Programs that translate economic growth into education and health care are essential to produce a better life for a nation's people.[171] The question then becomes: how soon can Uganda develop its human resource comparable to other countries?

Table 5.5: Inter-country comparison of Human Development Index (selected years).

COUNTRY	1970	1985	1991	1992	1993
Tanzania	-	-	-	0.269	0.270
Kenya	0.253	0.434	0.399	0.366	0.396
Uganda	0.241	0.273	0.204	0.192	0.194
Japan	0.853	0.997	0.993	0.981	0.983

Source: UNDP Human Development Reports 1991, 1992, 1993

Uganda's GDP has been projected to grow by at least 5% up to 1994-95. At the same time, population growth rate per annum is estimated at 2.5%. Going by these variables, GDP *per capita* will double in 29 years. To reduce the period by a half, that is to make GDP *per capita* double in 14 years assuming the same rate of population growth of 2.5%, GDP *per capita* will need to grow at 8% per annum. Doubling GDP *per capita* by the year 2005 (or approximately $ 340 GNP *per capita*) will still leave Uganda a very poor country. To reduce the period even further will need either more investment or reduced population growth, or both. Whatever policies are taken to improve the economic growth, they will need to be accompanied by equitable distribution of income.

5.2.2 Labour trends and characteristics

The size and quality of the labour force and its attitude towards work have a bearing on the growth of the economy. It is reported that the countries that have succeeded in reducing poverty over the long term have encouraged broad based rural development and urban employment, thereby increasing the returns to small farm production and wage labour[172]

Eighty-nine percent of the population is employed in the rural economy, mainly in agriculture (**Table 5.6**). Most of the agricultural employment is in household farming, which is based on a very high degree of labour intensity. On average, a member of the agricultural labour force works on 0.9 ha of land. It is estimated that the amount of land per agricultural worker could be raised to 3 ha if labour and/or a complementary resource to bring land under cultivation were available[173] Relative to land, labour is a scarce factor of production. Most households have small farms: 62.2% of farm households have 1 ha or less land; 85.1% of farm households have 2 ha or less; 95.5% of farm households have 4 hectares or less[174] Large scale commercial farms including plantations command very small proportions of both agricultural land and labour. By and large, 95-97% of the population have some land. Another characteristic of the labour force is that it supports a large population which is unable to undertake any productive work (**Table 5.7**).

The incidence of wage labour is low, perhaps not much more than one-tenth of total labour used[17].

Of the total wage labour employed in agriculture, casual and short-term contract workers account for a very high proportion. The incidence of permanent workers is very low. This is because most members of the rural labour force are predominantly occupied with work on their own farms. Very few are available for employment on a long-term basis. The relationship between the return to labour on household farms and wages in alternative activities can, however, be very complex. By and large, work in household farms is the most remunerative occupation for the unskilled person.

The service sector, which ranks second to agriculture, employs 16% of Ugandan workers, mainly in urban areas. Sixty-five percent of urban workers but only 10% of rural workers are employed in services[1]. Employment in urban services is dominated by public sector workers.

Table 5.6: Percentage distribution of employed household population by industry and sex, 1988-90

INDUSTRY	URBAN			RURAL			ALL UGANDA		
	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL
Agriculture	13	26	19	82	94	87	74	88	80
Mining and Quarrying	0	0	0	0	0	0	0	0	0
Manufacturing	9	4	7	2	1	1	3	1	2
Electricity/gas/water	2	0	1	0	0	0	0	0	0
Construction	10	0	5	1	0	0	2	0	1
Trade, hotels, restaurants	24	36	29	6	3	5	8	6	7
Transport & Communication	13	1	8	1	0	1	2	0	1
Financing, business services etc	9	7	8	1	1	1	2	1	2
Community, social services, etc	20	27	23	7	2	4	8	4	6
Activities not defined	0	0	0	0	0	0	0	0	0
TOTAL	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

All figures rounded off

Source: Household Budget Survey 1989-90

Industries employ only 3% of all workers, 13% of urban workers and 2% of rural workers[1]. Formal manufacturing enterprises, that is, those employing five or more workers, account for 0.8% of the labour force[2]. Thus a very large proportion of those employed in industries are actually engaged in informal, low output and rudimentary activities which provide little income.

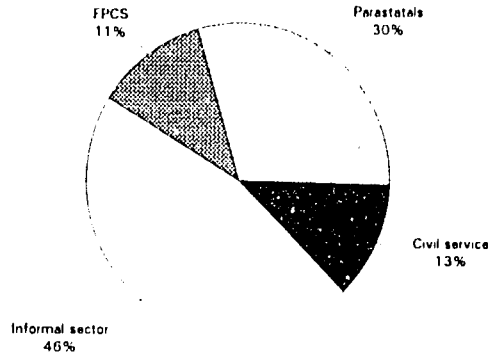
Women account for only 20% of employment in the formal sector and 26% of employment in the

[1] *Services include a wide variety of activities, ranging from the relatively highly productive, but numerically tiny tertiary services (eg. modern finance, transport and trades) to rudimentary trading in the urban informal and rural subsistence sectors.*

[2] *Industries include both modern and traditional manufacturing as well as construction, electricity, gas and water.*

skilled categories[177]. Discrimination against women as members of the labour force consists of extracting more labour out of them, and relegating them to less productive and less remunerative activities than men. An unknown but large number of children are also workers. Almost all working women have a helper at home, many of whom are below 18 years and are not paid a salary. There is no law regulating domestic child employment. According to the Employment Decree, 1975, a person may employ a child of 12 years on such light work as the minister may prescribe by statutory order. No minister has ever prescribed what is meant by light work.

Figure 5.7: Distribution of urban employment in mid-1992[178]



FPCS = Formal Private/Cooperative Sector

Source: World Bank (1993) Uganda: Growing out of Poverty

Table 5.7: Percentage distribution of household population by primary activity

PRIMARY ACTIVITY	UGANDA-URBAN			UGANDA-RURAL			UGANDA-TOTAL		
	MAL.	FEM.	TOTAL	MAL.	FEM.	TOTAL	MAL.	FEM.	TOTAL
Too young or old or disable to work	26	24	25	28	29	28	28	29	28
Student	28	25	27	29	23	26	29	23	26
Own account worker	15	11	13	26	13	19	25	12	19
Employer	2	0	1	1	0	0	1	0	0
Employee	23	11	17	6	1	4	8	2	5
Helper in household enterprise	2	7	5	8	21	15	7	20	14
Attending household duties	1	20	11	1	12	7	1	13	7
Pensioner, renter, etc.	0	0	0	0	0	0	0	0	0
Unemployed	1	1	1	1	0	1	1	1	0
Others	0	0	0	0	0	0	0	0	0
TOTAL	100	100	100	100	100	100	100	100	100

All figures rounded off.

Source: Household Budget Survey (1989-90)

There are other characteristics and trends which will bear greatly on the performance of the economy. The high contribution of the informal sector to employment is well known. In urban areas, it offers 46% of total employment (**Fig. 5.7**). It was observed in 1989 that "the modern/formal sector could not cope with the growing number of job seekers in the 1970s or early 1980s in Uganda; and cannot cope with it in future"[179]. Unfortunately, there are no specific institutions geared to development of informal sector activities. For example, most informal activities are discriminated against by banks. Training institutions tend to also overlook the training needs of the informal sector operators. They fail to take into account that entrepreneurs find it difficult to participate in full-time training programs. It is felt that the emphasis should be on policy reforms rather than on a direct program of assistance to the informal sector.

It is a strongly held view that the private sector alone cannot become the "engine" of growth and employment of this nation unless there are deliberate actions by the government to identify and remove constraints to growth[180]. Even more employment opportunities are needed in the private sector with the demobilization of soldiers (23,000) and civil servants (14,000). In the formal sector, low pay forces many employees either to indulge in other activities or reduce their effective hours at work.

By and large, it is difficult to predict the trends of the labour force over the next few years because many changes are taking place at the same time, including civil servant retrenchment, parastatal reorganization, outcry for a living wage, an increased number of unemployed graduates, brain drain and educational reform. The reported level of unemployment is 7% in the urban and 7% in the rural sector[181]. No documented data is available on under-employment[182]. However, there is sizeable disguised under-employment in the public service and in parastatals in the form of low productivity[183]. The reduction of the civil service is based on the understanding that the remaining service should be well remunerated and therefore more productive. It would also require the restoration of a culture that supports hard work.

5.3 Environmental health

5.3.1 The link between health and environment

There is a strong link between the quality of the environment and health: what happens in the environment directly or indirectly affects health. And when their health is affected, the ability of people to develop and manage their environment is undermined. Environmental health is that aspect of public health concerned with all factors, circumstances and conditions in the environment that can exert an influence on human health and wellbeing.

The living and non-living disease agents that affect health are found in the environment. Poor living and working conditions expose people to physical, chemical and biological pollution and to adverse psychological and social factors that may harm health. Similarly, the environmental condition of human settlements is a basic factor governing physical and mental health and the social wellbeing and general quality of life of the people who live in them. The level of hygiene in human settlements is very crucial.

Furthermore, humans through their endeavour to survive also influence their environment, mostly negatively. They may use water and return it to the environment in a polluted form. The polluted water then harms human health and that of other living organisms. Other human activities that affect

the environment and possibly human health include industrialization, agriculture, transportation and mining. The complete state of health cannot thus be attained without a clean environment. A healthy environment does not only mean provision of health services but also clean air, clean water, proper sanitation, safe food supply, proper nutrition, socioeconomic production systems and consumption patterns that do not harm the physical, social and biological environment. This is indeed the underlying connection between health and environment.

The Ugandan people are exposed to a number of environmental factors that influence their health, and it is often difficult to know which agent is the cause of illness or death. This is complicated further by the fact that statistics on causes of death in Uganda are unreliable since not all sick people go through hospitals. The ways to promote good health in Uganda for the present and future generations are summarized in **Box 5.2**

5.3.2 Health trends

The broadest measures of human health, life expectancy at birth and mortality among children under age 5 and infants under age 1, appear once again to be improving after the difficulties of the late 1970s and early 1980s. In 1991, life expectancy at birth was 47 years, having been 43 years and 48 years in 1960 and 1975 respectively.

Figure 5.8 shows trends in infant and childhood mortality rates for three five-year periods[A]. The decline in health delivery services in the 1970s and early 1980s due to political instability are evident. The reversal of this trend is also noticed after 1983. During the period 1983-88, health services, especially those aimed at preventing diseases among children (eg. immunization programs), improved markedly. By the end of the 1983-88 period, infant mortality had declined by 11%, childhood mortality by 9% and the overall probability of dying between birth and exact age five by 10%[184]. However, the impact of HIV may change this picture.

Box 5.2

How to promote good health

SAFE ENVIRONMENT

Control physical, chemical and biological hazards

ENHANCE 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

Cautious scepticism is better than uncritical enthusiasm

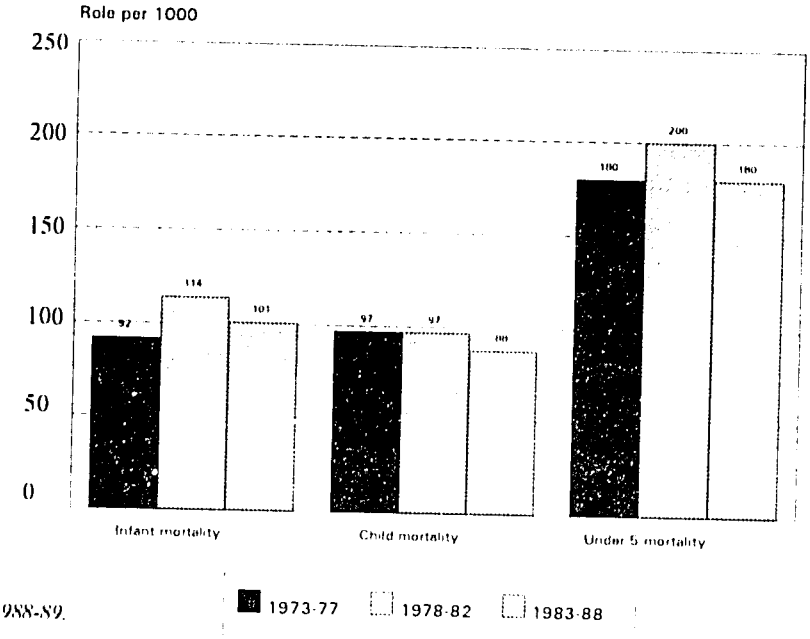
INSTITUTIONAL SUPPORT

Good policies and institutions to support health delivery systems

Adopted from Last, M.J. (1987) Public Health and Human Ecology

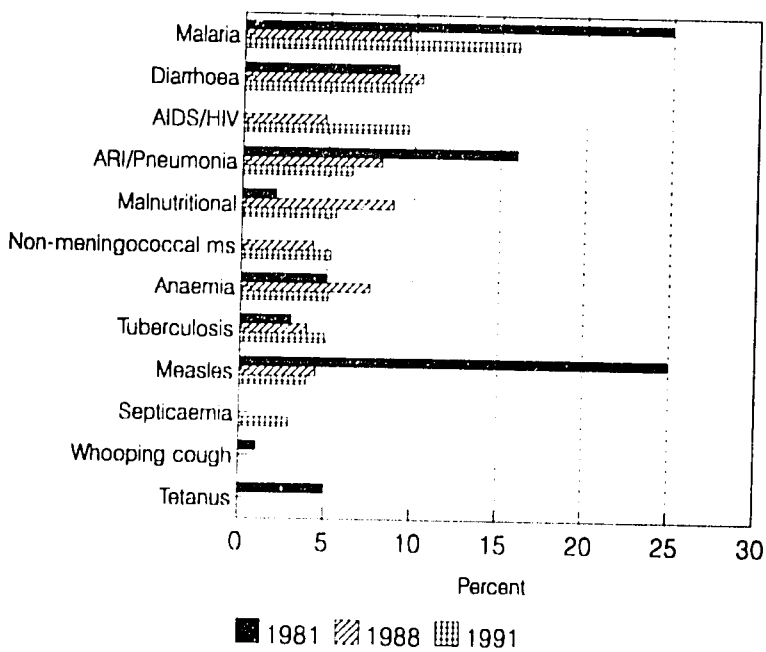
[A] *Infant mortality refers to deaths of infants at birth and up to one year. Childhood mortality refers to deaths of children between one and five years.*

Figure 5.8: Trends in infant and child mortality for three five-year periods



Source: DHS 1988-89.

Figure 5.9: Top ten causes of in-patient mortality: 1981, 1988 and 1991



Source: MOH Health Planning Unit

5.3.3 Causes of death and disease

The main causes of mortality and morbidity are environmental in nature: they are caused by living and non-living agents in the environment, poor sanitation and hygiene and poor eating and feeding habits. It is no surprise that malaria, diarrhoea and malnutrition are among the ten top causes of mortality in Uganda (**Figure 5.9**)

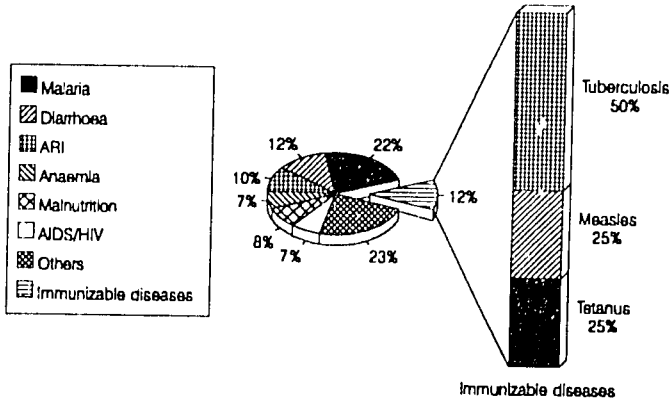
5.3.4 Death of children and mothers

The high infant and under-5 mortality rates for 1991 of 122 and 214 per 1,000 live births[185], have their immediate causes in the interplay between malnutrition and common diseases, including malaria, respiratory tract infections, diarrhoea, some of the immunizable diseases and AIDS (**Figure 5.10**). The incidence of death from the most common immunizable diseases (measles, tetanus, tuberculosis, whooping cough, diphtheria and poliomyelitis) has been reduced greatly since 1981

An estimated 20% of babies are born underweight, and 55% of households consume less than 80% of the recommended daily energy intake. As a result of this, and poor weaning practices, 23% of children suffer from either moderate or severe malnutrition[186].

More than 50% of women give birth at home without any specialized assistance. The fact that many of them are below 18 years and others are near menopause further jeopardizes their chances of survival. Maternal mortality is high at a rate of 500 maternal deaths per 100,000 live births[187]. Only 26% of women deliver in health institutions with assistance of trained personnel. Another 23% use traditional birth attendants.

Figure 5.10: Leading causes of death of children under the age of 5, 1991



ARI = Acute Respiratory Infections

Source: Health Information System, 1991

5.3.5 Diseases caused by improper food hygiene

Owing to poor sanitation, there is serious contamination of food by different infecting agents. In Uganda, as many as 24.5% of people in rural areas excrete on land, often near their dwelling units. Faecal material then contaminates food and water. In urban areas, many small eating places operate without licence. Some are unhygienic; some food vendors move with food as they look for customers.

Roasting of pork and chicken is very popular along the main highways. These areas sometimes lack the necessary sanitary facilities, and the food handlers themselves are usually not clean. The Public Health Act (1964) places the responsibility of overseeing matters pertaining to public health on urban and local authorities. These responsibilities, which include regulation of water and food supplies and setting standards for housing, are largely not met because the enforcement organs are weak.

5.3.6 Diseases associated with water pollution

Water-related diseases can be classified broadly into the following epidemiological groups: water-borne diseases, water-washed diseases, water-based diseases and water-arthropod diseases.

- **Water-borne infections** are transmitted by water from humans to humans through the oral-faecal route. They include the bacterial diseases of typhoid fever, cholera and bacillary dysentery and the viral diseases of polio and infective hepatitis. In 1991, intestinal worms ranked third among the causes of morbidity, with 1,005,006 cases or 9.4% of total morbidity, poliomyelitis was responsible for only about 943 cases. According to UNICEF, the expected incidence of poliomyelitis is 9-12 cases per 100,000 population[188].

- **Water-washed diseases** are those due to lack of enough water for personal hygiene. Examples are skin diseases, particularly scabies and trachoma. In many rural areas women and children walk long distances in search of water. In urban areas water charges are high and, as a result, low income earners get water under unhygienic circumstances. In 1991, skin diseases were among the top ten diagnosed causes of morbidity (600,943 cases representing 5.6%[187] reporting of total morbidity).

  The Uganda National Program of Action for Children aims to increase the provision of clean water within less than 1.5 km of the user from 23% to 75% and access to adequate sanitation facilities from 30% to 70% of the population by 1994-95[191]. Achieving this goal will have a marked effect on water-borne and water-related diseases such as diarrhoea, guinea worm and malaria.

- **Water-based diseases** are those where the intermediate host lives in infected waters. Examples are schistosomiasis (bilharziasis) and guinea worm (dracunculosis). The intermediate hosts (vectors) of schistosomiasis are aquatic snails which breed in ponds, lakes, marshes and swamps. In Uganda, schistosomiasis is a countrywide problem. Both types of schistosomiasis (urinary and intestinal) are very debilitating and expensive to treat. **Table 5.8** shows the number of patients and deaths from schistosomiasis from a few reporting hospitals. The main location of this disease has been the northern districts of Uganda.

Table 5.8: In-patient admissions and deaths from schistosomiasis, 1988-90

YEAR	1988	1989	1990
Reporting hospitals	15	18	20
Admissions	480	343	332
Deaths	13	4	11

Source: Health Planning Unit, Ministry of Health

- **Water-arthropod diseases** are those diseases in which the arthropod vectors responsible for transmitting the diseases breed in water. Examples are malaria and onchocerciasis (river blindness). In Uganda, malaria is the leading cause of mortality, accounting for 16% of all deaths and 25.4% of all morbidity cases in 1991[191]. About 25% of all illnesses in children under five are caused by malaria, and mortality by this cause is on the increase. Malaria among pregnant mothers is also a contributing factor to anaemia, premature deliveries and low birth weight[192]. At present local and urban authorities no longer conduct anti-mosquito campaigns which may be the underlying cause of the increase. Allowing grass and crops to grow right into the doorway and failing to eliminate other breeding places like stagnant water helps the mosquito to breed. Malaria is increasing in high altitude areas such as Kabale, which were malaria free in the 1960s, perhaps due to increased temperatures.

The mosquitoes *Anopheles gambiae s.l* and *Anopheles funestus* are the two most important vectors of malaria in Uganda. *A. gambiae* is more prevalent during the rainy season while *A. funestus* occurs in higher densities during the dry season. All the four species of plasmodia that cause human malaria have been identified in Uganda. The most prevalent is *Plasmodium falciparum* which accounts for more than 90% of malaria infections.

Low levels of awareness, lack of adequate public health services and lack of resources at the household level explain part of the increasing impact of malaria. Other factors include the spreading resistance of parasites to the safer and cheaper drugs, poor vector control, poor case management, and virtual absence of specific malaria control activities in the country.

The control of malaria is now limited to individual prophylaxis and treatment. The national supply of chloroquine is theoretically adequate to provide curative treatment for all projected cases of malaria. However, many health units do not have sufficient chloroquine mainly because of inadequate distribution and over prescription of the drugs. Considerable chloroquine resistance exists all over Uganda and may complicate future control efforts. Medically-treated mosquito nets, whose prices vary between Shs. 9500 and Shs. 19,000 ($7.60-15.20) depending on the size, have been imported into the country. At this price, most low income earners will not be able to afford them.

Onchocerciasis, an infection caused by a nematode *Onchocerca volvulus*, is widespread in Uganda. The intermediate host *Simulium damnosum* or *S. naevi* (blackfly) breeds in fast-running well-oxygenated streams. Humans are the only reservoir of infection, and it is maintained by cross transmission. It is a very debilitating condition characterised by the development of skin changes, subcutaneous nodules and ocular lesions which often lead to blindness. It is believed that the blackflies, which are the intermediate host, originate from Zaire and enter the western part of Uganda.

5.3.7 Diarrhoeal diseases

Diarrhoea was the second most important cause of mortality (9.7%) and leading cause of morbidity (25.4%) in 1991. The pathogenic agents responsible for diarrhoeal diseases in Uganda have not been fully studied[193]. Most diarrhoea is caused by bacterial, viral and parasitic infestations transmitted through water, food and contact with faecal matter. Preventing diarrhoea requires better environmental sanitation, cleaner water supplies and health education. The main danger from the disease is excessive dehydration. Diarrhoea in children varies by age, with highest rate among one and two-year-olds at the time of weaning and increased mobility. Treatment of the disease includes the use

of drugs and oral rehydration salts (ORS), but the permanent solution lies in addressing issues of poor water supply, sanitation and hygiene.

5.3.8 Malnutrition

As can be seen from **Figure 5.9**, malnutrition is one of the top ten killers in Uganda. According to the 1988-89 Demographic Health Survey, 4.9% of children under five are severely malnourished (underweight) and a further 18.4% moderately malnourished due to:

- the high incidence of low birth weights.
- the fact that 55% of households consume less than 80% of the daily recommended energy intake.
- poor weaning practices and care when the baby is 6 to 19 months old.

The low level of energy intake is caused by lack of financial resources to buy food. About 46% of the population is food insecure, while 15% is chronically in food deficit[104]. According to the Ministry of Health, nutrient deficiencies are responsible for over 70% of the total goitre cases prevailing in surveyed areas and particularly in the highlands and among sole-cassava consumers. In Kamuli district, 20% of the night blindness is caused by Vitamin A deficiency and nutritional anaemia[105].

The high levels of malnutrition lead to 44.5% of children being stunted, one of the highest levels in Africa. By comparison, prevalence of malnutrition (under five) for Tanzania and Zimbabwe is only 20% and 12%, respectively[106]. Maternal malnutrition causes 19% of "reproductive wastage" (abortions, neonatal deaths and stillbirths). It also causes low birth weights in a further 20% of new babies. Malnutrition can lower a child's immunity, making it more susceptible to diseases such as diarrhoea, measles and respiratory infections. These, in turn, reduce appetite, cause nutrient loss, inhibit absorption and alter the body's metabolism, thereby resulting in inadequate dietary intake and further malnutrition. This vicious cycle of malnutrition and infection has been termed the "most prevalent public health problem in the world today"[107]. The Ugandan government intends to address problems of childrens' health by improving health policy and services in support of nutrition, water and sanitation, basic education and child protection (**Box 5.3**).

5.3.9 Human trypanosomiasis

Sleeping sickness is essentially a disease of the rural population. It is caused by *Trypanosome gambiense* and *T. rhodesience*, an organism whose natural habitat is water, forests and bush (grass), and conveyed to humans by the bites of tsetse flies of the genus *Glossina*. Humans get infected during activities such as collecting water and firewood, fishing and cultivation. The "Gambiense" type of disease occurs in the districts of Gulu, Kitgum, Arua and Moyo. The "Rhodesience" type exists in Jinja, Iganga, Kamuli, Tororo, Mukono, Pallisa and Mbale. In 1990, out of the 6,952,681 out-patients seen in 20 reporting hospitals, 5,986 (0.1%) were sleeping sickness cases[108]. The surveillance reports show an exponential upward trend of the disease (**Table 5.9**). The effect of aerial spraying is seen in the years after 1980 and 1982. In 1991, out of 10,674,142 out-patients seen in 20 hospitals, the sleeping sickness cases were 1,656[109].

5.3.10 Cholera

The threat to human health posed by environmental deterioration has also been evident four times when cholera epidemics struck parts of Uganda: 1973-80 in Karamoja; 1978-84 in Kasese (7,708 people affected); Kampala in 1985; and Kasese district again in October 1991. The last epidemic was caused by *Vibrio Cholerae-Ogawa* (El Tor) according to laboratory verification[200]. The mode of spread is through contaminated water, food, fruits, etc. It can spread rapidly, especially in heavily populated communities with poor sanitation and unsafe drinking water. Children are particularly susceptible to the disease. Between 2 October 1991 and 5 June 1992, 13,731 hospitalised cases and 1,010 deaths[201] were reported countrywide.

Table 5.9: Cases of human trypanosomiasis in Busoga

YEAR	NUMBER OF CASES
1976	52
1977	563
1978	2076
1979	4997
1980	8465 (aerial spraying)
1981	1938
1982	1309 (aerial spraying)
1983	1199
1984	1956
1985	3551
1986	4446
1987	4223

Source: Ministry of Health Quarterly Report, 3rd Quarter, 1987

5.3.11 Vaccine-preventable diseases

At the end of the 1970s, the international community made a major commitment to immunizing the world's children against six major childhood diseases: measles, diphtheria, pertussis, whooping cough, tetanus, polio and tuberculosis. In Uganda this commitment has produced one of the most spectacular public health successes especially after October 1983 when Uganda National Expanded Program for Immunization (UNEPI) was launched. Unfortunately, the health information system does not provide data necessary to assess the impact of immunization on disease incidence and mortality[202]. In the past there had been other vaccination campaigns, including poliomyelitis (1963), cholera (1967) and smallpox (1968). Immunization against measles can have a significant effect on child mortality, helping to reduce deaths from other causes. In Bangladesh, for example, children who were vaccinated against measles experienced at least 40% lower mortality than those who were not[203].

5.3.12 AIDS and HIV infection

Although AIDS is not an environmentally-related disease, in severely-affected areas such as Rakai and Masaka, AIDS will have an impact on household structures, incomes, labour and other means to undertake farming. It will also have an impact on Government expenditure

The first cases of AIDS in Uganda were documented in 1982 but the disease seems to have been present in the country by early 1981. There are 3 main routes of transmission in Uganda: heterosexual contract, vertical or mother-to-child transmission and infected blood. The NRM government has been very open about AIDS and has done much to curb its spread. Non-governmental organizations

have joined in the struggle. The government first responded to the HIV/AIDS epidemic by establishing an AIDS Control Program (ACP) in the Ministry of Health. In 1991 the Uganda AIDS Commission was formed with the mandate to establish and coordinate a national multisectoral AIDS control approach through the development of policies and implementation guidelines, integration of support and monitoring of all AIDS control programs and activities throughout the country. In essence, all AIDS control programs fall under the Uganda AIDS Commission. The trend of the HIV/AIDS cases is shown in **Figure 5.11**. If unchecked, the AIDS pandemic will setback some of the gains made by Uganda in the health sector.

Box 5.3

Uganda National Program of Action for Children: Summary of Goals

Uganda pledged itself to the declaration and Plan of Action of the World Summit for Children, held in New York in September 1990 under the sponsorship of the United Nations. Consequently, the country intends to achieve the following major goals during the 1990s:

Policy

1. The *provision* of *sufficient resources* by government and communities to provide basic social services to all Ugandans.
2. The *effective use* of limited resources through the development of a national partnership of co-operation among governmental and non-governmental institutions, which facilitates the integration of planning, implementation and monitoring systems at central and local levels.
3. The development of *sustainable solutions to problems* that are low cost and community based.
4. The achievement of policy solutions to problems that are *equitable to all groups*, particularly women and children and those in disadvantaged areas of the country.

Health and Nutrition

To improve the health and nutrition of mothers and children through achievement of the following major goals:

1. *Nutrition*: Reduction of severe and moderate malnutrition among under 5 children from 4.9% and 18.4% to 2.5% and 9.2% respectively.
2. *Infant and under 5 mortality*: Reduction of the infant mortality rate from 101 to 60 per 100,000 and the under 5 mortality rate from 180 to 70 per 1,000 live births.
3. *Maternal mortality*: Reduction of the maternal mortality rate from 500 to 250 per 100,000 live births.

Water and Sanitation

1. Access to *safe drinking water and environmental sanitation* to increase from 23% and 30% respectively to 75% for both, ultimately reducing water-related and faecal-based diseases.

Basic education

1. Access to primary education for school age children to increase from 69 to 95%, and the completion rate of the primary education cycle from 32 to 50% of pupils.
2. *Reduction of the illiteracy rate* (with special emphasis on women) from 47% to 24%.

Child protection

1. *Legal protection* of the rights of all children.
2. Protection of the rights of all children with disabilities to equal access to health services, education and freedom from discrimination.
3. *Protection from abuse, neglect and exploitation* of children who are not cared for, or supported by parents or relatives.

The implementation of these goals will be supported by a National Council for Children.

Source: MFEP (1992) Uganda National Program for Action for Children-Priorities for Social Services Sector Development in the 1990s, and implementation Plan 1992-93-1994-95.

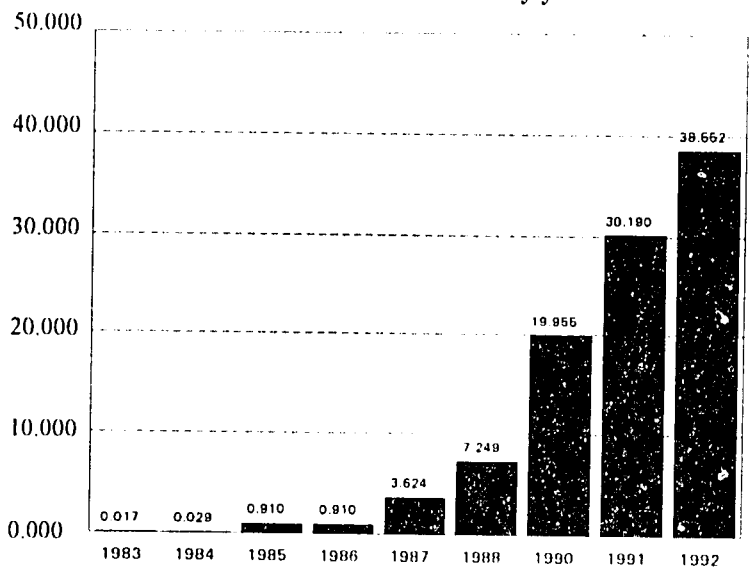
5.3.13 Diseases associated with air pollution

- **Respiratory tract infections**

Respiratory diseases, especially acute respiratory infections, are among the chief causes of mortality and morbidity in this country. In 1991, they accounted for 6.4% of mortality and 14.7% of morbidity. Some of the causes are emission gases from homes and industries.

Daily cooking, the most energy intensive activity, is done with wood, charcoal, animal dung and crop residues. Combustion of woodfuels in homes emits gases like sulphur dioxide, nitrogen oxides, polyaromatic and hydromatic hydrocarbons, and carbon-monoxide, all of which have deleterious effects on human health.

Figure 5.11: Cumulative number of AIDS cases by year



Source: MOH (ACP) HIV/AIDS Surveillance Report, 1992

Carbon-monoxide gas, for example, has a strong affinity for haemoglobin in blood. Once absorbed by the lung, it reduces the oxygen-carrying capacity of blood. Loss of oxygen impairs mental function, affects foetal development, and aggravates cardiovascular diseases. Acute exposure to hydrocarbons causes eye, nose and throat irritation. Chronic exposure is suspected to cause cancer. In addition, nitrogen oxides (NO_x) have been associated with respiratory tract diseases, especially among children, and aggravate emphysema and other lung diseases.

Sulphur dioxide (SO_2) is also a respiratory irritant. Chronic exposure aggravates respiratory diseases including asthma, chronic bronchitis and emphysema. It reduces lung function, irritates eyes, and is associated with mortality increase. Due to poorly built houses which lack ventilation, especially in rural areas and urban slums, the gases emitted by the woodfuels affect the occupants, especially the women who do the cooking. Infants and young children, a group particularly susceptible to life-threatening respiratory diseases, spend time in smoky conditions when their mothers are preparing food.

- **Lead poisoning**

Still in the category of diseases caused by air pollution are those arising from vehicular traffic. In Uganda, this is more significant in urban than rural areas. The situation is worsened by the fact that only leaded petrol is available in this country. As a result lead is emitted with the other major exhaust gases. Children are particularly sensitive to lead; the effects include impairment of intellectual performance, difficulty in concentrating and behaviourial disorders. The extent to which Ugandan children are affected is unknown.

- **Nicotine and alcohol poisoning**

Tobacco smoking and alcohol consumption are social habits which seriously harm health. Smoking not only pollutes the air breathed by the smoker but also by people in the vicinity (passive smokers).

Box 5.4

Coping with AIDS in Uganda

By June 1992, Uganda had reported 33,971 AIDS cases, the true number may be between 100,000 and 300,000 and it is estimated that 1 million to 1.5 million Ugandans are infected with HIV. In Kampala, more than 30% of all pregnant women are infected, and in many parts of the country AIDS is the most common cause of admission and death among hospitalised adults. With this immense burden, care of infected individuals and management of the social consequences of infection are perceived to be as important as prevention of further cases of HIV.

In response, a variety of innovative activities have been undertaken. In 1987 the first AIDS clinic was opened, with a small staff, a few drugs, and little outside support. The clinic recently enrolled its 8,000th patient. Patients regard the care they get there as much higher in quality than that available elsewhere. The founder of the clinic, Dr. Elly Katabira, and another physician at the national teaching hospital have produced a 104 page manual on AIDS care that recommends simple diagnostic and treatment strategies for AIDS, for example, nine relatively inexpensive drugs used in combination with tuberculosis therapy can achieve a high degree of relief for patients with AIDS.

Also in 1987, 16 Ugandans who were personally affected by AIDS (because of their own infection or that of a family member) set up a new voluntary organization. The Aids Support Organization (TASO) to provide emotional support for AIDS sufferers. 12 of the founding members have since died of AIDS, but TASO has grown to include 97 counsellors; 3 supervisors, and 6 trainers in 8 locations. Services which reach more than 30,000 people a year, include counselling, condom education and distribution, home care, income-generating activities, feeding programs and payment of orphans' school fees.

In 1990 to address the demand for personal testing, Uganda's first anonymous HIV testing and counselling center was established. The enormous demand has made individual pre-test counselling impossible, but group counselling has become popular, individual post-test counselling continues to be offered, and HIV positive patients are referred to TASO for further support. AIDS awareness in Uganda is so high that many people assume they are infected. Couples who are tested and found to be negative report they are more motivated to be monogamous and a small follow-up study found that such clinics have fewer casual sex partners and use condoms regularly. Additional centers have been established in other areas, as well as an executive testing center for business men and parliamentarians uncomfortable about being served the busy public clinic. High demand indicates that Ugandans want to know whether they are infected, particularly before embarking on important life events such as marriage. Uganda's experience demonstrates that an AIDS-testing program in a country with a high prevalence of heterosexual transmission can have a more positive influence on behavior than results from the industrial world would indicate.

Source: World Development Report 1993

5.3.14 Noise pollution

Noise pollution is a cause of ill health which is becoming increasingly common in Uganda, especially in urban areas. Major sources include vehicles, industrial operations, construction activities, aircraft and discotheques. Residents of Entebbe, where Uganda's international airport is located, complain of aircraft noise, especially now that night flights have resumed.

Noise from industrial operations is usually confined to the plant, affecting the workers. However, populations living near noisy industrial plants can be affected. For example, Kyambogo residents have started complaining of noise from nearby industries.

Construction noise originates from cranes hoisting equipment, concrete mixers, tractors, drills, compactors, bulldozing equipment and delivery vehicles. Construction activities are taking place almost everywhere, particularly in urban centers.

Vehicular noises originate from the exhaust system, tyres, engines and horns. Traffic concentrations are highest in Kampala, and that is where most of the effects are felt. At present, there seem to be no remedial measures for eliminating noise pollution from the general environment. In future, buildings will need to be designed to reduce noise pollution.

Prolonged noise exposure can cause general stress and permanent damage to the auditory system. Exposure to moderate intensities affects the cardiovascular system, causing vasoconstriction in the peripheral areas of the body and pupillary dilation. Continuous noise levels above 90 decibels (a weighting) [DB_A] have detrimental effects on human performance. Noise levels below 90 decibels can be disruptive, particularly if they have predominantly high frequency components and are intermittent, unexpected and uncontrollable.

5.3.15 Health effects of pesticides

Pesticides are a group of toxic chemicals that are a source of pollution in Uganda because of their use in crop and livestock protection, vector control, weed control and seed dressing. Estimated imports for 1989-90 were 1,325 metric tons valued at about US $25 million. Estimated imports rose to 1,660 MT in 1990-91 and 2,224 MT in 1991-92.

Pesticides are used throughout the year in Uganda owing to the tropical climate. They are the most easily accessible toxic chemicals and are stocked in farmers' houses in rural areas. Currently, there are over 300 pesticide formulations in use in Uganda. This represents a significant and varied load of toxic chemicals on the environment with the potential for a corresponding variety of health effects.

Apart from the threat of major accidents and hazards, pesticides can cause ill health to people, including acute and chronic poisoning, allergic diseases, tumours, attacks on the immune system, and deformities among infants. About 50% of the modern pesticides are mutagens, ie. cause changes in DNA.

There are an estimated 272,000 cases of pesticide poisoning in Uganda annually, about 1% are fatal.

5.3.16 Other environmental health problems

- **Chemical safety**

With many people using pesticides in agriculture, and with others employed in mining, industry and health settings where they come into contact with metals, dyes, acids, drugs and solvents, steps must be taken to avoid the negative effects of these substances. Health problems arise because of unprotected use of chemicals, poor handling, wrong mixing techniques, wrong application, poor labelling and insufficient information. Problems need to be avoided in production, use, storage,

transport, trade and disposal.

- **Natural disasters**

Disasters like landslides, earthquakes, floods and drought have had varied consequences in terms of property, environmental destruction and human suffering. Landslides have buried whole villages in Bundibugyo district and caused serious damage in Ibanda in Mbarara district, the Mt. Elgon region and Kabale district. Earthquakes, though less common, have had disastrous effects, particularly in the Rift Valley in Western Uganda. In 1966 and 1994 buildings in Kabarole district were destroyed. Floods, another environmental hazard, are common in low-lying urban areas where drainage is poor.

- **Hazard preparedness**

Uganda is poorly equipped to meet hazards from natural calamities, the work environment, and massive outbreaks of diseases. The country suffers from poor planning and training and lack of awareness and supportive infrastructure. The 1966 and 1994 earthquakes, for example, took the nation by surprise. The seismograph at Entebbe opened in 1925 but stopped functioning in 1976. The Ministry of Natural Resources is now implementing a project intended to establish a National Seismological Network, the information from which will assist planners and developers to construct earthquake resistant structures in high-risk areas. Drought is common and sometimes fatal in areas where precipitation is below 200 mm.

- **Shortage of physicians**

One key health service indicator is the ratio of population per physician. **Figure 5.12** shows that Uganda's ratio improved tremendously between 1960 and 1970 compared to the rest of SSA. Thereafter, it deteriorated while that of SSA steadily improved. This reflects the political turmoil of the 1970s that caused Uganda to lose its skilled manpower to the rest of the world. Presently, emigration of professional staff is caused by lack of a living wage (**Box 5.5**). Over the last 15 years, as many as 1500 doctors may have moved to other countries[2,34]. Graduates of the Makerere University medical school and other institutions also often refuse to work in rural areas. Consequently, most physicians are found in Kampala.

5.3.17 Health policy and institutions

In 1988 the National Health Policy was released to the public. It is in line with the international Primary Health Care (PHC) Alma-Ata declaration of 1978. The PHC strategy seeks to integrate health development into overall development through the following principles:

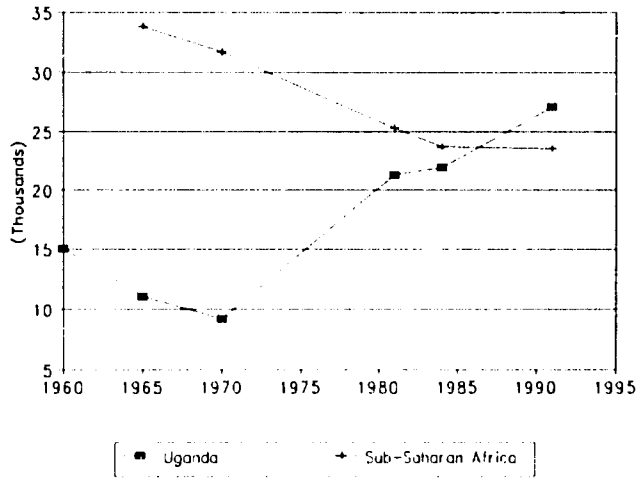
Equity - Individuals to have equitable access to all means of achieving health.

Participation - Individuals and communities to participate in the decisionmaking, planning and implementation of activities aimed at improving their health.

Multisectoral - All sectors concerned must participate.

Appropriate technology - The employment of technologies most suited for the communities.

Figure 5.12: Population per physician



Source: World Development Reports, 1988, 1990, 1993

Box 5.5

Stem Exodus of Doctors

Every year, 50 medical officers qualify from the Makerere Medical School But an equal number of physicians leaves the country to look for better conditions of work The reason for the doctors going to look for greener pastures abroad are well know They want to lead better livelihood which they cannot easily get here because of the poor pay The great danger is that this loss will continue so long as remuneration for such skilled personnel remains insufficient Even cows are attracted by greener grazing grounds

Certainly, the country and society that have often depleted their resources to educate doctors have lost a lot when the situation is looked at in terms of the required number of physicians and the actual number of those in our medical institutions, especially hospitals The often quoted figure of one doctor for over 20,000 Ugandans is grossly low and our people cannot have a reasonable number of doctors to attend to them

Currently most hospitals, especially in rural areas, are terribly under manned Many of them have one doctor, who is at the same time a hospital superintendent, and occasionally squares as District Medical officer

However, professional flight out of the country is not entirely a loss Savings from green pastures are often repatriated home and form part of the nation's earnings in hard currencies also crucially needed for national development But rationally, one cannot sell off all the food before the home is satisfied

On the other hand there are solutions at hand to the problem of brain dram, particularly of doctors One of them is the cost-sharing suggested several years back but which has never been effectively implemented Hospital should take a leaf from the private clinics and those hospitals which are doing a boom..ng business, and there is no reason why government-run hospital cannot tap such moneys and be able to pay their staff better Most government hospitals have better equipment than private ones, and are thus better placed to attract patients

The above measure may not necessarily put an immediate stop on the exodus of medical personnel out of the country, but certainly it will reduce it, and hoping that as the national economy improves, the balance could in future turn in our favour

Source: The New Vision Newspaper, August 3, 1993

The World Bank's 1993 Development Report *Investing in Health* proposed a three-pronged approach in government policies to improve health fostering an environment that enables households to improve health, improving government spending on health, and promoting diversity and competition

The public sector maintains 61% of the secondary and tertiary hospitals, and 58% of the registered outpatient clinics. The NGO and private for-profit sector is also very important in the formal health care system. Data on the location of formal sector facilities show that they are adequately distributed, with the exception of the northern part of the country where there is relatively less access. In addition, an "informal" sector (drug shops, for example) has also developed in recent years.

The NGOs account for 38% of hospital beds, but provide 54% of the bed-days, due to greater capacity utilisation and efficiency. Among the population seeking formal sector care, 40% use government services and 60% visit private or NGO clinics[2,6].

The Ministry of Health (MOH) employs about 9000 medically trained personnel, and about 9000 group employees, making a total of about 18,000. The formal NGO sector is estimated to employ about 3400 medically trained people. Salaries for physicians and nurses are about 2.2 times greater in the NGO sector than in the public sector. Many trained health workers are employed abroad or in private practice. The ratio of population per physician is 25,000:1. This is greater than in many other low-income countries, and twice the level of 1965.

The government health care system is organized into three principal tiers. Mulago hospital, the national referral hospital in Kampala, the District Medical Officer (DMO) and district hospital in each district; and lower-level facilities in the districts. The upper tiers are administered by the MOH, while lower level facilities are, in principle, supposed to be the responsibility of the district administration but they are on the MOH payroll and seconded to local governments. The decentralization policy is looking at devolving responsibility for health services to the districts and local communities, and at the relative roles of the MOH and Ministry of Local Government.

The larger public hospitals in Uganda have private wards where patients have in the past been expected to pay. Before 1972 physicians split consultation fees on a 50-50 basis with the government. However, that policy was discontinued. A new user fee policy was initiated in June 1990 but was discontinued due to political difficulties. The MOH plans to reintroduce cost-sharing in its facilities but the timetable is not yet announced[2,6].

Health has absorbed a relatively small share of the financial resources directly controlled by local government. Locally-controlled expenditure on health was only 0.5% of GDP in 1980-90 and 0.6% of GDP in 1990-91. Central government expenditure in the health sector outweighed local government controlled spending by a factor of 2.7 in 1990-91. **Figure 5.13** shows that much of the financial resources are devoted to curative cases. Of interest is the high cost of treating tuberculosis.

5.4 Human settlements

5.4.1 The pattern and type of settlements

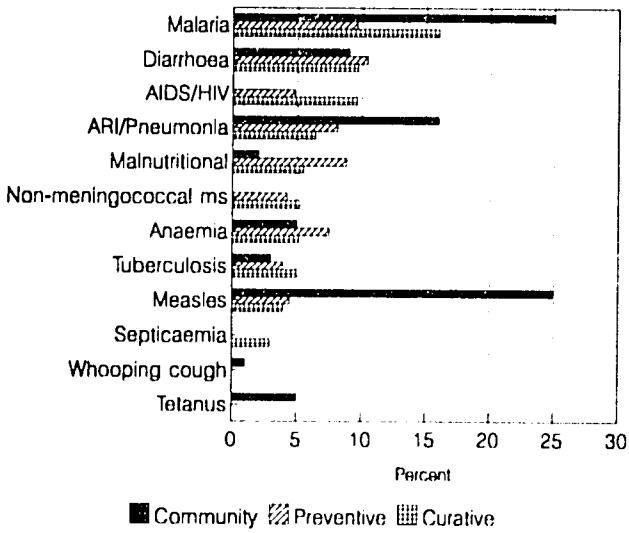
Only 1% of Uganda's land is under human settlement. The location of settlements is determined by a combination of factors: physical features, economic and sociocultural patterns and history.

There are three types of settlements according to the Ministry of Lands, Housing and Urban Development (MLHUD)[2,7]. They are:

- Dispersed rural homesteads

- Constellation of local administrative centres, intermediate towns and nucleated urban centres
- Linear corridors of fast urbanizing settlements[208]

Figure 5.13: Approximate spending on disease problem by government, NGOs and households according to type of service, 1989-90



In Uganda as elsewhere in the world, natural resource allocation, use, manipulation, degradation and environmental impact take place within a human settlements context. Furthermore, the size and quality of human settlement in Uganda is a reflection of the institutional framework of local cultural values and, importantly, large-scale national political and economic policies.

5.4.2 Overview of the housing situation and condition

In Uganda, the housing sector has been severely hit by the general economic decline since the 1970s. There are problems related to lack of appropriate policies and programs, inadequate financial resources, shortage of building materials, lack of manpower, collapse of the construction industry, and lack of attention to rural housing where the vast majority of the population live. The responsibility for providing housing in Uganda lies with the head of the household. This is more true in rural settlements than in urban areas because in the latter, government and other capable organisations sometimes provide housing to their employees.

The housing situation has further been aggravated by the population increase in the country, urbanisation which is not matched with sufficient infrastructure and utilities, and constant armed struggles and political skirmishes since 1978 which have considerably damaged the housing stock. Since 1986, there has been some improvement but given the historic situation, the impact has not yet been felt particularly in the lower income levels in which are the majority. In Uganda, the housing problem is both of quantity and quality but varies by location. While the problem of urban housing is both quality and quantity, the problem in rural is mainly quality[209]. The present housing stock, housing backlog and projected housing stock required by year 2006 are shown in **Table 5.10**. The

number of homeless people is not known. The extended family system and the fact that crowding in good tenements can be tolerated has helped to eliminate most homelessness. All places have a housing backlog. It is estimated that 44.5% of the existing stock requires upgrading and 51.6% requires replacement[1].

Table 5.10: Status of housing stock, 1991

DEFINITION & MEASURE	KAMPALA	OTHER URBAN AREAS	RURAL AREAS	ALL UGANDA (NATIONAL)
Population	730,189	1,103,000	14,700,000	16,533,000
Average Annual Pop. Growth rate %	4.9	3.6	2.5	2.5
Average Household size (individual)	4.0	4.6	5.6	5.5
No. of Households	182,439	239,783	2,625,250	3,047,472
Occupancy Density	1.32	1.36	1.1	1.1
Existing Persons per sponsor Housing unit	5.28	6.25	6.16	6.15
Existing No. of Dwelling units	138,068	176,310	2,386,282	2,700,660
Housing Backlog	44,228	63,473	238,600	346,301
Projected Pop. to Year 2006	1,607,000	1,981,000	21,083,000	24,671,000
Total Housing need	244,400	279,500	1,601,700	2,125,600

Source: MLHUD [1992] A National Shelter Strategy for Uganda Volume I

Table 5.11: Distribution of households by tenure of dwelling unit, 1991

TENURE OF DWELLING UNIT	KAMPALA %	OTHER URBAN AREAS %	RURAL AREAS %
Owner occupied	17.7	25.3	94.0
Rented public	0.9	0.7	0.4
Rented private	59.5	46.0	0.03
Subsidized public	3.8	4.6	0.2
Subsidized private	2.0	2.3	0.2
Free public	3.3	5.8	0.05
Free private	6.6	5.3	2.7
Others	0.2	1.0	0.02
TOTAL	**100**	**100**	**100**

Source: Ministry of Finance and Economic Planning Statistical Department. Population and Housing Census - 1991

1 *It is not possible to give trends as there are no previous data. The data being reported here were collected in support of the resolution of the UN General Assembly NO. 41/190 of December 1987 on the International Year of Shelter Strategies. Uganda and Zimbabwe were the two African countries to undertake the pilot shelter strategy project.*

5.4.3 Occupancy status and cost

Almost 94% of all housing units in rural areas are owner occupied. There are an estimated 70% tenement occupiers in Kampala and 60% in the other urban areas (**Table 5.11**). There are great variations in rental charges depending on the social and economic status of the urban area and the location of the dwelling unit within that urban area. This ranges from about 500/- per month for a single room (tenement - *muzigo*) in the poorest section of an urban area to about 300,000/- for high cost executive houses in Kampala.

5.4.4 Rate of housing construction

According to MLHUD, national information on housing construction is poor and even the rates advanced by the Ministry are tentative. In Kampala district, it is estimated that between 50 - 70 units are constructed per year in both public and private formal sector. In the informal sector between 200 and 300 housing units, mostly tenements are produced per year. In the rest of the other urban areas where construction is mostly in the private sector, the rate is between 1000 and 1500 houses annually. In the rural areas, the figure is about 10,000 housing units per year[20].

5.4.5 Environmental impact of housing

In rural Uganda, the population provides their own shelter through their own effort by using techniques passed on from generation to generation. In almost all instances, housing in these areas relies on the availability of natural local materials. Particularly significant are the actual and potential deforestation, the removal of rural vegetation cover and the deterioration of wetland ecosystems, which are occurring due to the demand for housing. The demand for building poles and wattle has led to the removal of trees from forested areas and to the disappearance of rural woodlots and tracks of natural vegetation between and among farm fields and settlements. Yet vegetation cover is the key to minimising soil erosion and maintaining soil fertility. Also important are the impacts of housing construction on swamps and swamp ecology. In many places, papyrus, reeds and other swamp vegetation provide the primary roofing materials. While papyrus can, in most circumstances, quickly regenerate in the swamps, any large-scale cutting of wetland vegetation is potentially damaging to wetland ecology.

Of great significance is the use of the swamps as a source of building clay for the manufacture of sun-dried or kiln-dried bricks. The drainage of the swamps or the interference with wetland ecology to gain access to building clays is a crucial environmental concern. Furthermore, brickmaking increases demand on forests for wood for the kilns and increases deforestation. There is no law which directly regulates the mining of non-metallic minerals like clay.

In the past, the Ministry of Natural Resources had created a small rural development project called the Pilot Villages Scheme for which it had received funding from UNEP. The scheme identified alternative brickmaking technologies that are environmentally friendly. With this and other steps it is hoped that most rural houses which are largely classified as "temporary structures", that is, not likely to last more than ten years, will have their lifespan increased.

In most urban areas, the environmental impact of housing construction is similar to those stated above, especially the need for bricks and poles for construction. Urban areas have a further problem. Their failure to follow physical planning has led to haphazard construction that lays no standards on infrastructures and utilities, sanitation, size of the house or location. In Kampala, out of 138,068 dwellings, 35,485 (25%) units are in need of upgrading while 11,510 (8.3%) need replacement. The

high proportion of the stock requiring replacement reflects the substandard structures in high-density low-income settlements. The quality of these houses could not be influenced by the government because they were constructed on "mailo land", under a land system that gives tenure to individual landlords, especially in Buganda. In other urban areas, out of 176,100 dwelling units, 51,400 (29.4%) require upgrading and 17,900 (10.0%) replacement. In rural areas, 77% of houses require some work to improve them and provide a better environment for the occupants[211].

5.4.6 Building materials

As revealed in **Table 5.12** most dwelling units in Uganda are made of poles and mud and grass (43%) or pole and mud and iron sheets (24%). They are followed by those made of burnt stabilized bricks and iron sheets (6%) and unburnt bricks and grass (5%). Poles and mud constitute the source of wall material for 74% of all dwelling units. Grass and iron sheets constitute 52% and 37% of all roofing materials respectively. The cost of iron sheets ranges between Sh 6,000 and Sh 18,000 depending on the gauge.

Table 5.12: Occupied dweller units by roof and wall material

Roof material	Burnt stabilized brick	Unburnt brick	Stone	Concrete	Cement blocks	Pole and mud	Wood	Other	Not stated	Total
Iron sheets	207,898	100,301	3,562	8,959	104,188	830,632	5,871	16,346	5,306	1,283,063
Tiles	13,153	1,398	89	1,123	7,518	4,878	144	108	126	28,537
Asbestos	7,916	2,019	520	4,942	9,810	3,026	186	612	146	29,177
Concrete	5,265	207	31	4,289	4,706	311	4	32	88	14,933
Papyrus	1,616	6,536	47	109	745	39,926	381	547	308	50 206
Grass	8,189	191,682	908	213	4,041	1,479,822	10,041	86,617	14,269	1,795,782
Banana leaves	620	2,653	125	22	436	174,158	1,691	5,270	2,423	187,398
Other	175	465	17	62	473	5,439	101	1,977	241	8,950
Not stated	957	1,433	55	77	488	7,732	101	525	24,763	36,131
Total	245,789	306,694	5,354	19,787	132,405	2,545,924	18,520	112,034	47,670	3,434,177

Source: MFEP, Population and Housing Census, 1991

The availability of building materials and their affordability, whether imported or locally manufactured, has an overwhelming influence on the ultimate cost of the building on one hand, and on the natural resource base, on the other. In the 1970s industries that were responsible for manufacturing some of the inputs collapsed. Cement imports cost $14.6 million in 1992[212]. This cement could be produced in Uganda. The current capacity utilization of cement manufacturing is 7.5%, while that of clay bricks and tiles is 50%. A 50 kg bag of cement costs Shs 10,000 on average retail. Corrugated iron sheets and paint output stand at 28% and 21% of their capacity utilization, respectively. Although some factories are said to "manufacture" materials locally, they are in fact very heavily dependent on imported raw materials. Many of them are more of "packing factories" as is the case with corrugated iron sheets factories. Finished building materials include sanitaryware, plumbing pipes, glass and electrical items. It is estimated by contractors that 60% of the materials they use in their construction activities are imported[213]. However, the majority of dwelling units in rural areas depend on local materials and technology. Success in overcoming the current housing shortage will depend, among other things, on the availability of building materials.

5.4.7 Occupancy and crowding

The national figure on the number of households per housing unit [occupancy ratio] is put at a modest 1:1. However, there are variations from urban to rural. Kampala is estimated at 1.32. Other urban areas are at 1.36 (**Table 5.13**). Most urban areas have peculiar housing development in that they are characterized by many commercial premises. There are many single-roomed units which accommodate average-sized households. Though each household is staying in its separate one roomed housing unit, crowding within the units is indicative of the housing need. As shown in **Table 5.14** more than 80% of urban dwellings and 57% of rural dwellings consist of 1 or 2 rooms.

Table 5.13: Distribution of households in dwelling units (occupancy rate/rate of sharing)

HOUSEHOLD IN DWELLING UNIT	KAMPALA %	OTHER URBAN AREAS%	RURAL AREAS %
1	66.0	63.3	86.6
2	8.6	10.4	7.0
3	6.8	7.2	2.4
4	5.8	5.0	1.3
5	3.4	5.0	0.3
6+	9.4	9.1	0.4
Average occupancy state	1.32 persons	1.36 persons	1.10 Persons
TOTAL	**100.0%**	**100.0%**	**100.0**

Source: MFED: Population and Housing Census 1991

Table 5.14: Distribution of household dwellings by number of rooms

NUMBER OF ROOMS	URBAN DWELLINGS %	RURAL DWELLINGS %	TOTAL DWELLINGS %
1	61.43	30.19	34.27
2	20.35	26.60	25.78
3	8.21	19.63	18.14
4	6.37	15.35	14.18
5	1.50	4.44	4.06
6	1.33	2.16	2.05
7 and above	0.81	1.63	1.52
TOTAL	**100.00**	**100.00**	**100.00**

Source: Report on the Household Budget Survey, 1989/90

5.4.8 Accessibility to basic social and infrastructural services

The provision of social and infrastructural service plays a vital role in supporting accelerated and sustainable social, political and economic development. During the past two decades, services suffered from wars, looting and neglect. Besides this, government resources have not been adequate to support rehabilitation efforts. Donor support has focused mostly on health water and sanitation. The supply of water and toilets in Ugandan households is shown in **Figure 5.14**.

- **Water supply**

It was estimated in 1990 that only 20% of the population had access to safe drinking water, whereas urban coverage is estimated at just under 50%. The majority of rural people depend on sources of water other than piped water (**Figure 5.14**). The distance travelled to water sources varies greatly. It is up to 500 meters in the south and central regions and as much as 5 km in the dry areas, particularly in the north east.

The traditional urban centers have piped water, particularly in the central business areas. However, because the water network has not been extended to cover the new town boundaries, the population in these areas and in new towns depend on boreholes, springs, wells and gravity schemes. High-density low-income settlements rarely receive piped water. Another important source of water for urban and rural populations is rain water from the runoff of roofs. However, the harvest tends to be small due to the lack of large containers. So, this source only supplements other sources.

Kampala residents make use of several sources of water, although most depend on piped water, the supply of which is irregular in many areas. The remainder depend on protected springs, streams and wells or buy water from vendors. Such delivery is costly, and the water may not be clean. As much as 40% of piped water is wasted due to old pipes in the water network which keep bursting[214]. Focussing on the poor who cannot afford the new water rates, the Program for the Alleviation of Poverty and the Social Costs of Adjustment (PAPSCA) is protecting some springs in Kampala and educating people on the need for safe water.

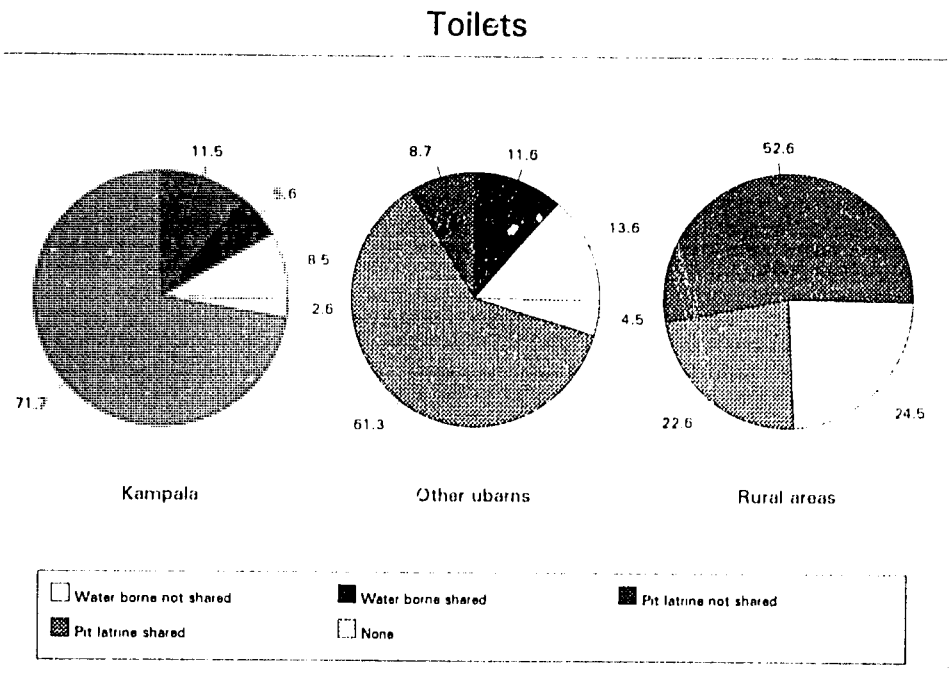
- **Sanitation**

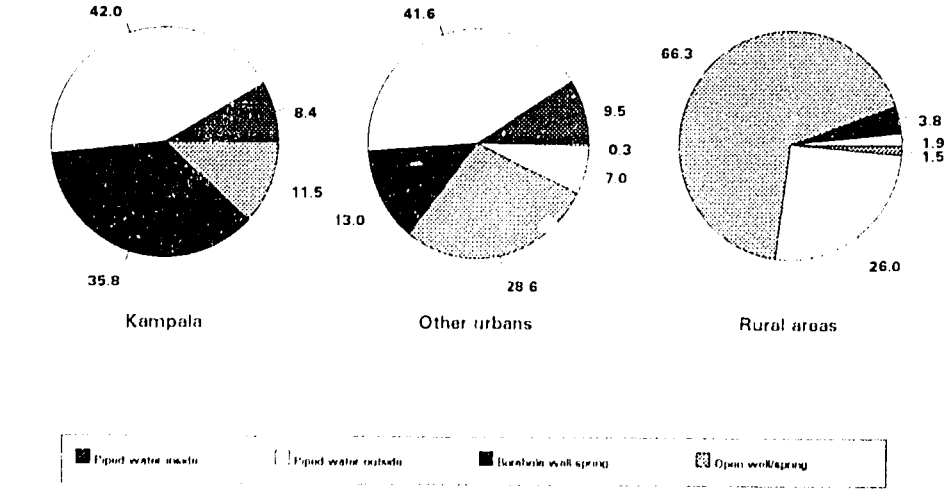
Figure 5.14 shows the sanitation facilities for Kampala and other urban and rural areas. The straight drop pit latrines are the most common in all areas. The design of latrines in many places, especially in low-income urban areas, is of environmental concern. They tend to be haphazardly sited since their builders seldom take into consideration the degree of slope, nearness to streams or springs, and potential for erosion. In addition, they are often not dug deep enough. During heavy rains, there is overland flow of sewage.

Another concern in low-income urban areas is storm water drainage. Few houses are sited so as to remove storm water quickly from around the house. This leads to the rapid deterioration of roofs, walls and foundations as large quantities of water stagnate in contact with the building for long periods of time. Additionally, with poor refuse collection and poor sanitation, uncontrolled storm water drainage leads to massive stream pollution.

Other sanitation facilities include water-borne-use sewer lines or septic tanks, and VIP latrines - a recent innovation mostly being introduced by NGOs and UNICEF. In Arua, an old, out-dated and unhealthy bucket latrine system still exists. Some rural households have no facility at all: defecation takes place in fields and dark corners. Causes of this include cultural beliefs, the nomadic nature of some pastoralists, and inability to afford to build some sanitation facility.

Figure 5.14 Percentage distribution of households by facilities as of 1990





Source: MFEP, Population and Housing Census, 1991

- **Household energy sources and uses**

Four major energy sources are used by Uganda's households for lighting and cooking: firewood, charcoal, paraffin and electricity. Electric power consumption is one index of development. It is estimated that only 8% of Ugandans have access to electric power. Its supply is usually so intermittent that even those who are connected to it still use other sources of energy.

The use of electricity in most rural areas for cooking is very limited because the network does not reach there: the electricity is not affordable by the majority of rural dwellers, and the equipment that must be installed to be able to use electricity is too expensive. Even in urban areas, most people still use charcoal and firewood. The efficiency of energy use in Uganda is very low. To address this, there are efforts to promote efficient utilization and diversification of energy resources, such as the use of biogas in tobacco curing industry, energy conservation in fish smoking, tea drying, firing of bricks and tiles and improved household stoves. A few people have adopted solar energy as an alternative source. The average household expenditure on each source of energy is shown in **Table 5.15**.

- **Garbage collection**

About 85% of garbage produced in settlements is organic material. The little inorganic material that is produced comes almost entirely from urban areas. Inorganic garbage includes polythene, tins, bottles and metals. Uganda recently banned the importation and manufacture of non-biodegradable polythene paper ("kaveera"). However, both are still going on. Almost all rural households dispose of their garbage in gardens as fertilizers. Very few homesteads bury their garbage in pits.

In Kampala, garbage collection has improved but is still a problem. The city currently has one dumping site. Kampala City Council (KCC) provides bins at designated collection centers and is responsible for its disposal. The private sector has not yet been given enough opportunity to participate in the garbage collection business. Neither is there any sizeable recycling scheme for this garbage which could be composted and sold as fertilizer to farmers. Rudimentary efforts such as the Namuwongo Women's Group are turning garbage into fertilizer. In the low-income settlements of Kampala garbage disposal is hampered by the poor infrastructure. Roads within these low-income settlements are at times blocked by garbage. The piles are a breeding ground for vermin, particularly rats.

The quantity of solid waste presently generated in Kampala is estimated at 1,700m^3 per day. This equals to 760 tons per day, amounting to an annual total of 277,400 tons, of which less than 20% is collected. KCC's collection service extends to less than 10% of the population. It consists of open communal containers and vehicles specially equipped for their uplifting and transportation to dumping grounds. Open containers are unsanitary, overflow, and invite scavenging by animals, insects and people. Future collection systems plan to use enclosed containers. Presently, KCC meets all costs. An alternative approach would be to privatize collection. Household waste in Kampala typically contains 70-80% wet organic material which decomposes rapidly. Three dump sites have been abandoned. Kinawataka, Busega and Lugogo Bypass. Land has been purchased at Mpererwe for construction of a sanitary land fill.

Table 5.15: Distribution of households by the major fuel sources used for cooking and lighting and costs

TYPE OF FUEL	COOKING %			LIGHTING %			AVERAGE ANNUAL HOUSEHOLD EXPEND.
	KLA	OTHER URBAN AREAS	RURAL AREAS	KLA	OTHER URBAN AREAS	RURAL AREAS	UGANDA SHS.
Electricity	10	2	0.03	41	25	-	36
Gas	-			-		1	-
Paraffin	5	1	-	58	73	92	251
Charcoal	72	60	1				191
Firewood	11	34	98	-		6	314
Dung/grass	-	-	-	-			
Others	-		-	-	1		10
Not stated	1	3	1	1	1	1	-
TOTAL	100	100	100	100	100	100	802

Source: *MFED, Population and Housing Census, 1991; Report on the Ugandan National Household Budget Survey, 1989/90*

5.4.9 Institutions for water supply, sewage and sanitation

The overall responsibility for the water supply sector lies within the Ministry of Natural Resources. The Directorate for Water Development (DWD) is responsible for water supply in rural areas. It drills boreholes and shallow wells, protects springs and wells and constructs gravity flow schemes, dams and valley tanks. It also provides water in 24 of the 33 towns that have central water supply systems. In the other 9 towns water is provided by the National Water and Sewerage Corporation (NWSC). The NWSC is a parastatal and is responsible for operating urban water and sewerage systems after the DWD has developed them and they have become financially viable.

Other institutions concerned with water and sanitation are:

- *Ministry of Health* which is responsible for rural sanitation and some water schemes such as spring protection and construction of wells.
- *Ministry of Local Government* which is responsible for operation and maintenance of rural (non-piped) water supplies and sanitation particularly in relation to community mobilization.
- *Ministry of Women in Development, Youth and Culture* plays an important role in low cost water supply and sanitation efforts.
- *Numerous NGOs and local communities* are also involved in the provision of services of all types.

Table 5.16: Summary of water supplies by NWSC, 1992

TOWN	AREA KM2	WATER SUPPLY						
		BY NWSC			By other services		Total	
		No. of connecti	Population		Population		Population	
			People	%	People	%	People	%
Kampala	164.50	26872	642419	75	216452	25	858871	100
Jinja	83.25	6675	95892	92	8214	8	104106	100
Mbale	40.25	2938	61156	79	13859	21	65015	100
Entebbe	33.50	2592	37780	59	26657	41	64437	100
Mbarara	42.00	1813	37226	85	6533	15	43759	100
Masaka	32.50	1848	25936	60	17300	40	43236	100
Tororo	31.75	1115	25880	76	8342	24	34222	100
Lira *	39.50	-	-	-			-	-
Gulu	28.75	-	-	-	-	-	-	-

* *These towns have not been taken over by NWSC. Much of their data are still being compiled*

Source: National Water and Sewerage Corporation

5.4.10 The National Water and Sewerage Corporation (NWSC)

The NWSC was established in 1972 by decree. It is currently serving nine towns: Kampala, Entebbe, Jinja, Mbarara, Masaka, Tororo, Mbale, Lira and Gulu (**Table 5.16**). Only Kampala and Jinja generate a profit. Without subsidies the NWSC would find it difficult to provide adequate service and fully meet costs. The NWSC could serve more people if it could improve the utilization of existing capacity as shown in **Table 5.17**. In virtually all towns oxidation ponds are the commonly used method in the sewerage treatment. Only Kampala and Masaka have some form of conventional treatment plants. The current status and plans for upgrading faecal waste management in some of the towns in Uganda is shown in **Table 5.18.**

Table 5.17 Present capacity utilisation of water and sewerage systems operated by NWSC

TOWN	SOURCE OF WATER	WATER					SEWERAGE			
		Design capacity cubic meters/day	Precent capacity cubic meters/day	Capacity utilization %	Point of discharge	Type of treatment	Design capacity cubic meters/day	Present capacity cubic meters/day	Capacity utilization %	Point of discharge
Kampala	L. Victoria	151,500	80,800	53	L. Victoria	C=S.F.D	45,500	25,000	55	L. Victoria
Jinja	L. Victoria	31,000	25,280	82	L. Victoria	P	16,300	7,650	47	R. Nile
Mbale	R. Manfura R. Nabiyonga R. Kamatsya	146,000	7,300	50	R. Manafwa	P	6,140	2,910	47	R. Namala R. Doko
Entebbe	L. Victoria	7,500	7,500	100	L. Victoria	P	2,500	835	33	L. Victoria
Mbarara	R. Rwizi	4,700	2,600	55	R. Rwizi	P	-	-	-	R. Rwizi
Masaka	Nabajjuzi swamp	6,100	3,400	56	Nabajjuzi swamp	C=S.A	760	460	61	R. Kaman'ba
Tororo	R. Malaba	7,300	4,050	55	R. Malaba	P	1,180	800	68	R. Lumuhuru
Lira	L. Kwania	10,320	4,300	42	L. Kwania	P	8,000	900	11	R. Okole
Gulu	R. Oyitino	1,800	1,600	89	R. Oyitino	P	4,000	200	5	R. Pece
Total		234,820	136,830				84,380	38,755		

C= *Conventional Plants with*
S= *Sentimentation*
F= *Trickling filters*
A= *Activated storage*
D= *Sludge digesters*
P= *Oxidation ponds*

Source: National Water and Sewerage Corporation

Table 5.18: Faecal waste management in other towns in Uganda

TOWN	CURRENT STATUS	PLANNED ACTION
Entebbe	Most environmentally clean in Uganda. No industries (residential town) sewage system present. Rehabilitated under World Bank funding (1986/87)	Expansion of sewage lagoons construction of 1 Km of sewer to treat additional 1,500 m/3 day.
Masaka	Sewage system limited to center of town. It is a conventional type. Inadequate. Frequent power failure renders it idle	Construction of sewage lagoons for hospital on its own Construction of 1.5 Km of sewer
Mbarara	New system recently commissioned (funded by Africa Development Bank)	
Kabale	Conventional sewage treatment plant broken down. Very poor sewage management	Rehabilitation of water and sanitation system in western Uganda (German Aid Agency)
Kasese	No sewage system; relies on plot sanitation	Rehabilitation of water and sanitation system in western Uganda (German Aid Agency)
Fort Portal	Conventional sewage treatment plant broken down	Rehabilitation of water and sanitation system in western Uganda (German Aid Agency)
Mubende	No central sewage system; septic tanks, pit latrines	Rehabilitation of water and sanitation system in western Uganda (German Aid Agency)
Masindi	No central sewage system; bucket, latrines, septic tanks, pit latrines	Rehabilitation of water and sanitation system in western Uganda (German Aid Agency)

Source: NEAP Topic Paper No. 6

In Kampala and Jinja, households still constitute the highest contributors to sewage. The metered costs of water supply and sewerage as set by NWSC differ among customers. Residential premises connected to a sewer pay Sh. 560/- per cubic meter (m^3), institutional ones pay Sh. 790/- m^3 while industrial/commercial premises pay Sh. 1,100/- m^3. The costs are 45% higher than they were in 1989 for residences and institutions and 189% higher for industrial/commercial premises. On the other hand, the unmeasured charges for residential houses with 2-4 taps is Sh. 12,000 per month, a figure considered high because of removal of subsidies.

5.4.11 Overview of housing policy and institutions

The practice of providing housing to the population, especially in urban areas, was developed by the colonial administration in the 1940s. The concern was at first prompted by the need to accommodate workers recruited from abroad. But with the increasing number of African (rural to urban) migrant workers, the colonial administration modified the policy to cater for the African labour force. In 1954, the African Housing Department was created and focused mainly on the urban population. As far back as 1948, it was recommended that the government stops providing free housing. This same recommendation has been sounded over and again and was re-emphasized in 1993 by MLHUD. In 1978, a housing policy was formulated by the then Ministry of Housing and Public Works but was not published. However, notwithstanding the lack of formal enactment, the policies and strategies contained in that policy document influenced the upgrading of the Namuwongo Low Cost Housing Project, the Masese Women Self Help Housing Project, the revision of sanitary and building rules of 1964, and the strengthening of the Ministry's departments[215]. During the 1981-85 recovery program, emphasis was given to rehabilitating the existing pool of government houses and reconstructing the war-affected towns of Arua, Masaka and Mbarara.

The government recognizes that the country's housing requirements are so huge that they cannot be

met by its efforts alone. In its 1993 National Shelter Strategy, it adopted the "enabling" approach as its major policy. Under this, the government will facilitate individual households and private suppliers to play a prominent role in the development of housing of quality[2]. Complementary policy strategies to improve housing are to rehabilitate the industries supplying building materials, to facilitate home ownership for all Ugandans according to their affordability, to utilize efficiently local resources, and to protect the environment

There are two types of specialized housing finance institutions in the country: the Housing Finance Company of Uganda, Ltd (HFCU) and the building societies. The HFCU has generally lacked medium and longterm capital and as a result did not invest in housing development. Recently it agreed to engage in the Namuwongo Slum Upgrading Project, which has demonstrated, particularly among low income families, that to own a house provides the greatest incentive to the saver. The HFCU branch set up in the project area is doing very well and, because of the tangible benefits concomitant with home ownership, the families' savings ratio has gradually increased[3].

There are two building societies in Uganda: the Continental Building Society and the Alliance Building Society. Building societies were established to provide loans to households to build or purchase dwelling units. The Registrar of Building Societies was expected to supervise these institutions. However, the failure and closure of building societies after 1986 has raised such public concern that their supervision has been brought under the Bank of Uganda.

Two insurance companies, the National Insurance Corporation and the Uganda American Insurance Company, have provided housing mortgage facilities, but they have of late abandoned the business, preferring instead to engage in real estate development of their own.

There is also the National Social Security Fund which is a government sponsored workers savings scheme for the benefit of its members at the end of their service. The fund is kept separate from government revenue and managed by a special agency established by an Act of Parliament in 1985. However, the Fund has not financed housing development. It plans to complete the construction of an office complex called Worker's House which has been at a standstill for over fifteen years. Uganda Commercial Bank is the largest banking institution in the country with branches in most rural areas. Three years ago it launched a Mortgage Finance Scheme. But the scheme has yet to make an impact in the housing sector. Its policy seems to have shifted from low-income financing to commercial financing.

Most banks still require collateral, and this eliminates most rural dwellers and low-income urbanites from the market. Given that funds for housing development or mortgage loans have to compete with lending to other sectors of the economy, the scheme is at a disadvantage. Other banks in the country provide some mortgage loans but on very limited scale. Consequently, there are still many people who must resort to the informal sources of funding like money lenders and thrift and credit groups.

Finally, there is the National Housing and Construction Corporation, a parastatal under the Ministry of Lands, Housing and Urban Development, the duty of which has been to construct, lease and sell residential houses. Most new dwelling units are paid for out of family savings.

Housing will remain limited until savings and credit institutions can be strengthened to provide mortgage financing

5.4.12 Monuments and historical sites

Under the Historical Monuments Act of 1967, eleven sites have been gazetted for protection.

- Kasubi Tombs, Kampala
- Nyero Rock Paintings, Ngora, Kumi
- Karambi Tombs, Fort Portal
- Mparo Tombs, Hoima
- Wamala Tombs, Kampala
- Baker's Fort, Patiko, Gulu
- Kalema's Komera (prison ditch), Mpigi
- Nkokonjeru Tombs, Kakika, Mbarara
- Bweyogerere Capital Site near Gayaza, Mpigi
- Katasiha Fort, Hoima
- Muganzilwazas earthworks, Kyebando, Kampala

The number of visitors to these sites has not been recorded. Other sites which are recommended for legal recognition include

- Ntusi area, Masaka - remains of ancient settlement and Bigo earthworks
- Kakumiro area, Mubende - Munsa earthworks, Bikekete rock shelters and Semwema hill human cave complex

There are clearly a number of ancient remains and defensive earthworks located around the country dating from the stone age to recent times. Many contain just a trace of human habitation or are simply mounds of earth. There are also historic sites, such as the Namugongo Martyrs Shrine, which are used for commemorative events.

5.4.13 Cultural institutions

Cultural institutions are all those institutions where exhibitions of all types take place and/or where people can go for amusement or information. There are quite a number of these all over the country but most are concentrated in urban areas with Kampala having the largest share. They include green/open parks, theatres, art galleries, public libraries, Uganda National Museum, and video clubs. There are no operational cinema halls in Uganda. Zoological and botanical gardens are found in Entebbe.

5.5 Transport and communication systems

5.5.1 Road network

With the turmoil in the 1970s and early 1980s, Uganda's road network deteriorated greatly. Feeder roads suffered most, and the majority became impassable. Great emphasis and massive investment has been put into the rehabilitation of both trunk and feeder roads because they are the most important and widely distributed infrastructure in Uganda. Rural feeder roads are mainly gravel or earth roads and make up a total of 20,369 km. About 50% of these require full rehabilitation, 20% are expected to deteriorate further and 30% need only routine maintenance[21]. About 30% of rural households have

no roads and are served by footpaths. Quite a sizable length (1,979 km) of trunk roads are tarmac while most (7,939 km) are murram. Urban roads are neither sufficient nor are they all tarmac. Some urban centers do not have a single tarmac road. Kampala has seen the greatest amount of road rehabilitation, but because of poor maintenance and drainage, its roads deteriorate quickly. New roads in Kampala (30 km) have been developed to serve industrial areas, as by-passes to heavily-trafficked roads, and as important links from one area of the city to another. Much rehabilitation is still required, new roads need to be built to create access to new residential areas.

There are three institutions in charge of road infrastructure:

- The Ministry of Works, Transport and Communications is responsible for constructing and maintaining trunk roads. It has so far embarked on rehabilitating and developing an internal capacity necessary to maintain these roads.

- The Ministry of Local Government is responsible for building feeder roads and has embarked on strengthening District Works Stations which will rehabilitate and maintain rural feeder roads with the participation of Resistance Councils.

- Urban authorities are responsible for opening up, rehabilitating and maintaining roads within their respective jurisdictions that are not the responsibility of the above ministries.

5.5.2 Motor vehicles

Presently, privately-owned vehicles constitute 80% of all vehicles in the country. The government owns 10% while projects and diplomatic missions own 7% and 3% respectively[1]. There has been a dramatic shift in the composition of vehicles owned privately in the last 20 years. There is a trend in favour of pick-ups and vans as compared to heavy commercial vehicles. Minibuses have taken over from buses (see **Figure 5.15**). The number of cars and private vehicles declined in the 1970s and early 1980s but is now increasing rapidly. It is, however, not possible to establish the number of passengers transported over time nor the tonnage of goods or cargo transported by vehicles because of lack of data. The fares are not controlled by the government, but are generally standardized for specific routes. There is no government restriction on the type or quality of the vehicles to be imported. Since the early 1980s, Uganda has imported many reconditioned vehicles from Japan. Write-offs are dumped haphazardly throughout the country. Recently past, the demand for scrap has led to the search for written-off vehicles, particularly in Kampala and Jinja.

5.5.3 Transport companies

There are two public companies transporting passengers. Uganda Transport Company based in Kampala and Peoples Transport Company based in Jinja. Over the years, the fleet, efficiency and coverage of these companies has been on the decline. A decision seems to have been made by government to wind up the two companies. There are a few individuals who also operate buses privately. In haulage, the major freight transporter in the country is the Uganda Cooperative Transport Union (UCTU), a co-operative owned by regional cooperative unions. It was set up primarily to provide transport for its members but it also transports for the general public. The government parastatal Transocean Company has become weak because of lack of fleet and poor management. The regulation and management of passenger traffic in urban taxi parks is contracted

Figure 5.15: Trends of number of vehicles on the road, 1972-92

Figure 5.15a

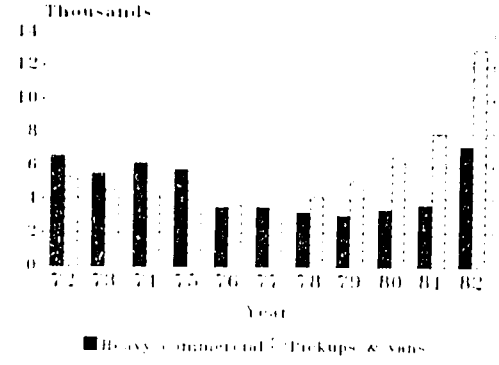


Figure 5.15b

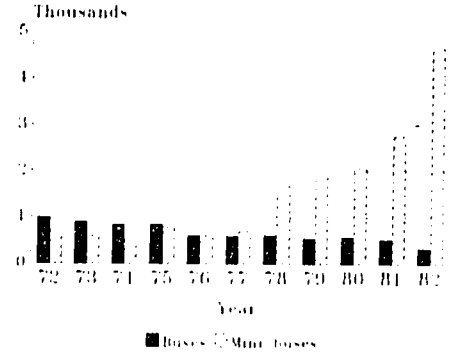


Figure 5.15c

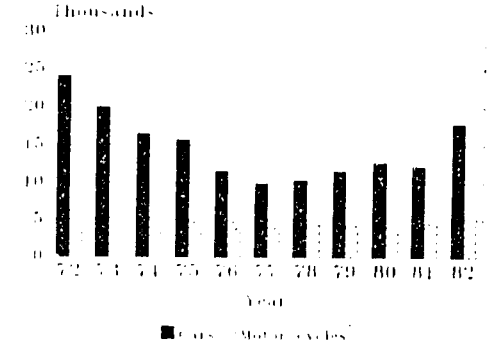
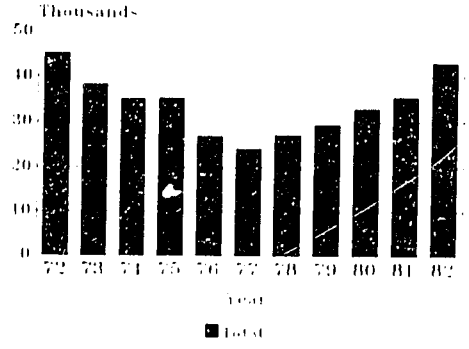


Figure 5.15d



Source: BOU (1993) Quarterly economic report Jan-Mar 1993

5.5.4 Accidents

The classification of road traffic accidents in Uganda is not thorough[m]. But evidence shown in **Figure 5.16** suggests that the number of cars involved in accidents has risen dramatically in the past decade.

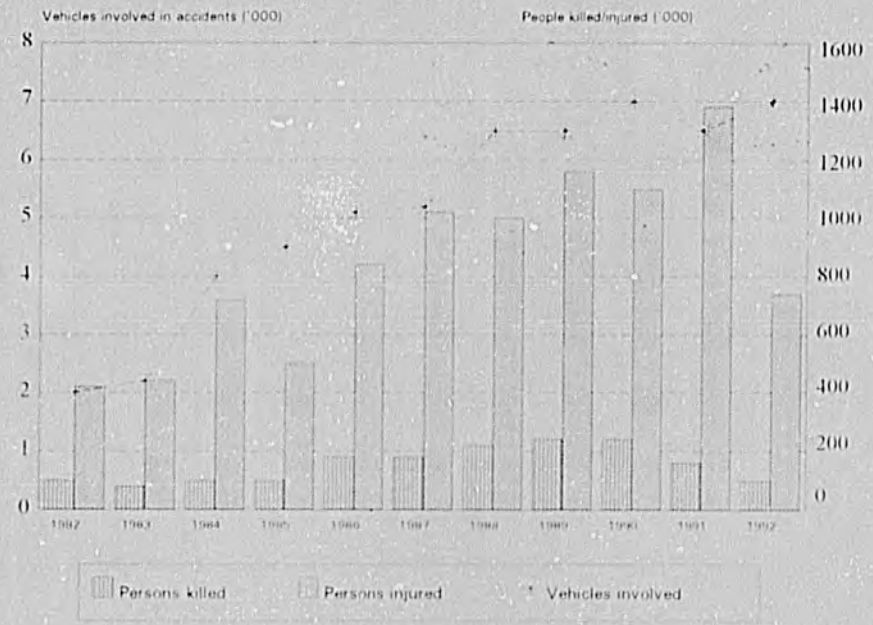
5.5.5 Railways

The history of railways in Uganda goes back to 1905 when a rail-line was built from Mombasa to Jinja. Extensions were later made to Namasagali (1912), to Kampala (1931), to Kasese (1953), from Tororo to Soroti (1929), from Soroti to Lira (1962), and from Lira to Packwach (1964). All totalled, the railway comprises 1,280 km of single track. From 1963 to 1977, East African Railways Corporation managed the railway network in Uganda, Kenya and Tanzania. In 1977 the management was put under the Uganda Railways Corporation (URC) for the network in Uganda.

m Accidents are classified as fatal, serious, slight, persons injured, motor vehicles involved, government motor vehicles, bicycles involved. With such a classification there can be a lot of overlaps.

Over 70% of the railways permanent way is substandard or in poor condition due to old age and almost a decade of inadequate maintenance and repair. Among other priorities, the system requires efficient communication equipment, handling equipment and specialized freight wagons particularly for containers. Another urgent requirement is a training facility[220]. Further, URC is critically dependent on Kenya railway operations for its transit operations to and from Mombasa. A new route has also been opened to Dar-es-Salaam. Whereas URC's passenger business has been on the decline because of closure of routes and irregular service, that of cargo has slowly been on the increase (**Figure 5.17**). Recently, URC reopened its route to Packwach which had been closed for over 10 years. If URC can maintain and upgrade its services, the number of passengers transported can be expected to grow

Figure 5.16: Trends of road traffic accidents



Source: Ministry of Internal Affairs

5.5.6 Waterways

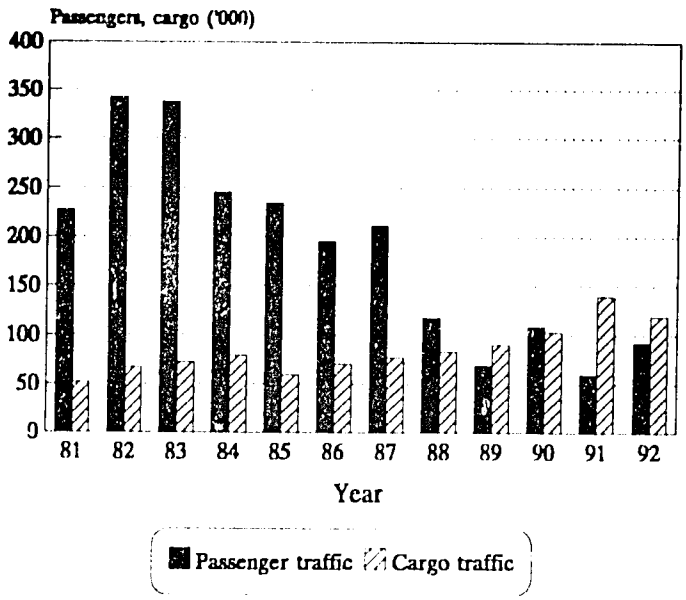
Uganda has 18% of its total area as open water in the form of rivers and lakes. The lake system includes Lake Victoria, Lake Albert, Lake Edward linked to Lake George by the Kazinga Channel, Lake Kyoga and several other small lakes situated in the south. The East African Railways Corporation used to operate lake services on Lake Victoria quite successfully till its break up in 1977. Recently, however, important services have been resumed by wagon ferry between Jinja and Mwanza (Tanzania) and also between Port Bell and Ssese Island.

5.5.7 International and domestic air traffic

The infrastructure for air transport consists of the international airport at Entebbe and 12 gazetted domestic airfields[221] at Kasese, Mbarara, Jinja, Tororo, Soroti, Moroto, Lira, Masindi, Kabalega Falls, Pakuba, Gulu and Arua. Private airstrips exist at Mweya, Naguru, Kidepo and Moyo. Many of the latter are not operational now. In 1979, Entebbe Airport suffered structural damage during

the war against Amin and is now undergoing rehabilitation. Uganda Airlines was formed in 1976 and became the sole national carrier with the collapse of East African Airways in 1977.

Figure 5.17: Trends of railway passenger ('000 passengers/km) and goods traffic ('000 tons/km)



Source: Background to the Budget 1991-92, 1993-94

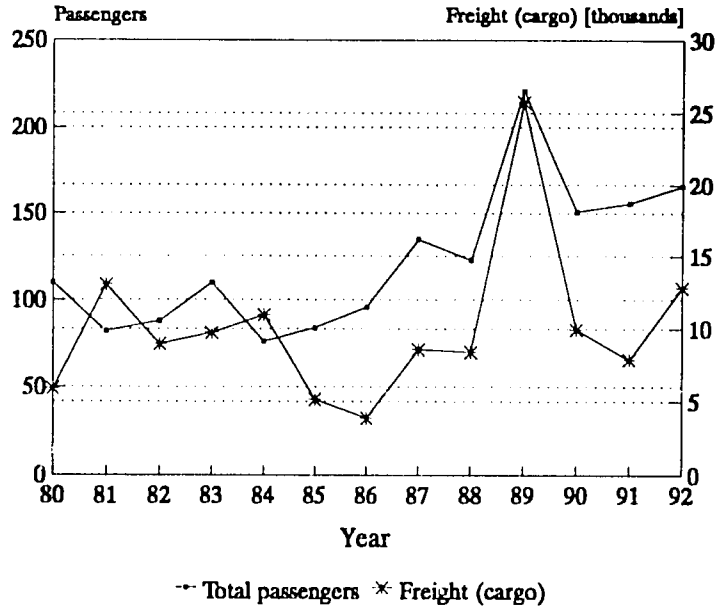
The Civil Aviation Authority was formed in 1991 to licence and regulate civil aviation activities in the country. It has granted air service licences to 11 scheduled airlines and 10 non-scheduled airlines[22]. This reflects the restoration of peace and economic recovery. The Authority is bound to carry out its functions in a manner consistent with the Chicago Convention. No major accident has ever taken place at the Airport. In 1990, however, a Uganda Airlines Aircraft was involved in an accident at Rome in which 32 people were killed.

5.5.8 Posts and telecommunications

Posts and telephones bear directly on the performance of the economy and society because they facilitate communication. Like others, this sector also had its share of the bad times.

By 1988, when there were about 27,900 Direct Exchange Lines (DEL), the waiting list for telephone service totalled about 25,400 registered applicants, indicating that only 52% of expressed demand was satisfied. The situation has not changed much since 1988. By 1988 Uganda had an installed capacity of 57,900 connected subscriber lines and a telephone density of 0.2 DELs per 100 persons, comparable to Sudan (0.2) and Tanzania (0.2) but considerably lower than Kenya (0.6) and the rest of Africa (0.4). At present, the fault rate is 2.7 per DEL per annum in the case of telephones. This is the highest ever recorded in the world. A reasonable fault rate would be 0.5 per DEL per annum. There are 890 telex subscribers in Uganda, 90% of them in Kampala.

Figure 5.18: Commercial traffic at Entebbe International Airport



Note: In 1989 there was a big increase in number of passengers and cargo mainly due to increase in domestic flights to Arua, Kasese and Mbarara and increase in Air cargo charters.

Source: Background to the Budget 1993 94

All domestic and international telecommunications services are provided by the Uganda Posts and Telecommunications Corporation (UPTC), which is a parastatal under the Ministry of Works, Transport and Communications. Postal services unlike telecommunication service are provided by both UPTC and four private companies. The private companies have to be licensed by UPTC before they go into operation.

6.0 ENERGY RESOURCES

6.1 Introduction

Energy is a critical ingredient for a country's development. The stage of development of a country can often be gauged by its level of consumption of commercial energy. Compared to other countries in the region, Uganda's *per capita* total energy consumption is very low and declined in the 1970s and 1980s (**Figure 6.1**). When only commercial energy is considered, the present level of consumption is even lower both in absolute and relative terms (**Figure 6.2**). By these last data, the average Ugandan consumes about 0.02 toe (tons of oil equivalent) per year and the average European and American about 5.0 per year.

The energy sector of Uganda divides into four subsectors: woodfuel, petroleum, electricity, and new and renewable sources of energy.

Woodfuel is the dominant energy subsector accounting for 94% of the total energy consumed in the country. Woodfuel feedstock is consumed either as firewood or charcoal. Firewood is used mostly in rural areas while charcoal is largely an urban commodity. The dominant position of woodfuel in the energy sector of Uganda is shown in **Figure 6.3**.

The *petroleum*-based energy subsector provides about 4% of the country's consumption requirements. Petroleum products are obtained entirely through imports. Although some exploration work has been carried out, there are as yet no proven commercial reserves of crude oil.

The *electricity*-based energy subsector contributes about 1% of the total energy consumed in Uganda and is generated primarily from Owen Falls Dam at Jinja in southeastern Uganda. In the smaller, remote urban centers, electricity is produced using diesel-oil generators. Only 8% of the population of Uganda has access to electricity.

The interest in *new and renewable energy sources* is relatively recent. The combined contribution of the new renewable sources of energy to the total energy consumed in Uganda was estimated at 1%. This subsector probably has a much larger potential than the current contribution suggests. Except for biogas, these sources of energy have not been sufficiently explored to determine the best methods of harvesting them at sustainable levels. Even for biogas, less than ten stations (digesters) are now in operation in the whole country[223]. The new and renewable energy sources include:

- **Solar** energy can and is being used for drying crops. It represents an abundant form of energy in Uganda; and it can play a significant role in preserving most food crops, beverages, tobacco, fish, meat and even sawn timber. It has been observed that the effort to improve solar drying should be supported[224] but concentrated on food and other crops where continuous drying is not essential. This source of energy could be substituted to some extent for fuelwood. Solar water heating could save considerable energy in hotels, hospitals, factories and homes where the current electric grid system is not available. However, the potential of solar energy for cookers is at present limited since this involves an expensive storage system.

- **Biogas** can be generated from organic wastes of grasses, weeds, aquatic plants, crop waste and farm yard manure. It was once estimated that about 50,000 metric tons of cattle manure is available in the country[225]. Compared to other sources of new renewable energy, the utilization of biogas seems to be the only one on the

increase. Organic waste, which in some cases is a health hazard, is a potential source of biogas production. However, other studies caution the use of biogas by the subsistence sector. These groups often lack sufficient capital to build or operate self-sustaining units. On the other hand, biogas could prove useful on large scale farms.

•**Wind energy** has a high potential in Uganda. This source of power could be used both for milling grain and pumping water, but data on its practical use is still relatively scanty. However, windmills have existed in Uganda for sometime now. They have been installed in Karamoja for pumping water. However of the 12 windmills in Karamoja, only six were operational as of 1992.[226]

•**Sawdust** from sawmills such as the Sanau Sawmills in Mbale and Kiira Sawmills in Jinja, each producing 10,000 tons of sawdust annually[227]. This exploitation is still negligible, despite scarcity of fuelwood in areas like Mbale. Sawdust may be transformed into charcoal briquettes by mixing it with coffee or rice husks.

•**Crop wastes**: The actual consumption of crop wastes is difficult to estimate but is probably less than 100,000 toe. For household use, residues are considered inferior since they burn quickly. Although a higher proportion of crop residues could be used for fuel in the short term, this may be to the detriment of soil or at the expense of other uses such as animal feed and organic fertilizer.

•**Coffee husks**: Coffee is a major crop in Uganda and the husks could be a prime source of energy. Since coffee is hulled centrally instead of at households, there is a good potential for commercializing the production and briquetting of the husks[228]. For example, production of coffee reached 175,000 metric tons at one time. This production level generates 120,000 metric tons of coffee husks and 147,000 tons of clean coffee. One notable example where coffee husks are used as energy source is in a brick and tile plant.

•**Rice husks**: Rice production is becoming an important activity in Uganda. Currently, it has been estimated that rice production covers 18,000 ha with a yield of 1.6 metric tons/ha of paddy, generating a total of 8,200 tons of rice husks[229] available for energy production.

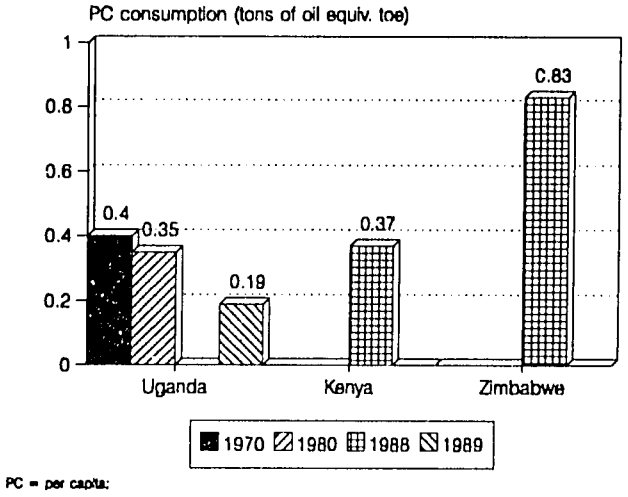
•**Geothermal energy**: This energy resource could be tapped from the Rift Valley region of Uganda, but so far, it has not been exploited. The estimated potential is 450 megawatts. There are three potential geothermal fields: the Katwe volcanic field to the south; the Buranga field at the foothills of Rwenzori mountains and; the Kibira field in the northern part of the Rift Valley near Lake Albert.

Of the three sites, the Katwe field is the most promising as well as famous for its explosive craters and saline lakes. The hot water comes from sub-surface steam with a temperature of 230°C. In addition, the Katwe field is well located, that is, only 35 Km from the terminus of a 132 Kilovolt transmission line at Kasese. A geothermal power plant could supply energy to the salt mining facility at Katwe. The other two fields are located in sparsely populated and remote areas, with some potential for local consumption.

•**Liquid fuels**: These fuels include ethanol and bio-diesel and have a direct bearing on the level of the crops needed as feedstock. Fortunately, Uganda has both a starch-based crop (cassava) for ethanol production and simsim (sesame) for bio-diesel[230].

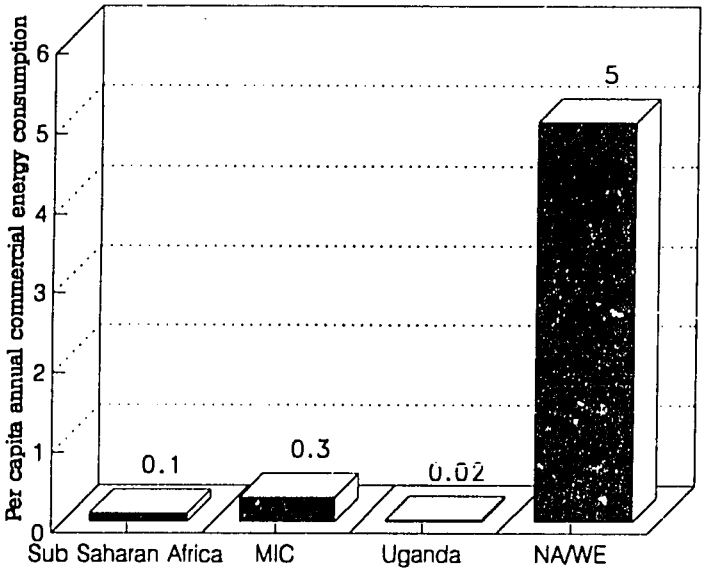
•**Peat**: This form of energy can be obtained in abundance, in the central part of Uganda, particularly around Lake Kyoga. It is a rather bulky form of energy and remote from potential consumers. So far, no work has been carried out to determine the feasibility of its production and marketing.

Figure 6.1: **Comparison of *per capita* total energy consumption: Uganda, Kenya and Zimbabwe, selected years**



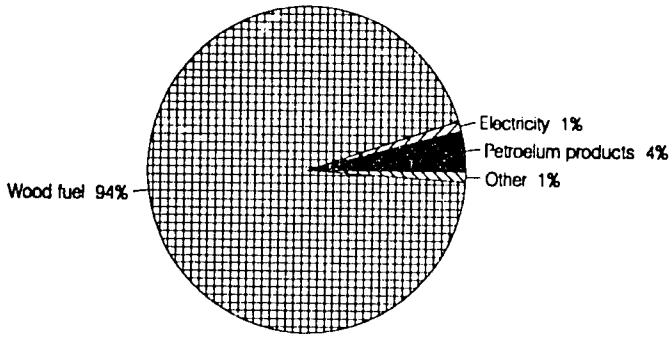
Source: World Bank (1991)

Figure 6.2: **Comparison of *per capita* commercial energy consumption (1989 basis); Sub-Saharan Africa (SSA), Uganda, North American and Western European (NA/WE) average; and Middle Income Countries (MIC)**



Source: World Bank (1991)

Figure 6.3: Composition of energy consumption in Uganda, 1990



Source: MFEP (1992)

6.2 Energy crisis in Uganda

Each of the four energy sub-sectors were seriously affected by the economic decline of the 1970s and early 1980s, characterized by falling demand, deforestation, inadequate maintenance, low investment, and distorted pricing mechanisms. Several indicators point to an energy crisis in Uganda, including: reductions in quantities of petroleum imported; accelerated deforestation; lower levels of nutrition in some districts due to lack of fuelwood for cooking; and deterioration in electricity generation and distribution systems.

6.2.1 Reductions in petroleum imports

Uganda's petroleum imports are met entirely by imports and contribute about 70% of commercial energy supply. Petroleum imports are closely related to export earnings. During the early 1970s, the quantity of petroleum imports declined. The main reasons were a stagnating economy and a dramatic increase in crude oil prices (the Oil Crisis of 1973). During the 1980s, especially 1986 to 1989, petroleum imports increased significantly. Partly, this was due to a relatively stable economy. There was some private investment, the revival of agricultural and industrial capacities, and reduced inflation. The revival of export earning capacity during this period allowed for increased imports of petroleum.

The demand for petroleum products rose by an average of 16.2% per annum during the 1965-70 period, 5.8% per annum for the 1982-85 period, and 4.4%, thereafter. These increases follow closely the export earning capacity of the economy. For example, coffee exports which account for over 90% of earnings, declined from 176,450 metric tons in 1989 to 127,440 metric tons in 1991. This decline in quantities exported was accompanied by declines in unit prices, thus further exacerbating the export earnings situation. The foreign exchange provided for petroleum imports usually just meets or is somewhat short of amounts needed to meet demand. Consequently, stocks of petroleum products are often low and sometimes non-existent. **Figure 6.4** shows trends in the sales of petroleum products by the oil industry. Sales of petroleum products over the 1971 to 1992 period have not recovered to the 1970 levels.

6.2.2 Deterioration in electricity generation and distribution

Electricity is primarily generated from the Owen Falls Dam Station (installed capacity of 150 MW) and to a lesser extent from diesel oil generators (installed capacity of 5.0 MW). There was a remarkable decline in the generation of electricity in 1970 when the Nyanza Textile Mill switched to the use of fuel oil for steam generation and UEB had to cut back its power sales to the firm. Other declines also followed. From 816 GigaWatt Hours (GWH) of electricity generated in 1971, the production at Owen Falls declined to 459 GWH in 1979, but has since then improved, reaching 660 GWH by 1989. The decline in electricity generation from 1971 onwards was caused by a deliberate reduction in power exports to Kenya (since it was paying lower rates than Ugandan consumers) and poor or inadequate maintenance, a result of shortage of essential materials and spare parts to keep the facility fully operational. Electricity generation efficiency was thus heavily impaired.

Although 40% of Uganda's population lives in the area covered by the Uganda Electricity Board (UEB) system, only about 8% of the total population has access to electricity, or 20% of those in the UEB areas. One reason for this inadequate service is the poor maintenance of the transmission system. Over the years, as shown in **Figure 6.5**, transmission and distribution losses have been substantial, increasing from 60.6 MW in 1982 to 221.7 MW in 1991.

The distribution of electricity in towns is through 33 KV and 11 KV power lines. Long distance transmission is through 132 KV and 66 KV lines. The electric grid extends across the southern part of the country to cover Masaka, Kampala, and Jinja to the west of Owen Falls Dam and Tororo to the east where it connects with the Kenyan system and to the northern line running up to Lira.

This system is supplied by only one source, the Owen Falls Dam Station. Therefore, any fault at the station results in total loss of supply throughout the country including parts of Kenya. Second, as some of the transmission lines are very long and pass through unpopulated areas, they are difficult to maintain. For example in eastern Uganda, powerline poles have rotted in swampy areas, and some have collapsed. Localized power outages also occur frequently. Finally, since many of the sub-stations and cables in the distribution system are now more than 30 years old, with limited maintenance in recent years, there is a tremendous backlog of replacement requirements. The immediate problem is to keep hydroelectric power supply operating, while combating the problem of overloaded lines and shortages of spare parts to maintain the UEB system.

The current objective is to increase the capacity of the Owen Falls Station from 150 MW to 180 MW through uprating. This is a short-term measure and will certainly not meet the projected demand for the year 2000. Also, there are plans underway to put up new plants by the year 2000 at Bujjagali, Kamdini, Ayago and possibly Murchison Falls (subject to environmental assessment)[53].

6.2.3 Accelerated loss of vegetation and soil degradation

Considerable pressure is being exerted on woodlands, forests and agricultural lands by the exploitation of woodfuel (firewood and charcoal). Current production of fuelwood is estimated to be 15.6 million m^3 whereas consumption is about 18.3 million m^3. Thus demand exceeds supply by 17%. There is, therefore, a marked gap growing between sustainable supply of and demand for fuelwood[54]. This gap is attributed to two complementary factors: decreasing amount of woodfuel, and inefficient utilization of the resource due to the use of rudimentary stoves and the three-stone-open hearth. The shortfall is made up by cutting more of the woodfuel stock. This accelerated harvesting or "resource mining"

is non-sustainable, leading to devegetation, soil erosion and degradation, siltation of water courses and reservoirs, and even a change in local climate. In many parts of Uganda, rural women are traversing longer distances in search of wood. With the two aspects of apparent increase in urbanization and inadequate or inefficient electricity supplies, the prices of other energy forms like kerosene have shot up[233]. It has been suggested that districts like Arua, Soroti, Mbarara, Rakai, Tororo and Pallisa are already experiencing fuelwood scarcity[234].

Urban dwellers have also contributed significantly to the destruction of forests in their need for charcoal. In 1985-86, there were 441 licensed charcoal burners, but it was estimated that about 5,000 people were actually involved in charcoal burning[235]. The Household Energy Planning Project (HEPP) Study[236] confirmed widespread encroachment on forest reserves by charcoal burners. About 77% of the South Busoga Forest Reserve and 25% of Mabira were encroached upon for both agriculture and charcoal production.

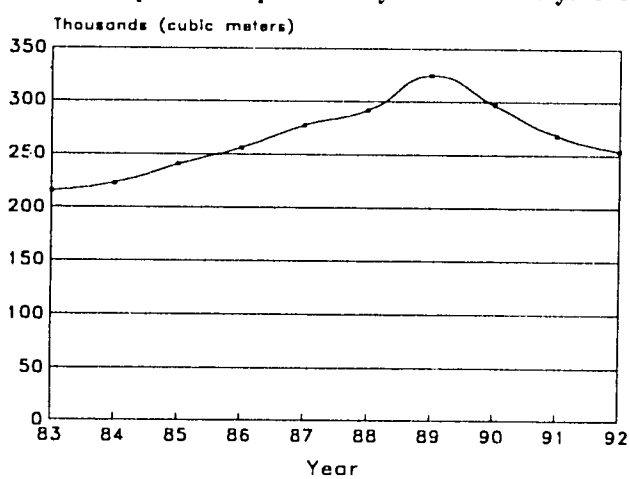
6.2.4 Lower levels of nutrition

There is no hard data on the impact of the lack of affordable energy on the nutritional status of Ugandan households, but observation in other parts of Africa suggest that:

- some families are resorting to burning crop residues and livestock dung due to scarcity of fuelwood and lack of access to adequate supply of kerosene and electricity. At best, these crop residues can be useful for short periods. Consequently, these families reduce the number of meals cooked in a day, and traditional diets are changing in favour of faster cooking, but less nutritious foods thereby contributing to growing malnutrition in these homes. The most vulnerable members of the households are usually children. Prices of charcoal and paraffin have steadily risen in Kampala since 1990 (**Figure 6.6**).

- the use of crop residues and livestock dung as a source of energy in turn undermines increased food production since these materials are often used as cheap sources of organic fertilizer. Crop residues are often used as mulch in soil moisture conservation.

Figure 6.4: Sales of petroleum products by the oil industry: 1983-1992

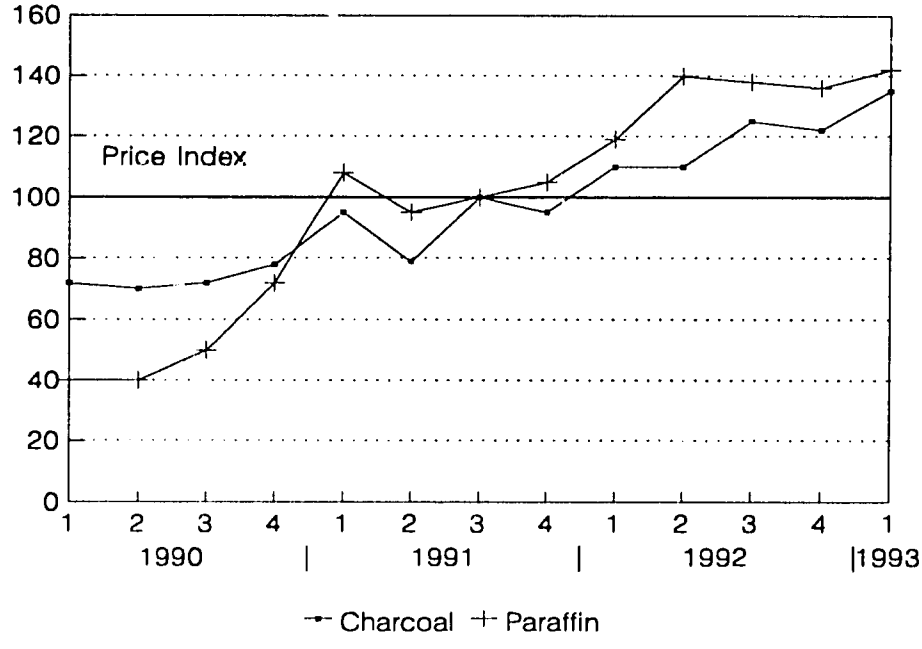


Source: MFED, Background to the Budget, 1991-93, UEB

Figure 6.5: Trends in electricity transmission and distribution losses

Source: MFEP, Background to the Budget 1991-93, UEB

Figure 6.6: Price indexes for charcoal and paraffin sold in Kampala markets



Source: MFEP (1993)

6.3 Electricity supply and demand

6.3.1 Demand

The main uses of electricity in Uganda are residential, commercial, and industrial. Overall, electricity accounts for only 1% of the total energy consumed in the country. A comparison of the consumption of electricity by end-user categories for 1982 and 1990 is shown in **Figure 6.7**. From the data, it is clear that the share of electricity exports to Kenya declined from 42.7% in 1982 to 30.6% in 1990, partly as a result of the UEB's realization that tariff rates in Kenya were much lower than those in Uganda[37]. The share of industrial/commercial use also declined from 33.5% in 1982 to 30.7% in 1990. Only the residential consumption of electricity increased, from 23.8% in 1982 to 38.7% in 1990. **Figure 6.8** shows annual trends in the consumption of electricity by the same use categories for the period 1982 to 1991.

The domestic category is the largest source of demand for electricity. It experienced growth over the past two decades while other categories such as industry stagnated partly due to the then-insecurity and macroeconomic uncertainty. Demand patterns have also shifted. For instance, in 1971, 64% of electricity sales were to medium and large industries, while 18% were to households. Currently, however, households are now estimated to account for 46% of electricity consumption and over 50% of peak demand.

Estimates of regional demand for electricity in Uganda for the years 1970, 1980 and 2005 indicate that in 1970 eastern Uganda consumed the largest share of electricity. By 1989 it was overtaken by the central region and is expected to lose its previous dominance up to 2005. Furthermore, the data also clearly illustrate the high concentration of electricity use in only two regions, east and central. These two regions did and are expected to account for over 80% of the share of electricity consumption in the country.

Table 6.1 shows growth rates in the demand for electricity. This forecast is partly based on the hope for re-opening certain industries such as the fertilizer plant at Tororo, the paper factory in Jinja, and Kilembe copper mines in Kasese. Electricity is also expected to remain the cheapest source of energy for most households. Thus the projections assume that some shift will occur away from other sources of household energy, towards electricity. Furthermore, the demand forecasts exclude the possible impact of rural electrification due to uncertainty about future programs. Rural incomes cannot currently bear the cost of electrification, and the current electricity consumer base is not big enough to allow it to be subsidized. This assumes that since 90% of the population live in rural areas, they will continue to depend largely on woodfuel. Furthermore, urban households outside of the national grid will also continue to demand greater quantities of charcoal. The twin effect will be to further worsen wood scarcity.

6.3.2 Supply

Installed capacity was estimated to have increased from 155 MW in 1983 to 167 MW in 1992, of which over 90% represented hydroelectric capacity and the balance diesel oil generation.

Uganda is well endowed with hydroelectric potential. The greatest potential is found on Victoria Nile. There are several potential hydroelectric sites from Lake Victoria to Lake Kyoga, Lake Kyoga to Lake Albert, and Lake Albert to the Sudanese border at Nimule. **Table 6.2** shows the potential hydroelectric sites along this route. If some of these sites could be developed, and electricity were

attractively priced, the pressure on woodfuel would be lessened.

Table 6.1: Alternative projections of energy consumption* (forecast)

	GROWTH RATE (% PER ANNUM)			CUMULATIVE INCREASE OVER 1982 LEVEL (%)		
	1985	1990	2000	1985	1990	2000
Base Case:						
Electricity	11.6	6.2	6.2	41.7	87.5	225.0
High Case:						
Electricity	24.0	14.5	8.0	91.7	275.0	708.3
Low Case:						
Electricity	6.1	6.1	3.0	20.8	62.5	116.7

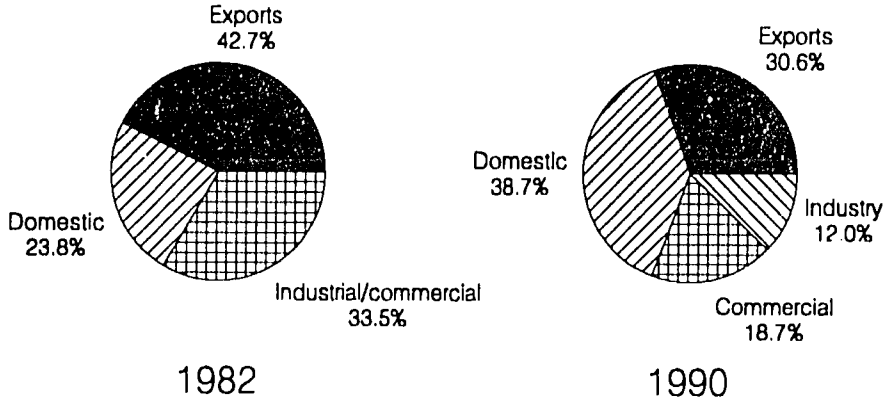
* *Based on alternative economic and population projections*

Source: UNDP/World Bank. Uganda: Issues and options in the energy sector, 1988

In addition, due to their geography and high rainfall, areas in the southwest, central west and northwest have many possible sites for small hydropower projects[238]. However, making these sites operational would affect the environment. The structures that would be installed would certainly modify the regimes of the rivers and streams, cause flooding of reservoir areas and, in some cases, reduce the potential of water for irrigation. This will greatly affect the livelihood of the people living around the sites.

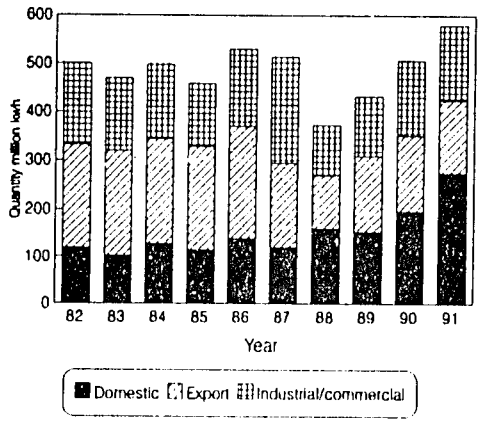
Figure 6.9 shows a balance between hydroelectricity demand and supply. The data shows that Uganda's hydroelectric potential far exceeds its projected demand to the year 2000. However, action will be needed to develop additional capacity to meet expected increases in domestic consumption.

Figure 6.7: Percentage consumption of electricity by major end-use categories, 1982 and 1990



Source: MFED, Background to the Budget, 1992-93 Economic Performance 1991-92 and prospects for 1992-93

Figure 6.8: Annual trends in the consumption of electricity in Uganda, 1982-91



Source: MFEP, (1992)

Table 6.2: Major sites with hydroelectric potential

SITE	POTENTIAL CAPACITY (MW)	ANNUAL GENERATION CAPACITY (GWh/Year)239
Between Lake Victoria and Lake Kyoga		
Owen Falls (uprated)	210*	981
Bujagali	180	915
Busowoko	160	840
Kalagala	115	585
Sub total	665	3321
Between Lake Kyoga and Lake Albert		
Kamdini	230	527
Ayago	540	2900
Kabalega	520	3300
Sub total	1290	6727
Total	1955	10048

* *Assuming the Owen Falls Station is uprated and based on 630 m3/s firm flow, the 60 MW extension project on the east bank of the river would not generate firm power on firm energy. However, it is possible that the detailed restudy of the hyrology of the Victoria Nile might modify this conclusion. In the case, the hydroelectric potential of the river would be higher than shown in this table.*

Source: UEB's consultant reports

6.4 Petroleum supply and demand

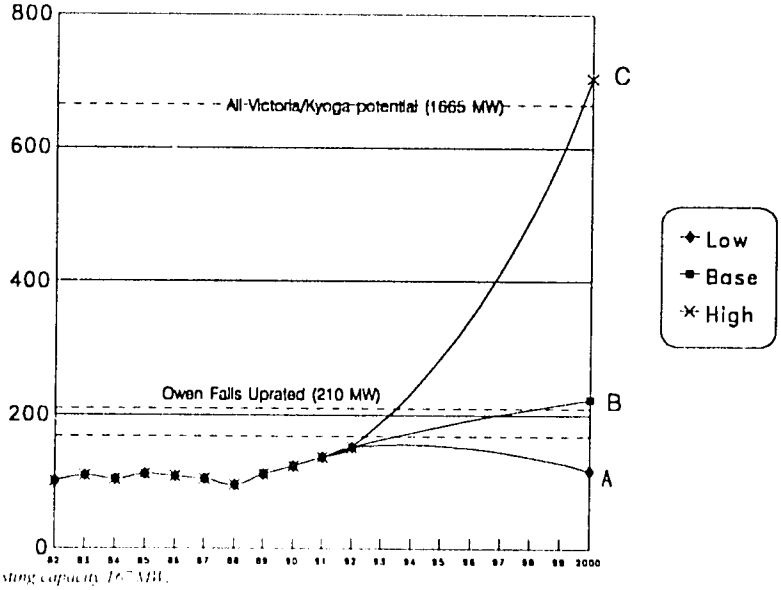
During the 1970s, the performance of Uganda's economy declined: foreign exchange earnings dwindled (except for a brief period around 1976 when coffee prices increased sharply) and the volume of petroleum products consumed in Uganda fell to 250,000 metric tons by 1980 from 431,000 metric tons in 1970. During this period, the scarcity was further exacerbated by smuggling of petroleum products to Rwanda and Zaire (a form of illegal re-exports). An estimated 40% of kerosene imports were smuggled to Rwanda and Zaire, while 20% of auto diesel was re-exported back into Kenya illegally.

Since the beginning of the 1980s, there has been a steady increase, averaging about 12% per annum, in the sales of petroleum products by the oil industry. A comparison of the consumption of petroleum products by end-users is shown in **Figure 6.10**. The data show that both the shares of the transport and domestic use categories increased in 1990 when compared to 1982 data; that of industry showed a decline. **Figure 6.11** shows annual trend in the consumption of petroleum products by the same end-users for the period 1982 to 1991.

In 1990 there was a decline in imports of petroleum, reflecting a drastic drop in the export of coffee, the main foreign exchange earner. To put this consumption of petroleum products into perspective, it was about one-half of the peak level of 1970. The share of motor spirits increased from 29.4% in 1983 to 42.4% in 1992. Shares of aviation fuel, kerosene, industrial diesel and fuel oil all declined, while that of auto diesel increased slightly. The share of liquid paraffin gas (LPG) remained relatively unchanged.

The transport sector consumes about 76% of petroleum products and accounts for about 4% of total energy consumption in the country. The dominant fuel in the transport sector is petrol which accounts for 50.6%. Diesel represents 42.5% and other products 7.1% of total sector fuel usage.

Figure 6.9: Hydroelectricity demand and supply



A - Existing capacity 150 MW;
B - Owen Falls Uprated 270 MW;
C - All Victoria Kyoga potential 665 MW;
D - Not shown but includes all Victoria Kyoga Albert 1955 MW

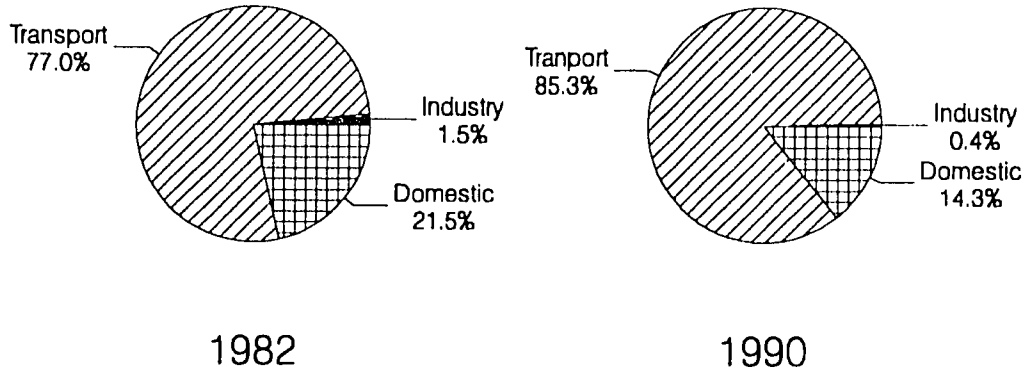
Source: *Actual - Ministry of Finance and Economic Planning, MFED (1992-93); Projected - Uganda Electricity Board, 1990*

6.5 Woodfuel demand

Information on woodfuel consumption is very scanty because of the decentralized organization of this subsector. Hence only rough estimates exist. On the average, Ugandans are estimated to consume one air dry ton of fuelwood *per capita* per year[240]. Most of the woodfuel is consumed by households.

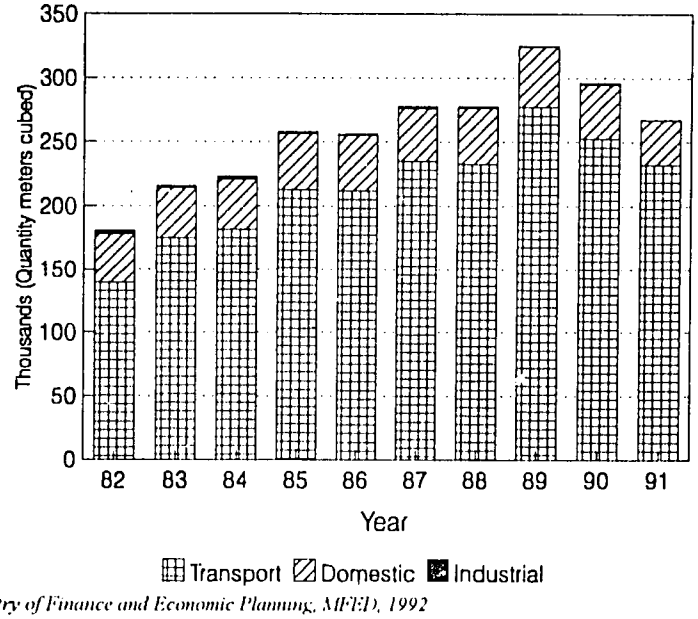
Woodfuel is expected to remain the major source of energy for Ugandans for a long time to come. About 90% of the population is rural and depends on fuelwood for its energy needs. This demand exerts great pressure on the woody biomass resource base. Unless properly managed, the long-term implication of this level of resource use could well be the irreversible depletion of fuelwood resources and the degradation of the environment.

Figure 6.10: Consumption of petroleum products in Uganda by major end-user categories, 1982 and 1990



Source: Ministry of Finance and Economic Planning, 1992

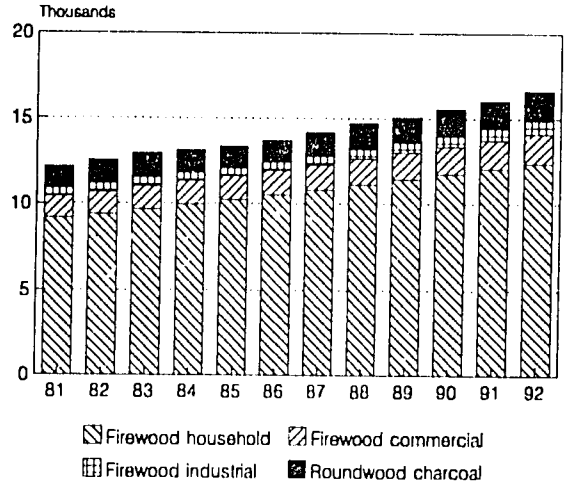
Figure 6.11: Annual trends in the consumption of petroleum products, 1982-91



Source: Ministry of Finance and Economic Planning, MFEP, 1992

The large amount of non-commercial woodfuel consumption compared to the lower level of petroleum and electricity use reflects that there is a concentration of energy use in rural households. Approximately 73% of household energy needs are met by fuelwood. This is expected since 90% of the population lives outside of the country's electrical grid system. Even in urban areas, there are many dwellings not connected to the electrical grid. Significant quantities of fuelwood are also used in industry and commerce for various purposes including: curing tobacco leaves, drying tea leaves, smoking fish, baking, steam generation in sugar mills and cooking in small hotels. **Figure 6.12** shows the annual trend in fuelwood consumption from 1981 to 1992 in roundwood equivalents.

Figure 6.12: Annual quantities of fuelwood consumption-roundwood equivalent, ('000 tons)



Source: Ministry of Finance and Economic Planning (1993)

It is reasonable to assume that in the near term at least, the rate of growth in fuelwood consumption should closely parallel that of the increase of the rural population. **Figure 6.13** gives demand projections assuming three (base, low and high) alternative growth scenarios based on different rates of GDP growth.

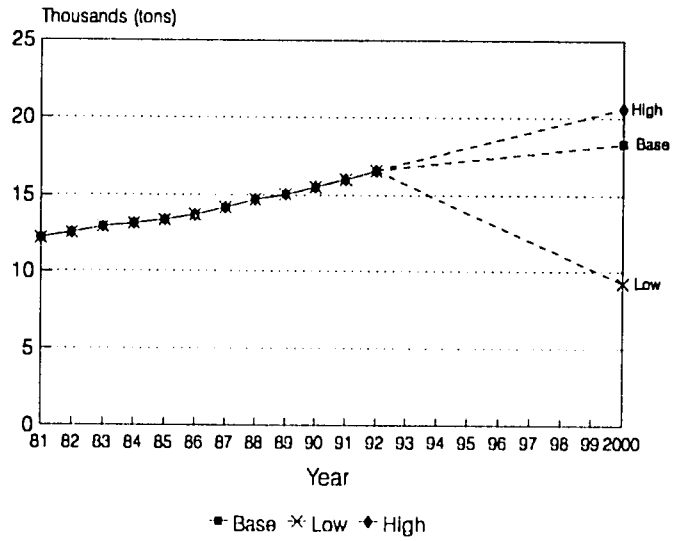
6.6 Biomass supply

The National Biomass study[34] has provided some preliminary information which is useful in assessing the biomass situation in the country. The major types of biomass used to provide energy are:

- *Tree Biomass*: Firewood, charcoal, sawdust.
- *Bush Biomass*: Bush stems and twigs, gathered as firewood.
- *Agricultural Residues*: Coffee husks, rice husks, crop stalks (maize, sorghum stalks), bagasse.

Other possible sources of biomass fuel include *papyrus* and *peat*, but these have not been exploited due to their bulk and remoteness from consumers. The dominant biomass fuel is still woodfuel. Others such as twigs, bush stems and crop residues are particularly important where wood fuel shortages are experienced.

Figure 6.13: Actual and forecast demand for fuelwood to the year 2000.



Source: Ministry of Finance and Economic Planning (1993); Projection-UNDP World Bank (1986)

Woody biomass comes from vegetation cover on public lands, plantations, woodlots, and natural forests. Charcoal is made from firewood. However, some of the processes used are inefficient, resulting in low recovery rates and more wood being harvested to produce a given quantity of charcoal. The wasteful production processes and the carbon dioxide and other gaseous emissions during manufacturing have implications for environmental quality.

Crop residues obtained from agriculture include stalks of maize and sorghum, sugarcane bagasse, and rice and coffee husks. In severe fuelwood shortages, animal manure is also often used for energy.

Uganda has large amounts of fast growing papyrus, but it is at present in limited use as a source of energy. Papyrus can be used as fuel directly after drying or after carbonization. The technology of carbonization is well known but requires investment. Other problems are more related to people's habits, preferences and the harvesting process. If developed, the use of papyrus could threaten the integrity of wetlands unless appropriate conservation measures are put in place.
There are very few established plantations to cater for the supply of wood, but this is changing. The Peri-Urban Plantations Project (see **Chapter 3**) is promoting the expansion of fuelwood and poles plantations all over Uganda. Individuals, communities, religious organizations and other non-governmental organizations (NGOs) are currently participating in this project. However, there are constraints. tree planting programs are currently heavily dependent on donor-funding both at local and national level, tree planting is dependent upon a well-functioning organization and professional inputs.

Figure 6.14 shows the composition of harvestable biomass in Uganda. However, as shown in **Table 6.3**, there are marked differences among the districts with respect to resource endowments. For example, in Kamuli, tree biomass constitutes over fifty percent of harvestable biomass, while in Moroto, bush biomass is the main source.

Finally, **Figure 6.15** shows biomass budgets for selected districts in Uganda. The data show that while there is a small net surplus of biomass supply over demand for all study areas, the picture for individual districts is quite different. Of the nine districts in the study area, five had shortfalls, while the remaining four were surplus regions. Apart from Jinja, Kamuli and Moroto, the biomass supply in the study area was not sufficient to meet demand and should, therefore, be handled carefully to minimize environmental degradation. The shortfall districts were: Arua (tobacco growing area), Kabale (high population density area), Kampala (high population density and urban region with preference for charcoal), Mbale (high population density area), and Mbarara (high population density area). In these districts, arable, uncultivated and pasture lands, forests, and wetlands are being encroached upon for the purposes of expansion of areas under cultivation and to exploit biomass for energy.

Precise trends of biomass supply have not been established due to paucity of data and incomplete country inventory. Phase 2 of the National Biomass Study is expected to improve upon the available data on potential and actual biomass supply for energy. However, current consumption of fuelwood is an estimated 17% above sustainable supply. Current shortfalls in fuelwood are being made up through accelerated harvesting in excess of the estimated annual increment.

Existing information does not allow for the determination of costs associated with the use of biomass for energy needs. However, some indications are available and worth noting. The social cost of collecting and producing fuelwood has become an increasing burden to many people[32]. As fuelwood becomes scarce, the cost of obtaining it, in terms of time, effort and money, steadily increases. Women and children traverse longer distances and spend more time to obtain fuelwood. This in turn results in less time for other activities, such as food production, home nutrition and other domestic chores. In urban areas, prices of fuelwood are often beyond the means of lower-income households.

The economic value of charcoal or firewood is based on the opportunity cost of land, production costs and a normal distribution margin[33]. Most rural consumers avoid the high retail cost of fuelwood by collecting their own requirements, legally or illegally. It was estimated in 1986 that the cost of cooking using electricity was one-nineteenth of the cost of fuelwood, which in turn was about half the cost of kerosene and LPG. At the time, there was no price differential in using firewood or charcoal for household cooking. From the foregoing, it is important that the economic costs or comparative advantages of using biomass as sources of energy should be carefully analyzed, on a case by case basis.

6.7 Other bio-fuel resources

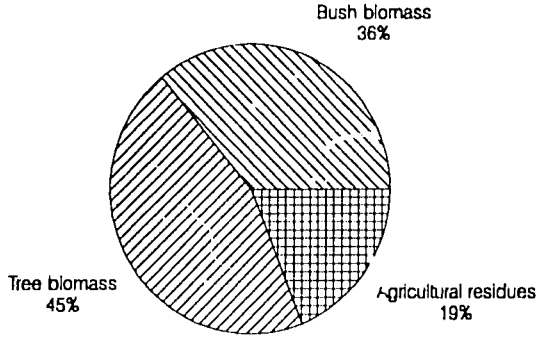
Bio-fuel resources which have potential for use as energy feedstock include:

- Animal manure for biogas production
- Starch-based crops for ethanol production
- Vegetable oil crops for bio-diesel production

Potential is good for encouraging increased production of cassava and sugarcane as ethanol feedstock, and oilseed crops as sources of bio-diesel. Akel International, based in USA, has been contracted to investigate the viability of producing gasohol and bio-diesel.

Uganda has three large sugar cane estates and several smaller farms, with a total installed crushing capacity of 7,000 tonnes of sugarcane per day and production capacity of 133,000 tons of molasses annually. There is an opportunity to produce ethanol for gasohol production[34].

Figure 6.14: Average composition of harvestable biomass in Uganda, 1992



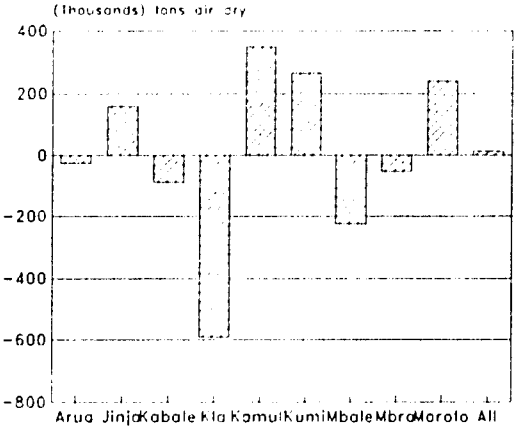
Source: Uganda Forest Departments, National Biomass Study: Technical Report, Phase I: Uganda

Table 6.3: Annual tree increment/harvestable biomass potentials in tons *per capita* air dry weight, 1992

	TREE BIOMASS	BUSH BIOMASS	AGRIC. RESIDUES	TOTAL
Arua	0.39	0.27	0.22	0.88
Jinja	0.61	0.32	0.47	1.40
Kabale	0.41	0.22	0.01	0.64
Kampala	0.26	0.20	0.13	0.59
Kamuli	2.41	1.53	0.65	4.60
Kumi	1.35	1.07	0.36	2.78
Mbale	0.35	0.17	0.14	0.65
Mbarara	0.20	0.40	0.01	0.61
Moroto	0.97	6.38	0.18	7.52

Source: Uganda Forest Department, National Biomass Study, Technical Report, Phase I, (1992) Table 62.

Figure 6.15: Annual harvestable biomass surplus or deficit for selected districts in Uganda, 1992.



Source: Uganda Forest Department (1992)

6.8 Main Policy issues and institutional responses

In **Box 6.1** the major energy supply and demand issues and some of the more promising institutional responses described.

Box 6.1

WOOD FUEL	
A) Excessive consumption, wasteful and inefficient use of wood fuel	A joint UNDP/World Bank Energy Sector Management Assistance Program (ESMAP) Mission to Uganda in 1984, recommended implementation of energy efficiency measures in agro-industries, especially the brick, tobacco, and tile industries.
B) Deforestation/devegetation of forests, wetlands, wetlands/swamps, for agricultural land expansion	World Bank, EEC, DANIDA and CARE have financed the Forestry Rehabilitation Program which became effective in 1988; the goal was to improve forest management, support wood industries; and rehabilitation of forest department, plantations, and programs.
C) Unreliable/inconsistent data on wood energy resources and patterns of utilisation	The Household Energy Planning Program (HEPP) study was initiated with the objective of assisting the government of Uganda to assess household energy usage patterns and alternative fuel types. However, the study results failed to meet targets set; hence the World Bank recommends that the study be redone. National Biomass Survey Project- started in nine districts-completed in 1992
d) Lack of awareness of the benefits of fuelwood conservation- and awareness of social and environmental implications of wood conservation actions	Launching of National Tree Planting Agenda by Government of Uganda with the objective of sensitising the population to environmental degradation caused by deforestation; and call for participation in planning woodlots and practising agro-forestry. Established a National Tree Planting Day. Tree planting by NGOs.
e) Low licensing fees to operators who harvest fuelwood and forest products for commercial purposes.	Recommendation: Government should strengthen and promote National Tree Planting Agenda; expand the peri-urban plantations to supply fuelwood deficit urban centers; licensing and stumpage fees to be fixed at defined levels that would meet some of the development targets of the forest sector.
f) Exclusion of women from the decisionmaking process on fuel wood use and fuelwood conservation	Recommendation: Include women in the decision making process on fuelwood utilisation and conservation schemes.

Box 6.1 cont'd

PETROLEUM	
A) High cost of petroleum imports andtheir unreliable supply	Transport diversification: Government has been encouraged touse rail rather than road transportation from Indian Ocean coast.
B) Lack of strategic stores and stocks of petroleum products	Department of Energy in the Ministry of Natural Resources has been rehabilitating government strategic storage facilities in Jinja and extend services to Nakasongola. Exploration for petroleum in western Uganda has been done to determine possible exploitation of this resource to boost supply of petroleum for Uganda.
HYDROELECTRIC POWER	
A) Monopoly of production, transmission, and distribution of hydroelectric power by UEB; yet management of these services is poor resulting in heavy losses	Five potential sites on River Nile have been studied. Recommendation to government to promote private sector involvement in power generation and distribution.
B) High power tariffs, installation fees and cost of electrical appliances, tending to discourage potential consumers	Recommendation: Encourage private sector participation in production of electrical appliances locally or government reduces taxation on imported appliances.
C) Unreliable electricity supply and high power losses	Rehabilitation of the transmission system by UEB; training and installation of fault detecting equipment.
D) Unfavourable UEB Act, protects interest of the power generating company at the expense of the consumer	Recommendation: UEB Act should be reviewed in order to accomodate consumers interest with respect to power surges and prolonged interruptions, enforce measures to discourage illegal connections and installation.
E) Poor maintenance leading to loss of life/property	Rehabilitation of the transmission system by UEB
F) Unfavourable terms of power export-lower tariffs for Kenya than for Uganda (approximately 1:4)	Power exports to Kenya have been reduced

Box 6.1 cont'd

ALTERNATIVE SOURCES OF ENERGY	
A) Lack of awareness - both within government and the general public about viability and potency of alternative energy techniques.	Two studies have been carried out and results indicate that there is great potential for recycling organic waste and also using manure for biogas production. Restocking areas hit by cattle rustling. Recommendation: Government and NGOs private sector should initiate a comprehensive awareness program about viability and potency of Alternative Energy Technologies (AETs)
b) Lack of data on alternative sources of energy	Uganda's geothermal potential has been estimated to be 450 MW (UNDP, 1971) found mainly in the western rift valley. Recommendation: strengthening research and development in AETs in institutions and NGOs including private sector, through the creation of a Renewable Energy Research and Development Center.
c) Lack of Alternative Energy Technologies (AETs)	NGOs; few Ministries and commercial agents- already using solar photovoltaic technology; YWCA have started construction of solar cookers.
d) Unacceptability of new technologies and high cost of some AETs; disruption of agricultural acitivities by cattle rustling, unacceptability of new technologies	Biogas expert from Burundi has surveyed potential sites for biogas production in Uganda Government has been trying to restock areas which were affected by cattle rustling. Recommendation made for promotion of awareness programs through government and NGOs. Government should support local manufacturing firms from AETs in order to render them cheaper than using imported renewable energy devices.
Lack of sector-wide coordination and planning due to general institutional collapse during the 1970s, and these problems have been compounded due to subsequent neglect; subsector issues were left to operational organisations; eg. energy sector decisions were made by Bank of Uganda	Joint UNDP/World Bank Mission to Uganda (ESMAP) came to asess the energy sector. Creation of five technical units in the Department of Energy: hydropower, petroleum, Energy conservation, renewable sources of energy, and planning and research. In 1983, the Petroleum Desk in Central Bank of Uganda with assistance of ESMAP, began to improve the monitoring of the petroleum import arrangements.
Lack of adequate professional manpower	Research going on in the Department of Physics at Makerere University in the area of AETs. Improved cookstoves techology carried out by USIKA, YWCA, CARE etc. to disseminate their findings UNIDO- to facilitate, guide and coordinate energy programs for Uganda.

7.0 INDUSTRY AND MINING

7.1 Introduction

Industrialization as a strategy of economic growth has benefited many countries worldwide. Uganda has put in place a conducive environment to enable itself revitalise the mining and manufacturing sectors. It has also planned to pursue a deliberate policy to link the manufacturing sector to the natural resource base so as to build an integrated economy. In the process, Uganda must avoid the experiences of countries where growth was detrimental to the natural resource base and human population. In some developing countries now in the throes of industrialisation, city air pollution is far worse than in the industrial countries[245]. Further, despite high economic growth, the newly industrialised countries (NICs) are not a model of sustainable development, as in the USA and Japan their development has been at the expense of environmental degradation[246].

The first problem to anticipate is that as emissions from Uganda's existing and potential industries increase, they will pass a point at which they can be readily assimilated by the environment.

Second, workers will be exposed to health hazards. Third, a shift is likely to occur from less polluting activities such as textiles, towards industries with greater potential for environmental harm such as chemicals. Finally, most industries which have sprung up in the last ten years in Uganda are small-scale and poorly capitalised. Even though environmentally safe technologies continue to become available, they may be too costly. Small-scale industries are numerous, diverse and not demarcated in well-defined industrial zones, thus posing challenges of regulation and enforcement.

At policy level, Uganda needs to avoid passing through its own industrial revolution in ignorance of the relationship between industrial pollution and its serious impact on society. This calls for vigilance to scrutinize and censor imports of technologies and raw materials which have been rejected elsewhere on environmental grounds. Also, clear and easily enforceable measures and economic incentives must be put in place with particular emphasis on those industries whose emissions and wastes cause the most damage, particularly to humans. From the economic standpoint, the criteria for rational action should be that the benefits of reducing exposure to industrial pollution should exceed the costs of control.

The capacity to identify, quantify and value the consequences of environmental management must be enhanced as an integral component of industrial development.

7.2 Historical perspective of industrial development

During the 1960s, the Ugandan government encouraged import substitution to provide essential consumer goods. In many industries, more than 75% of all inputs were imported, in addition to capital equipment and know-how. Little effort was made to see what raw materials were essential for the industry and whether they existed in the country or could be developed. The implementation of industrialization marched forward oblivious of the issue of using local resources and the savings that could accrue from it[247]. Nonetheless, industrialization continued steadily. The manufacturing share of GDP was about 7% in the early 1960s and during the decade real growth averaged over 6%[248] per annum. Industry provided the domestic market with adequate supplies of basic goods, and there was some production for export, most notably textiles and sugar. Unfortunately a dramatic downward trend started in the early 1970s. The value of total output of the manufacturing and its share of GDP were halved between 1970 and 1981. The decline continued until 1986, but the sector recovered slightly in 1987 and 1988 with the rehabilitation of some industries. In 1992, the sector's contribution to GDP at 1991

constant prices was 4.7%. It contributes only 2% to total formal employment. Presently, revenue collected on three industrial products (beer, cigarettes and soft drinks) along side petroleum and spirits accounts for close to 50% of the total revenue collections[249] by central government.

Industrial surveys in 1971, 1983 and 1988 show that structural changes took place during the 1970s, which still affect industry's ability to contribute to economic growth and deal with environmental issues. In the 1970s many industries changed hands from their previous Asian owners to the government. It is now the NRM government's policy to return these properties to the owners to reduce government spending and increase their viability. But during the 1970s and 1980s equipment was poorly maintained and hardly any new equipment was added. Most industries still operate at less than 50% of capacity. Further, many of the new manufacturing enterprises created in the late 1970s and 1980s were small private firms, set up to provide goods and services that the nationalised industries were not able to provide[250]. Investment in environmentally-friendly technologies was not a priority.

The geographical distribution of industries in Uganda has changed little since the 1970s. Kampala, Mpigi, Mukono and Jinja are still the heartlands of industrial employment (**Figure 7.1**). This is because most industries were started by Asians who settled in those areas after they had completed the building of the Uganda Railway at the beginning of this century. There has not been a deliberate policy to regionalize industrial activity, and these few towns act as magnets for other industries. Kasese would be a major industrial region if Kilembe Mines and Lake Katwe Salt Company were fully utilized. But this would also pose many environmental problems (**Box 7.1**).

In 1991 Uganda promulgated an Investment Code and established the Uganda Investment Authority to act as a "one-stop" center for investors. An estimated 54% of new investment proposals are in manufacturing[251]. One condition for obtaining an investment licence is that the holder shall "take necessary action to ensure that the operations of the business enterprise do not cause injury or damage to the ecology or environment or to the health and safety of its employees and the general public".

The promotion of direct foreign investment in Uganda will provide new finance for development. But Uganda's industrial planning in the 1990s needs to be realistic about the extent to which regional opportunities have changed since the breakup of the East African Community (manufacturing has expanded in the neighbouring countries since that time), while taking advantage of opportunities offered by the Preferential Trade Area (PTA) arrangement. Phosphates, starch for pharmacy and NewCastle's vaccine, all of which are based on Uganda's resources and needed in the region, should give Uganda comparative advantage in the PTA[252].

7.3 Structure of industrial establishments

The manufacturing sector in Uganda can be divided into two categories. A formal sector made up of a small number of large enterprises, and an informal sector made up of many small-scale industries (SSIs). Official data fail to capture the full contribution of the informal sector. The major products of the formal sector are beverages and tobacco (26.1%), food (20.7%), textiles and clothing (16.3%) and chemicals (12.3%). Employment opportunities in the same industries are also correspondingly large (**Table 7.1**). The structure, as shown in **Figure 7.2**, will surely change over the next decade as a shift occurs away from an entirely orthodox import-substitution policy to a more resource-based, export-oriented strategy that also exploits linkages with other sectors[253].

Box 7.1

Environmental challenges of mining and industrialisation in Kasese district

Kasese district is poised to be a big industrial town with the revival of copper mining at Kilembe, Cobalt smelting at Kasese Cement manufacturing at Hima and salt processing at Lake Katwe. Kasese town currently has a population of 18,750 (1991 Census). This number is likely to double with full resumption of activities. Kasese is thus an example of a town whose industrial development should help to distribute income outside the Lake Victoria crescent. There are studies to indicate that, despite the benefits to be derived from the industry, close attention must be paid to its effect on the environment. The district lies in the rift valley in which Queen Elizabeth National Park is located. Water bodies support fisheries (Lake Edward and George and the Kazinga Channel). The Rwenzori Mountain range and the eastern escarpment constitute the main catchment for this water system. Katwe and Kasese towns lie on the valley floor, located very close to the southern and south-eastern foothills of the Rwenzori Mountains. Katwe is on the shores of Lake Edward. Kasese is situated close to Songo swamp, the waters of which join the Lake Edward-George system.

In 1980 a plant was commissioned to industrially process brine from lake Katwe. It was designed to produce 3 tons/hour of crystalline NaCl at 90% purity and 1 ton hour of KCl of unknown purity. However, problems were encountered immediately. After a few months, chronic corrosion was experienced. The plant was abandoned without ever operating properly.

The government would like the derelict plant to be rehabilitated. It has proposed that dissolved Burkeite would be pumped to Lake Munyanyange for disposal. The exact quantity has not been known but is estimated to be in the region of 20,000 tons/year. It has also been proposed that brine from which Burkeite and much of the NaCl has been removed will be pumpted back into Lake Katwe for disposal (and ultimate re-use). Non-condensable gases from the evaporators will be released in the atmosphere. They will contain H_2S. No proposal has yet been made for the treatment of disposal of the contaiminated water.

The revival of the salt industry is bound to create challenges of environmental management. It will generate air pollution. Lake Munyanyange is home toa diversity of animals, particularly birds, and to a rare and interesting plant species. *Odyssea jaggery*, which would probably become locally extinct with waste disposal into the water. If the industry took off, it would employ 250 people. Well over 12,000 persons are employed in the nearby traditional salt panning industry. So there will be displacement of artisanal miners. If this activity generates a services industry, the population is likely to remain high or even increase. This will escalate poaching and gathering of fuelwood in thepark. An increased volume of traffic would adversely affect the animals in the park, undermining the park's attractiveness

Despite its economic importance, copper mining too has brought with it environmental damage. The 1.11 million tons of cobalt ferrous pyrite stockpiled at Kasese underwent water and air erosion. The pile contains cobalt and other metals like nickel, copper, iron and zinc. Erosion led to an unacceptable concentration of metals in the soil, plants and the waters of Lake George. This has been taking place for over 20 years. At the same time tallings from the mill were deposited in lagoons along River Nyamwamba. Water from this river is used for domestic purposes. A high human intake of metals causes illness. The population of herbaceous and grass species and invertebrates has dwindled. The mine also drains into Lake George. It is not known to what extent this pollution has affected other portions of the natural drainage region of Western Uganda and Zaire. Neither is it known to what extent the reduced productivity of Lake George is as a result of the pollution. With resumption of copper mining in the near future, more risks are anticipated.

At Kasese cobalt is being extracted by bioleaching. This consists of the biological oxidation of cobaltiferrous pyrite into a sulphate, using naturally occuring bacteria strains *Thiobacillus Ferrooxidans* (T f.) and *Thiobacillus thiooxidans* (T t) which exist in the stockpile. According to the proponents of this process, the recovery of cobalt will be 1,000 tons/year. The residual solids will be composed of gypsum, ferric hydroxide, silica and feldspar with small quantities of sulphides. These are inactive. The mixture will then be stored in leak proof tanks (concrete) located in the same area where the stockpile exists. Unfortunately, the method of storage does not take into account the earthquakes and tremors to which Kasese area is prone. The process is heavily dependent on the use of hazardous chemicals in liquid form: sulphuric acid and inorganic solvents. These can easily find their way into the environment as effluent. Also the bioleaching process for recovery of cobalt has never been tried before. The only available experience is from laboratory trials which have been successful. Uganda is venturing into the unknown.

Source *IUCN 1990 Preliminary Environmental Impact Assessment of Lake Katwe Salt Plant, Western Uganda; BRGM (1991) The bioleaching of the cobaltiferrous pyrites in Kasese (Uganda) A feasibility study report Economic considerations in industrial pollution P. 26-27.*

Figure 7.1

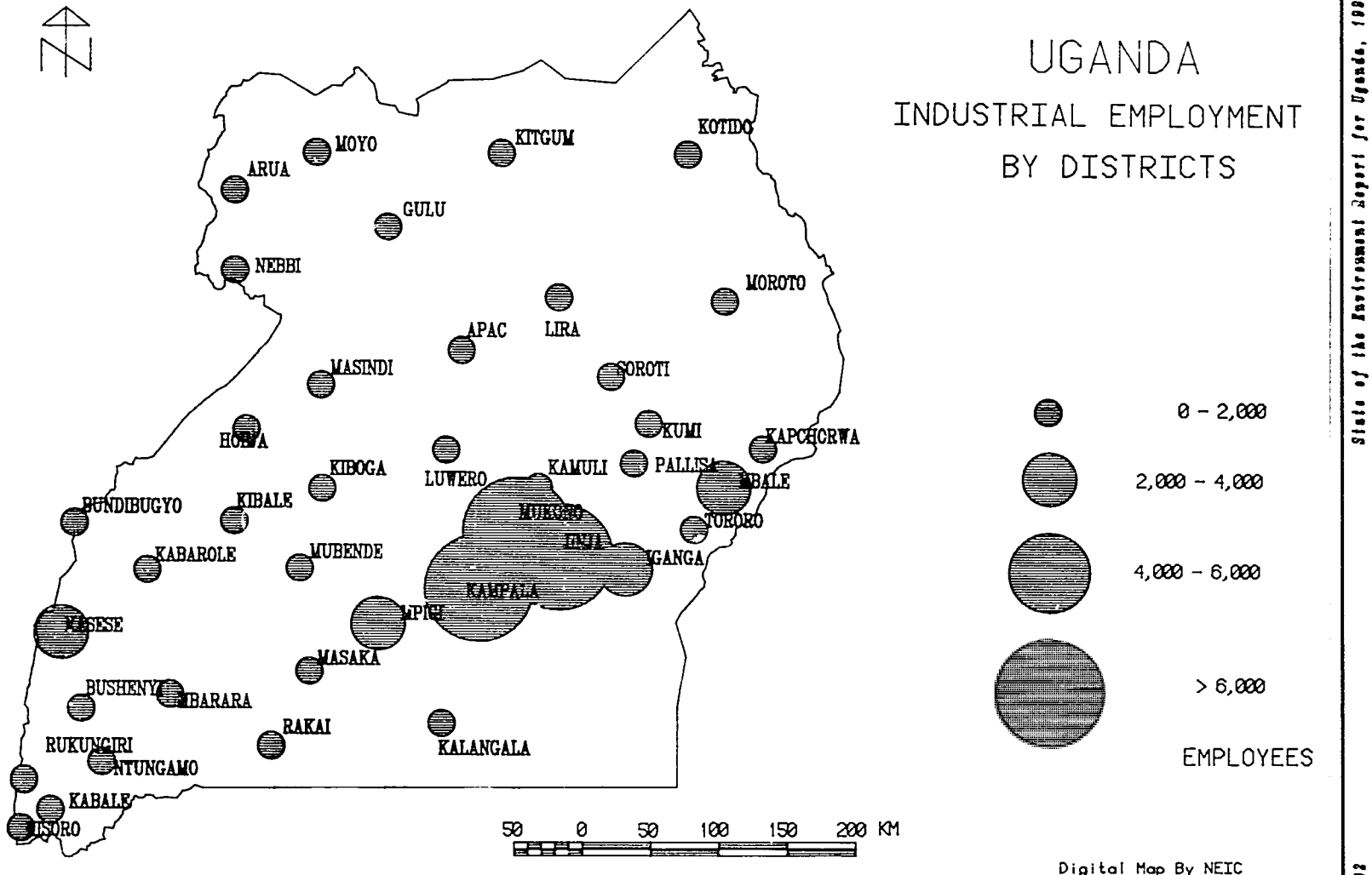
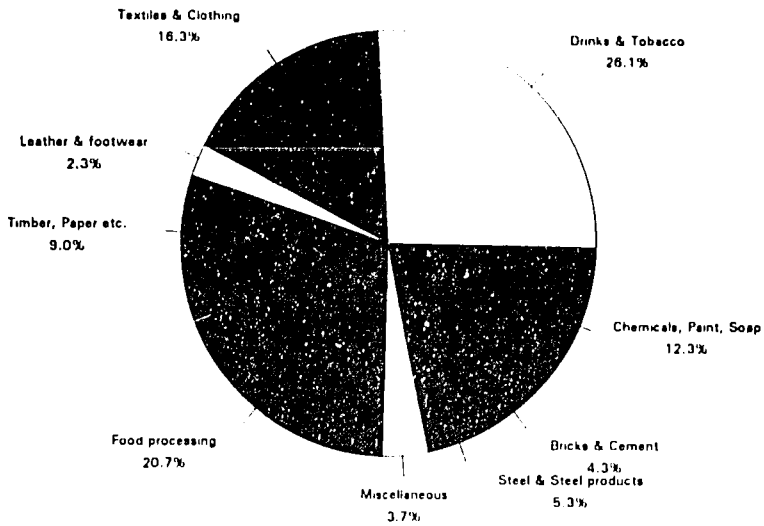

UGANDA
INDUSTRIAL EMPLOYMENT
BY DISTRICTS
N
MOYO
KITGUM
KOTIDO
ARUA
GULU
NEBBI
MOROTO
APAC
LIRA
MASINDI
SOROTI
KUMI
KAPCHORWA
HOIMA
KIBOGA
LUWERO
KAMULI
PALLISA
MBALE
BUNDIBUGYO
KIBALE
MUKONO
TORORO
KABAROLE
MUBENDE
JINJA
UGANGA
KAMPALA
LIRA
MASAKA
BUSHENYI
MBARARA
RAKAI
KALANGALA
RUKUNGIRI
NTUNGAMO
KABALE
0 - 2,000
2,000 - 4,000
4,000 - 6,000
> 6,000
EMPLOYEES
50 0 50 100 150 200 KM
SCALE 1:4,000,000
Digital Map By NEIC
(CENSUS OF INDUSTRIAL ESTABILISHMENTS, 1989)

Figure 7.2 **Structure of industrial production in 1992**



Source: MFED (1993) Background to the Budget 1993/94 p.80

At present, the economy is incurring costs as a direct consequence of poor linkage between the natural resource base and manufacturing. In 1992 Uganda's import bill on five major items, which the natural resource base could have supported with excess being left for export, totalled over US $41.3 million (**Table 7.2**). Hopefully, this situation will be reversed in the near future as problems in the industrial sector are corrected. They include legal ownership of enterprises; lack of credit worthiness of enterprises; low effective demand; human resource constraints; and infrastructural bottlenecks including irregular power supply[254].

The distance of Uganda from the sea is a limitation that handicaps the country in competing with her East African neighbours. On the other hand, it provides some protection against imported goods, particularly those of large volume and relatively small unit value.

The Directorate of Industrial Training and the Vocational Training Center at Lugogo have been rehabilitated to enable them to provide skilled manpower to the formal and informal sector.

Indices of industrial production are shown in **Figure 7.3**. Much progress has been made since the launching of the economic recovery program in 1987. But leather and footwear and textiles and clothing have had a downward shift since 1982 because of slow recovery of cotton production and the organizational weakness of Lint Marketing Board and Uganda Leather and Tanning Industries respectively.

A recent positive development in the manufacturing sector is the recycling of scrap to make iron and steel, polyethylene, paper, and plastics. The estimated amount of scrap available in Uganda is 201,269 tons[255]. Further, major garages - Nalukolongo Locomotive Depot, Uganda Transport Company and Spear Motors - collect oils and grease for recycling. They use materials which would be very detrimental to the environment. For example, the heat transfer fluids are mainly polychlorinated

biphenyls (PCBs) which are known carcinogens. The toxic nature of PCBs came to public attention in Japan (1986) when over 1,000 persons were taken ill after eating rice contaminated by the oils[256] In general, however, if recycling efforts continue, they will reduce liquid wastes which have greatly polluted Nakivubo Channel.

Table 7.1: Industrial establishments and employees by manufacturing subsectors, 1989

SUB-SECTOR	NO. OF ENTERPRISES	NO. OF EMPLOYEES	EMPLOYMENT %
Foods, beverages & tobacco	480	23035	44.8
Textiles, leather & footwear	160	10320	16.5
Wood & Furniture	556	9760	15.6
Paper & paper products	106	2050	3.3
Chemicals, rubber & plastics	47	1610	2.6
Non-metallic mineral products	60	3150	5.0
Iron & steel	7	635	1.0
Tools, hardware, metals	305	4070	6.5
Mining, including salt	23	2920	4.7
Other	2	5	
Total	1746	57,580	106.5%

Source: Ministry of Industry and Technology, Directory of Manufacturing Establishments, 1989

Table 7.2: Potential foreign exchange loss on selected imports caused by failure to make use of local natural resources and existing industrial capacity, 1992

COMMODITY	UNIT	INSTALLED CAPACITY	CAPACITY IN 1992	QUANTITY IMPORTED IN 1992	VALUE US $ million 1992
Edible oil and fats	Tons		628	1625	16 072
Cement	Tons	507500	7755	13304	14 664
Sugar	Tons	160000	53539	1225	5 749
Wheat flour	Tons	45000	12222	1125	2 883
Footwear	'000 pairs	5093	211	4233	1 975
Loss on imports					41 343

Source: MFED, Background to the Budget, 1993-94; MFED, Statistics Department [for quantity and value of imports]; URA

7.4 Small-scale industrial development

Small-scale industrial development, most of which is informal, has not been well studied. According to a survey by the Ministry of Industry and Technology, 878 industries were registered with the government. Only 257 of them were reported to be in operation[257] The Uganda Small Scale Industries Association (USSIA) has a membership of only 600, but the total number of operating units is believed to be between 2,000 and 6,000[258] Most of the small scale units are concentrated in the districts of

Kampala and Jinja.

Table 7.3: Size distribution of manufacturing enterprises by number of employees

EMPLOYMENT	NUMBER OF ENTERPRISES	%	TOTAL NUMBER OF	%
1-5	328	19.0	1430	2.3
6-10	524	30.3	4150	6.6
11-20	378	21.9	3191	8.3
21-35	213	12.3	5858	9.4
36+	285	16.5	45926	73.4
TOTAL	**1728**	**100**	**62555**	**100**

Source: Ministry of Industry and Technology, Directory of Manufacturing Establishments, 1989

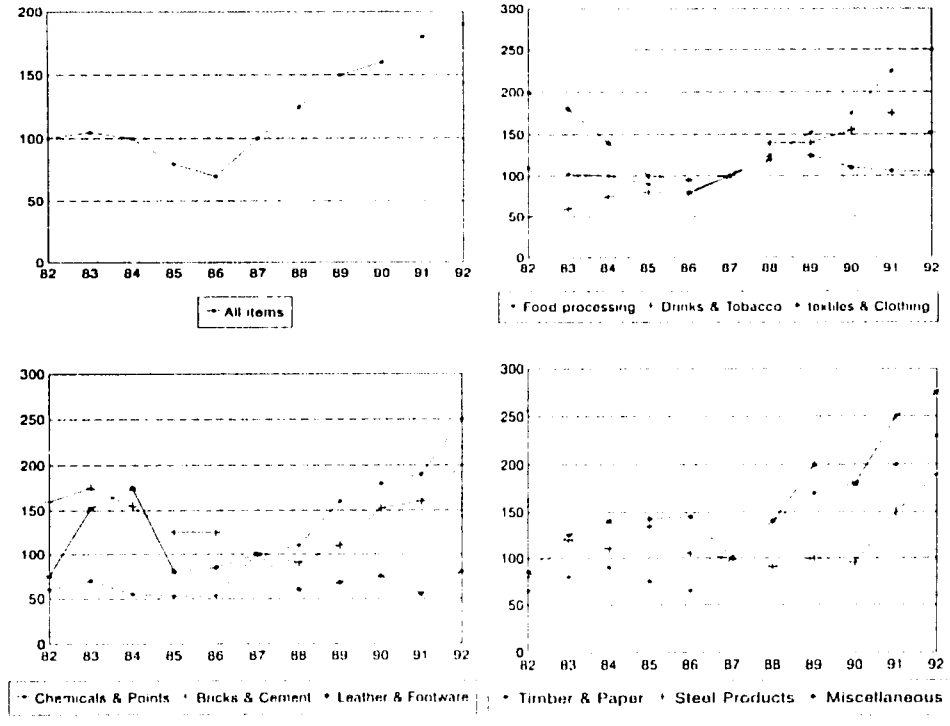
Official data cannot capture the scope, size, production, employment and investment in this sector[259]. Presently, there is no national definition of a small-scale enterprise[260]. According to the Industrial Act of 1964, enterprises using more than 5 horse powers and employing 11 or more persons are required to obtain an approval from the Ministry of Industry and Technology. However, this regulation is not observed. According to the Ministry of Industry and Technology, almost 50% of manufacturing enterprises employed ten people or less (**Table 7.3**). Most SSIs are engaged in five sub-sectors: grain milling and bakeries, wood working and furniture making, brick and tile manufacture, textiles and footwear, and steel fabrication, including equipment for grain milling, brick making and edible oil extraction. The same survey found that the average 1988 replacement value of capital assets (plant, machinery and tools) of the surveyed units was only US $2,761 and that the majority of units had investments below $1,600.

The expulsion of the Asians in 1972 and the subsequent erosion of civil service wages and salaries by inflation (these were on average $20/month for government employees in 1988, according to the National Manpower Survey[261], compared with $122 for private formal sector employees) appear to have stimulated indigenous entrepreneurship. An estimated 10% of civil servants are believed to be engaged in small-scale enterprises. An ILO survey of informal sector employment estimated that it was growing at 5.6% per annum compared with less than 1% for the formal sector[262]. A 1990 survey estimated that small-scale industries (SSIs) could contribute 70% of industrial output and most of employment opportunities and that their development would help to stem the drift from rural to urban areas. Another positive aspect of SSIs is that, in contrast to the early large industries which pursued the import substitution strategy, they are based on the local resources of agriculture, fisheries and forests. However, these industries still suffer from weak institutional and physical infrastructure, weak linkages with large-scale industry, lack of access to credit, past government concentration on the development of large-scale industry to their neglect, and lack of coordination among SSI support agencies[263]. Since 1986 policymakers have given greater recognition to the importance of small scale industrialists to the growth of Uganda's economy. This is demonstrated by the revival of the UGADEV Bank, (although now closed because of poor management), the funding by the Bank of Uganda of the Small-Scale Loan Scheme of UGADEV, the formation of a Small Scale Industry Division within the Ministry of Industry and Technology, and public pronouncements by the Head of State. There are few industry organizations representing the SSIs. The Uganda Manufacturers Association (UMA) represents mostly larger enterprises, as does the Uganda Chamber of Commerce and Industry. Only the Uganda Small Scale Industries Association (USSIA) represents the SSIs

n Much of the information on the minerals exploitation is derived from NEMP's Topic Paper No. 4 on Mining and Industry

Unfortunately, it lacks a professional secretariat to assist members with information or guidance.

Figure 7.3: Indices of industrial production, 1982-92 (base 1987=100)



Source: MFEP (1993) Background to the Budget 1993 94 P. 81.

7.5 Status of minerals in Uganda

Mining in Uganda, which dates as far back as 1907, has contributed significantly to the national economy. But it has also degraded the environment through pollution and damage of the landscape. In the 1960s minerals contributed 30% of Uganda's foreign exchange earnings. The main mineral exports were copper, gold, tin, wolfram, bismuth, tantalum, beryl, columbite and phosphates. Other minerals like iron ore, limestone, salt, clay, sand and stone were consumed locally. In 1970 mining was employing 7,000 people. The number fell to 4,100 by 1976[n]. By 1987 mining had almost stopped altogether in Uganda. **Table 7.4** shows the present status of metallic and non-metallic minerals. Minerals hold high potential for industrial use and export which is not being exploited.

7.5.1 Copper

Copper mining started at the foot of Mt. Rwenzori in Kilembe in 1956. Between 1956 and 1977, 15,400,000 tons of copper ore of 1.9% copper content was extracted. It was processed on site into copper concentrates (averaging 27% copper) which was then transported by rail to the copper smelter

n The trends of employment by sector were discontinued in 1976

at Jinja. The production of blister copper at Jinja averaged 16,000 tons per year from 1956 to 1977. Besides the production of copper, the Kilembe mines produced a cobalt ferrous by-product containing 1.4% cobalt which was stockpiled at Kasese. In 1979 copper mining ceased because of political instability. This disrupted the economic health of the country and that of the local population and workers[o]. However, rehabilitation of the mines complex is underway. Going by past experience (**Figure 7.4**), copper exports should provide Uganda with a valuable new source of foreign exchange.

Table 7.4: The status of Uganda's minerals and their potential for industrial use

TYPE OF MINERAL	POTENTIAL INDUSTRIAL USES	CURRENT USERS IN UGANDA	RESERVES QUANTITY/QUALITY	LOCATION
		MINERALS		
Iron ore	Iron and steel alloys		Kashenyi 30m surface 90-0 98 Ferrous oxide,hematite estimated to be over 50 million tons	Muko, Kabale, Mugabizi, Masaka and Sukulu, Tororo
Tin Cassiterite	Tin solder, Tin canning and utensils		Not yet quantified. Grade varies from 0 5Kg per ton to 30Kg per ton	Kikagati, Ruhaama Ndamyankoko, Mbarara, Bulunga, Kabale, Kamwezi, Kabale
Wolframite	Alloys, high speed tools, resistant non-ferrous alloys		Kirya wolfram 2.5x106 tons average grade of 3.5 kg/ton other reserves not yet quantified and qualified.	Kirya Wolfram mine, Bjordal mines, Ruhizha mines, Kisoro; Rakai, Singo mine, Mubende, Karamoja
Tantalite, Columbite	Alloy additive to semi-skilled temperature alloys, magnets, dental and surgical instruments peupoints, reactifiers of alternative currents.		Not yet quantified or qualified	Rubaale, Pukungiri, Kamwezi, Mubende.
Galena (lead)	Batteries		Not yet quantified or qualified	Kitaka mine, Bushenyi
Bismuth	Alloys, connecting with tin, lead		Not yet quantified or qualified.	Kisoro.
Dorty	Alloy ceramics, electrical porcelain alloys for high and heat resistance, springs, motor brush holders and collector ringe		Not yet quantified or qualified (Uganda used to produce 10% of the world dorty).	Rubaale, Rukungiri, Kanungu, Ntungamo
Amblygonite	Fireworks, paints		Not yet quantified or qualified	Nyabushenyi, Rubaale
Gold	Coins, jewellery, decorative arts		Not yet quantified or qualified.	Kabale, Busia, Bushenyi, Mubende, and Arua
Copper				Kilembe mines
Cobalt				Kilembe mines

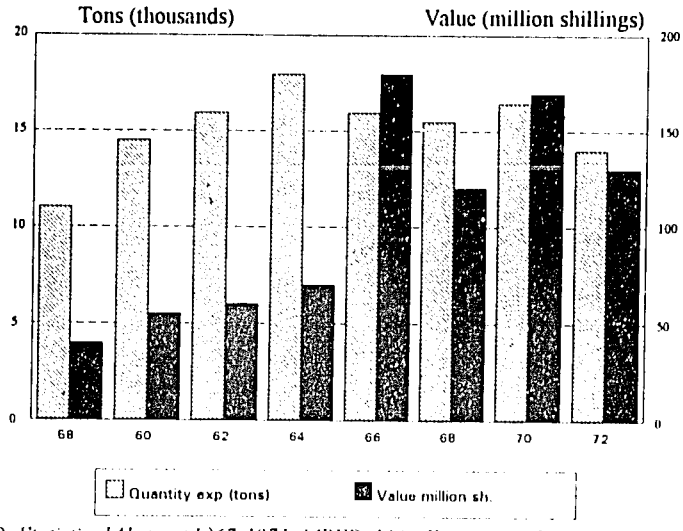
o *Much of the information on the minerals exploitation is derived from NEAPs Topic Paper No 6 on Mining on Industry*

Table 7.4 cont'd

TYPE OF MINERAL	POTENTIAL INDUSTRIAL USES	CURRENT USERS IN UGANDA	RESERVES QUANTITY/QUALITY	LOCATION
NON-METALLIC MINERALS				
Asbestos	Shingles, pipes, sheets, asbestos cement, brake linings, fireproof, current and cloth.	Tororo Asbestos, cement, roofing sheets and pipes.	Not yet quantified or qualified.	West Nile, Karamoja.
Kaoloin	Paper, rubberin, paints, sanitary ware, ceramics, white cement, pottery, insecticides.	Papco Industry co. Ltd, Uganda Leather Industry, African ceramics, tableware, insecticides.	12 million tons at Mutaka; Namasera Buwambo not yet quantified.	Mutaka, Bushenyi, Kisai, Rakai, Migade, Namasera, Buwambo, Mpigi.
Diatomite	Filter aid in sugar insulation, filter absorbents, carriers for insecticides scouring and polishing compounds, mixtures, in concrete cement, glass manufacture.	Koki Kaolin insecticides mixing with kaolin. West Nile cooperatives for cotton oil filter, Nile Breweries Filter Aid.	Currently 0.1 million tons quantified. Further quantification and qualification to be done.	Packwach, West Nile.
Feldspar	Glass making, pottery, ceramics, enamels scouring compounds, abrasives, porcelain and cement.	African ceramics (tableware) East African Industries Scouring Poweder (vim).	Not yet qualified.	Mutaka, Bushenyi, Lunyo, Karamoja, Lubaale.
Gypsum	Building lath and wall board sheathing and plaster. Farm use, cement retarder, land plaster, oil sweetner and fertilizer and filter	Uganda Cement Industry, African ceramics for sanitary ware.	29,000 tons in Muhokya; 1.2 million tons in Kibuku; 80,000 tons in Lake Mburo.	Kibuku, Muhokya, Lake Mburu, Mbarara.
Limestone	Building stone, portland cement, refractors, paper mills, concrete and road metal, alkyl and calcium carbide works, asphalt filter, animal feed, water treatment whiting substitute, glass and sugar.	Uganda Cement Industry, Lugazi Sugar Works, Uganda Leather industires, roads and railways.	National total reserves 200 tons of varying grades.	Tororo, Muhokya, Kasese, Kaku River, Busanza, Kisoro.
Mica	Electrical insulation, tubes capacitors, asphalt roofing, paper coating, furnace peep holes, wall paper, paint lubircant, rubber goods.	robbialac/berge paints. Leyland paints.	Not yet quantified.	Gulu
Talc	Ceramics paints, paper insecticides, electrical porcelain acide proof tables, refractory blocsk.		Not yet quantified.	Karamoja, West Nile, Rwenzori area, Kasese.
Vermiculite	Building plaster, house insulation, insecticides, soil conditioners. Wall board and sound insulating paints, lubricants and motor dope.		Not fully quantified. Preliminary estimate 350,000 tons.	Namakere East Uganda.
Silica sand	Foundry sands, glass sands, glass grinding ceramics, abrasives, construction wiresery, silica brick; furnaces; refractories, coresands, filler sands, lime bricks.	African Ceramics, foundaries.	National total 1.5 million tons.	Lake Victoria shores, Kome island.
Marble	Terrazo, concrete blocks, ceramics.		Not yet quantified.	
Volcanic ash	Lime pozzalana cement, filter medium, fertlizers.	Construction indsutry, Agriculture	More than a million tons but not quantified.	Kisoro, Kasese; Karamoja; Bunyaruguru.
Kyanite	Porcelain spark plugs, cores siliminate brick, glass plant refractories and cement refaractories.	Finances, oven kiln linings.	Not yet quantified.	Ihunge, Rukungiri, West Nile.
Phosphates	Phosphate fertilizers, phosphoric acids.	Agriculture	202 million proven.	Tororo, Tororo, Busumbu carbonatites, Tororo.
Pumice and pumicite	Scouring preparation, filter aid, building tile, floor sweeping heat insulation, asphalt filler, lithographic and electroplating.	Building, fencing, cement.	Not known.	Large quantities in Kisoro, Bunyaruguru, Tororo.

Source: Uganda Investment Authority (1993) Natural Resource Endowment and Comparative Advantage

Figure 7.4: Trends in output and value of copper exports in selected years.



Source: MPED: Statistical Abstract 1967, 1971; MPED (1986) Economic Adjustment and Long Term Development in Uganda

7.5.2 Cobalt

A cobalt and sulphuric acid plant has started operating at Kasese. Use is being made of cobalt pyrites which had been stockpiled at Kasese. Cobalt will be recovered by the bioleaching process. About 1,000 tons will be recovered annually. Although bioleaching was recommended as being the most environmentally friendly, it has never been used for cobalt[p].

7.5.3 Lime

Limestone mining began in 1952 when Uganda Cement Industry, Tororo, started using limestone to produce cement. At its peak in 1969, the factory produced 160,000 tons annually. Production fell to 10,000 tons in 1992. Despite the drop, the effects on the environment are enormous and continuing. Open cast mining has left a gaping hole at the foot of the Tororo Rock. The roofs and walls of Tororo Girls' School have been damaged by ground vibrations from explosions to break up the rock. Air pollution from the factory has damaged houses and local gardens. Small-scale local lime production has been growing in Tororo and Kasese but it is poorly supervised, leaving behind pits. Forests have been depleted by the need for fuelwood to fire local kilns.

Hima Cement Factory is to be rehabilitated and upgraded to a capacity of 225,000 tons per year. Failure to exploit the lime resource in Uganda has been a drain on scarce foreign exchange. In 1992 the import bill for cement was $14.6 million.

7.5.4 Gold

Gold prospecting and mining have been going on for a long time but without supervision or regulation. In 1988, the government set up gold buying centres after legalising the activity by the 1988 Statutory

It is reported in the NEAP Topic Paper No. 6 on Industry and Mining that this technique has been successfully used for copper, gold and uranium in Canada and Australia. The observation made was that the chemistry of (solvent-solvent) extraction of these metals is different from that of cobalt. The only available experience is from laboratory scale trials which have been successful.

Instrument. Between 1988 and 1992, more than one ton of gold was exported, generating revenue of US $970,750[265]

The search for gold in the western region has left behind open pits and scared landscapes with serious impacts on water quality and living resources. Damage is most notable in Bwindi, Kisoro District and Busia, Tororo District. The irresponsible use of mercury to recover gold is hazardous to micro-organisms, aquatic species and terrestrial organism. It is also toxic to humans as shown by the widely-documented Minamata disease (Japan, 1955).

7.5.5 Petroleum

The existence of petroleum in Uganda has been known for almost 100 years. The first exploration in 1917 was disappointing, establishing that the oil, if it existed, was below a hard rock. A second attempt was made in 1925 to establish the geology of the area with a view to reaching the oil. In pursuance of the earlier efforts, the Petroleum Exploration Act of 1985 was enacted to regulate the exploration and possible production of oil in Uganda. In 1991 a Production Sharing Agreement was made between the government of Uganda and Petrofina of Belgium giving the company exploration rights in Laropi of Pakwach basin, Lake Albert Basin, and Lake Edward-George Basin.

At this early stage, there is a need to anticipate environmental impacts from this activity and be prepared to prevent them and provide financial means for mitigation. This is more so in light of the fact that the potential areas with oil are the homes of the two oldest national parks in the country - Queen Elizabeth and Murchison Falls National Parks. The Mining Act of 1964 and Petroleum Exploration and Production Act of 1985 may need to be amended to incorporate means of anticipating and managing environmental risks.

Table 7.5: Production of selected minerals, 1982-92

MINERAL	UNIT	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Gold	Gram	215	0	1317	142	150	-	21	1700	75230	776000	117800
Tin Ore	Ton	4	25	263	7	44	10	64	45	31	72	30
Wolfram	Ton	7	7	15	17	19	30	75	32	48	98	66
Tantalite/Columbite	Ton	-	-	-	-	8	-	-	5	3	-	5
Kaolin	Ton	-	-	-	-	400	-	-	-	-	-	-
Feldspar	Ton	-	-	-	-	200	-	-	-	-	-	-
Iron Ore	Ton	-	-	-	-	-	-	11.1	-	-	-	132

7.5.6 Geothermal mining

Since 1952 unpublished reports have indicated the location of thermal springs and their geological formations. Chemical analysis and interpretation has also been carried out on a small scale. It is now government intention to produce a comprehensive report on the possibilities of utilizing geothermal energy on a wider scale in eastern and north-eastern Uganda. Preliminary studies will be carried out at Kabiro, Bwanga and Katwe to select a site for exploratory drilling. The likely environmental effects of these efforts will need to be studied so that prevention and mitigation measures are put in place.

[265] It is not known how much gold is still traded in the informal market

7.5.7 Volcanic ash

Volcanic ash, lime and local lateritic soils have been studied with the aim of developing small-scale technology for the production of Lime Pozzalana Cement (LPC) and LPC/lateritic soil blocks to be used in low cost houses. Kisoro, Karamoja and Bunyaruguru in Bushenyi have been identified as locations with more than one million tons of volcanic ash[266]. Environmental impact assessments, with the cooperation of local institutions, will need to be carried out.

7.5.8 Clay mining

Clay mining is widespread particularly for making bricks and tiles used in housing. It is worrying that this activity is not regulated under the Mining Act. Nor are places gazetted for this widespread activity. Pits are usually left unfilled. Some get filled with water and become breeding grounds for malaria. Clay has been mined in wetlands, interfering with wetlands ecology. There is also high demand for trees to be used to fire bricks and tiles. This is an area in which environmental and land use assessments should be conducted locally and regionally.

7.6 Industrial Pollution

7.6.1 The working environment

Dust is the leading cause of workplace pollution in Ugandan industries. The processing of solid raw materials generates large quantities of dust. Industries that process coffee, cotton, wood and sugarcane generate toxic organic dusts. Those handling cement and clay generate toxic inorganic dusts.

7.6.2 Airborne dust

The coffee industry is the leading emitter of toxic dust in Uganda. Coffee requires hulling, grading, sorting and packaging before export. There are 64 registered coffee processing factories of various capacities. The largest is the Coffee Marketing Board's Central Processing and Storage Unit (CMB-CPSU) at Bugolobi, Kampala.

A survey of 22 of these factories including the CMB-CPSU was carried out from 1989 to 1991. Respirable dust concentrations were measured, and a medical examination carried out on 1,200 workers and 200 control subjects. Dust concentrations ranged between 1 to 25 mg/m^3 with higher values registered in older factories.

This pollution was accompanied by a high incidence of lung disorders of which the worst were occupational asthma, rhinitis and allergic alveolitis. The permissible exposure of toxic organic dust is 0.2 mg/m^3. This has been far exceeded in Uganda's coffee industry. Over 50,000 coffee industry workers are being exposed to this health hazard in Uganda (see **Table 7.6**).

The next largest dust-producing industry is cotton. There are 55 ginneries throughout Uganda (only 24 currently operational) with a spinning mill in Lira (currently out of commission) and 5 textile mills using cotton for cloth production. The health hazard arising from cotton dust is a respiratory disorder called byssinossis. The Departments of Occupational Health and Factories Inspectorate are carrying out a research project - Occupational Health and Safety in the Cotton Industry (Uganda) - to evaluate the current situation. As in the coffee industry, the acceptable limits for cotton dust is 0.2 mg/m^3. Initial results suggest workers are exposed to levels above international standards. Noise from the ginneries and the motor conveyor system is also a problem.

7.6.3 Noise

Noise levels in industry are measured in the range 90-115 dB_A which is above acceptable levels of 85 dB_A as determined by the International Labour Organization. High noise levels cause hearing loss and create tension among exposed workers.

7.6.4 Other airborne toxics

Plastic industries also cause health problems. The plastic industry makes foam mattresses using toluene di-isocyanide (TDI) and cups, buckets and other plastic products from polyvinyl chloride (PVC). These factories generate toxic fumes that cause major occupational diseases. TDI is known to cause asthma and alveolitis. Vinyl chloride monomer released from heating PVC causes a cancer of the liver called angiocircoma. Angiocircoma has not been observed yet, but this is because it usually takes more than 8 years to appear. The factories where it is expected to appear have been in production for less than that time. Several cases of TDI-caused asthma have been recorded. Up to 1993 six cases had been recorded by the Department of Occupational Health and Hygiene.

7.6.5 Water pollution

Industries which discharge effluents with serious and immediate environmental consequences include breweries, tanneries, textiles, sugar refineries, oil and soap manufacturers, meat and fish processing and soft drinks producers. Others will emerge in the future as industrialization expands; these include chemicals and fertilizers, paper, dairy and intensive agribusiness.

Table 7.7 shows the major kinds and sources of water pollution and their likely effects on human health and on other living organisms. It should be noted that these are only the polluting effluents from large industrial establishments. Many establishments, most of which are of small scale and dispersed throughout the country, have come into existence in the last ten years: the pollution they cause is neither monitored nor known. Second, given that most of the industries in Uganda are operating far below their capacity, their effluent discharge is bound to increase as they tend towards full capacity. New industries are also coming into operation all the time.

The following is noteworthy:

- Some industries which had some form of effluent treatment facilities have failed to maintain them eg. textile industries.
- Most industries have old technology which may not meet environmental challenges of the day.
- Given the low performance levels of our small-scale manufacturers, many cannot afford the new technology.
- By law, the National Water and Sewerage Corporation is responsible for industrial sewage treatment. Will the corporation remain viable if it extends its services to cover these many smaller industries?

7.7 Industrial wastewater treatment

The public wastewater treatment plants that receive industrial wastewaters are shown in **Table 7.8**. These use sewage and wastewater treatment standards similar to other countries. The following

standards are the most frequently used for sewage before disposal to a water course:

BOD_5 :	Less than 25mg/l
Suspended solid:	Less than 30mg/l
Faecal coliforms:	Less than 5000 FC/100 ml

Except for the Kampala Works, all other public wastewater treatment works are of the waste stabilization ponds type. These ponds operate well even under poor operation and maintenance conditions. However, they are sensitive to toxicity and excessive organic loadings. The pre-treatment of industrial wastewater is therefore essential before discharge into these units. The only conventional plant receiving industrial wastewater is Bugolobi in Kampala. It has detritus channels, settling tanks, sludge digesters, trickling filters and sludge drying beds. It is now in very poor operating condition.

Currently, there is very little treatment of industrial effluent in Uganda. Even industries which had some "balancing tanks" have failed to maintain them. The new industries that are coming in promise that their technologies will not destabilise ecological balance. This is the stated position of the Clovergem Fish Factory being built near Entebbe International Airport, and the Kasese Cobalt Project. Industries will need to be environmentally conscious because environmental legislation and policy will require environmental impact assessments (EIA). Hitherto, industrialists have been within the law to set up industries without being required to carry out EIAs.

Table 7.6: Health impacts from industrial dust

INDUSTRY	DUST	HEALTH OUTCOME
ORGANIC		
Coffee (hulling, grading sorting and packaging	Coffee dust moulds	Occupational asthma, allergic alveolitis, rhinitis
Wood (sawmills, construction)	Wood dust moulds	Bronchial asthma, extrinsic alveolitis
Cotton (ginning, textiles)	Cotton moulds	Obstructive lung disease (byssinosis)
Grain (milling-rice, maize, wheat)	Flour moulds	Occupational asthma
Sugar	Bagasse moulds	Obstructive lung disease (bagassosis)
INORGANIC		
Clay (brick/tiles, pottery) mining	Sio2	Obstructive lung disease
Cement	4-7% Al2 03 19-24% Si 02 60-70%	Chronic bronchitis, emphysema
Asbestos	Anthophylite Chrysolite Amosite Crocidolite	Lung fibrosis (asbestosis)

Table 7.7: Industrial water pollution by major industries

INDUSTRY (No. of establishments)	EFFLUENT DISCHARGE (cubic meters/day)	AMBIENT CONDITIONS (pH, BOD, etc.)	COMMENTS
Breweries (2)	5 200 with contents of yeast, alcohol and fermentation vats.	pH 10.2-11.6; BOD 3500 mg/l	Both discharge into Lake Victoria without treatment. Brewery waste has already produced fish kills in the immediate locality, especially in the Murchison Bay waters; endangers the sources of water supply for Kampala.
Textile industries (7)	20 000	pH 10-12; BOD 1200 mg/l	- Chemicals used cause cancer in mammals. - Waste discharged into Lake Victoria and Nile untreated. - The factories were equipped with "balancing tanks" to give some form of chemical treatment, but they are all unoperational.
Sugar industries (2)	1 630	BOD 130000 mg/l; Lugazi 224000 mg/l; Kakira & SS 1200 mg/l and suspended solids.	- Waste released untreated includes cane wash, cellulose matter, cane juice, molasses waste, alcohol, sulphur. - The receiving waters at Musambya (Lugazi), Kiko for Kakira are devoid of living organisms for 20 and 30 km respectively from the point of discharge.
Leather tanning (1)	420	BOD 30000 mg/l (raw sewage); BOD 660 mg/l (from pre-treatment plant)	Chemicals discharged untreated include: arsenic, DDT, chloride, various dichlorobenzenes, chlorine, sodium flouride mixture, caustic soda, sodium sulphide, sulphuric acid and chromium
Dairy industry (1)	250	BOD 2500 mg/l (raw sewage). Suspended solids 600 mg/l.	Effluent is mainly composed of milk for spillage. It is released untreated into a public sewer (Bugolobi).
Soft drinks (10)		pH 11; BOD 450 mg/l	- The effluent alters the characteristic of aquatic habitat. - No treatment is done.
Oil & soap industries		pH 12. Suspended solids 1 000 mg/l; BOD 25000-30000 mg/l; Oil concentration 5000-6000 mg/l.	- Effluent contain large amounts of sodium hydroxide. BOD is harmful to aquatic fauna & flora. No treatment is made. Mukwano Inudstries has yet to discharge water into sewers of National Water and Sewerage Corporation.
Meat & fish processing indsutires (6)		BOD 2000-3000 mg/l. Suspended solids 800 mg/l.	- Use of chlorine for treatment of Boruba Fish Factory may be hazardous to the lake micro-organisms. - Victoria Fresh Fish Factory does not treat its waste.
Asbestos cement manufacture (Tororo)			- Asbestos causes the growth of scar tissues in the lung (pulmonary fibrosis) and cancer of the lining of the lungs (mesothelioma) all incurable diseases. - Waste was discharged in urban centers where it can be disturbed and become airborne. - Uganda ratified (1990) the ILO Convention No. 162 concerning the use of asbestos at work.
Battery manufacture (1)	5		- Effluent has high concentration of acid and lead all discharged into the public sewer untreated. - Lead is toxic to humans and other organisms. In humans lead has a variety of chronic health effects. It attacks the blood (haematopoietic) system to cause a brain disease and neural dysfunctions (encephalopathy). It can also cause sterility, abortion, still births & neonatal deaths.

Source *Ministry of Environment Protection (1990) Report on the Purification of Industrial Waste Waters - Uganda. NEAP (1992) Topic Paper on Mining, Industry, Hazardous materials & Toxic materials. Task Force No. 6.*

7.8 Legislation in controlling pollution and worker health and safety

The basic environmental industrial and mining goals of the government are to protect workers' safety and water from pollution. There are three public testing laboratories in the country. These are operated by the National Water and Sewerage Corporation, the Water Development Department (of the Ministry of Natural Resources) and the Government Chemist (of the Ministry of Internal Affairs).

Table 7.8 Industrial wastewater and sewage treatment facilities

PARAMETER	KAMPALA		JINJA		MBALE	
	Raw sewage	Treated sewage	Raw sewage	Treated sewage	Raw sewage	Treated sewage
Place	Bugolobi		Kiriinya works		Doko treatment works	
Temperature (degrees centigrade)	24.5-25.5	24			25.5	26
pH	6.2-7.2	7			7.1	7.3
Conductivity (micro-s/cm)	1015-1598	719			718	667
BOD (mg/l)	365-1133	89	299-665	18-20	397	93
Suspended solids (mg/l)			570-785	26-198	630	158
Turbidity (NTV)	150-160	65				
Total waste flow (cubic meters/day)	1600 cubic meters/day (15% industrial)		6748 cubic meters/day (23% industrial)		2502 cubic meters/day (40% industrial)	

Source: Ministry of Environment Protection (1990) Report on the purification of industrial waste in Uganda

The first is reasonably well equipped, while the other two are in desperate need of facilities. All need more staff and restocking of reagents if they are to cope with extra duties. Makerere University's Department of Chemistry also has a laboratory that can carry out similar functions. Its problems are similar to those above. Important legislation includes the following:

Mines Act 1964: Prohibits prospecting and mining without prior authorization and prevents unauthorized interference with water supplies (streams, rivers, ponds etc) by mining and the processing of minerals. The Mines Inspectorate was established to ensure compliance.

The Mining Regulations under this Act seeks to ensure a safe working environment in mines and quarries. Its enforcement is inadequate owing to understaffing and underequipping. It is undergoing review.

Other pieces of legislation concerned with health and safety at work are the Employment Decree (1975) and the Workmen's Compensation Act 1964. Both are being reviewed.

Public Lands Act 1969: Prohibits pollution of public lands and water bodies, but does permit "reasonable use" of both.

Public Health Act 1964: Provides for prevention of diseases to the public from sewage, poor sanitation and pollution. It establishes rules for drainage and sanitation which specifically mention technical aspects of waste disposal. The Health Inspectorate was established to ensure compliance. This act provides the Minister with powers to stop the establishment of any industry or economic activity that may result in pollution and to the operation of any existing industry that is causing pollution.

These Acts, however, are not a meaningful way to regulate industry in the absence of standards against which to judge pollution and health status. The situation is worsened by the absence of regular environmental monitoring and audits.

These laws were enacted more than thirty years ago. At the time, the toxicology and health impacts from chemicals and agents used in industry were poorly understood. Their environment had not become an important issue in international trade, donor funding or the design of technology. It is in response to these developments that the laws are now being reviewed.

The institutions mandated to enforce compliance in the laws are compartmentalized; almost no communication and coordination exist among them. Yet the subject of concern is multisectoral and multidisciplinary. A multisectoral and multidisciplinary environmental law will be more cost-effective to enforce.

In the absence of standards against which to judge pollution levels, laws resort to general terms such as 'reasonable care'. The National Bureau of Standards set up in 1983 is yet to publish any standards.

Despite the above shortcomings, the government's proposed policy on industrialization emphasises the need for all industrialists to be environmentally conscious. The proposed policy strongly supports establishing industries in gazetted areas, taking into consideration waste management; establishing industrial estates for small-scale industries in all urban areas; and mandatory pre-treatment of wastes before disposal. The policy also emphasises the "polluter pays" principle, the need to make increased use of local resources, and the need for a balanced regional development[67].

There are, in addition, a number of ILO conventions that are not yet incorporated into Ugandan law but whose provisions are recognized. Some are being implemented. These are:

- Convention No.139 and Recommendation No. 147 (1974): Prevention and Control of Occupational Hazards caused by carcinogenic substances.
- Convention No. 148 and Recommendation No. 156 (1988): Protection of workers against Occupational Hazards in the working environment due to air pollution, noise and vibration.
- Convention No. 155 and Recommendation No. 164 (1981): Occupational Safety and Health and Working Environment.
- Convention No. 161 and Recommendation No. 171 (1985): Occupational Health Services.
- Convention No. 162 (1986): Safety in the Use of Asbestos.
- Convention No. 160 and Recommendation No. 175 (1988): Occupational Safety and Health in the Construction Industry.
- Convention No. 170 and Recommendation No. 177 (1990): Safety in the use of chemicals at work.

The ILO has developed "Major Hazard Control: A Practical Guide 1990". This guide is indispensable for emergency preparedness. The ILO has also released "Occupational Exposure Limits for Airborne Toxic Substances" which is used in Uganda as a standard for evaluating working environments.

7.9 Policy and institutional framework

There are two government departments charged with responsibility for industrial hygiene and safety. The Factories Inspectorate (responsible for safety since 1954) under the Ministry of Trade and Industry, and the Occupational Health and Hygiene (responsible for health matters since 1966) under the Ministry of Health. Both are poorly staffed and equipped.

The Factories Act 1964 prohibits dangerous emissions and discharges to the working environment.

The Factories Inspectorate was set up to ensure compliance. The law is now undergoing review by a multisectoral and tripartite "Labour Law Review Committee" in the Ministry of Labour and Social Affairs.

7.10 Special environmental profiles

Most industries in the country are found in Kampala and Jinja. There are areas close to these centers of industrial activity where serious environmental problems are likely to occur. The first is the Inner Murchison Bay near Kampala, which receives almost all the wastewater from Kampala. The second problem area is the Nile at Jinja. Most Jinja industries discharge most of their wastewaters directly or indirectly into the Nile. These two problem areas are discussed below.

7.10.1 Inner Murchison Bay

Inner Murchison Bay is affected by Kampala's industrial areas. There are five areas in Kampala officially zoned for industrial activity: Central Industrial Area, Nakawa/Ntinda Industrial Area, Port Bell Industrial Area, Kawempe Industrial Area and Masaka Road Industrial Area. The first three are growing rapidly, and all discharge their waste water into Inner Murchison Bay.

The Central Industrial area has a wastewater treatment plant that is in very poor condition. Besides this problem, a substantial number of industries do not discharge their waste water into the sewers but rather into the stormwater drainage system which goes directly to the bay through the Nakivubo Channel untreated. Infact the channel is seriously polluted and is devoid of fish.

There are over 200 industries located in the Central Industrial Area. The major and most polluting ones are: 2 soft drinks factories, 2 textile industries, 2 abattoirs and meat processing industries, 3 oil and soap industries, and over 20 garages and engineering workshops. The total estimated industrial waste water discharge from this industrial area is over 5000 m^3/day (see **Table 7.7**)

The Nakawa-Ntinda Industrial Area is the most rapidly growing industrial area. There are over 20 manufacturing concerns already in operation and several being built. The major ones are: 2 soft drinks industries and 4 major garages and engineering works. There is currently no serious wastewater treatment in the area. The waste production is estimated at about 2000 m^3/day, all of which ends up in Inner Murchison Bay. The Port Bell industrial area has some of the wettest industries in the country and produces some of the most contaminated wastewater. Industries located there are: 1 brewery, 1 distillery, 1 metal enamelling factory, 1 soft drink factory, and 1 leather tanning factory (due to be

commissioned). The estimated wastewater production is over 4000 m^3/day, all discharged untreated directly into Murchison Bay.

The Inner Murchison Bay is the source of water supply for Kampala. It is also extensively fished by local fishermen as well as being used for recreational purposes. At present the bay is not seriously polluted. This has been partly attributed to the ability of the extensive papyrus swamps on the fringes of the bay to clean the wastewater of pollutants. How long this natural resource will continue to purify wastewater needs to be studied. The sudden degradation of the swamps after excessive pollution cannot be ruled out. This may lead to serious ecological consequences and increased economic and health costs to the community.

The longterm effect of nutrient enrichment within the bay also needs to be studied. The interchange of water has previously been assumed to be partly responsible for the low level of pollution in the bay despite the high level of pollutant discharge. Further investigation is needed to determine whether excessive growth of aquatic weeds is likely. And the hydraulic interchange between the bay and the main body of Lake Victoria needs to be determined. Are changes in water quality localized or are they spreading?

If pollution to the bay is to be reduced, industry will have to carry out its share of pollution control. This means that the following steps need to be taken.

- Factories discharging wastes into storm water drainage channels need to be identified and appropriate incentives and regulations applied.

- Legislation will need to require standards for wastewater discharges and penalties for failure to meet the standards. For wastewater discharging into the public treatment system, tariffs will need to be devised.

- Polluting industries will need to be advised on ways to treat wastewater and/or make changes in the production process to reduce pollution. Many of the existing industries will probably have difficulty in building wastewater treatment units within existing premises or changing the manufacturing process. Many will need advice.

- There is need for a licensing procedure that ensures that all necessary measures to prevent pollution have been considered in the planning for new industries. This process could require the preparation of an environmental impact assessment.

7.10.2 River Nile, Jinja

Some of the wettest and most polluting industries in Jinja are located on the banks of the River Nile. They are: Nile breweries, Nyanza textile industry, Pabco (paper industry), Mulco (textile industry) and Mulbox (paper industry).

These industries together discharge more than 13,000 m^3/day of untreated industrial wastewater into the Nile. No serious concerns have been raised because it is assumed that the flow of the Nile at 630

m^3/s is sufficient to dilute wastes (1 in 4,000) making treatment unnecessary. The impact of the waste on the Nile is hoped to be negligible.

The issues that may need attention here are related to faecal matter in the case of domestic waste and toxic metals and other hazardous substance in the case of industrial wastewater. The organic load (BOD) is not the main concern. There is also the aesthetic issue of floating matter and colour in this water. Toxic metals are picked up in the food chain and may eventually be concentrated at toxic levels by the time they reach humans and certain wildlife.

There is an urgent need to set standards for discharge into the Nile. The laxity in discharge requirements at this location could encourage highly polluting industries to locate here to avoid treatment costs. This mushrooming of polluting industries at this location may eventually lead to pollution at a time when it is costly to alter the production processes or introduce wastewater treatment. Should the assimilative capacity of the Nile be taken into account in deciding the treatment required by the industries? There is wide difference of opinion on this question.

7.11 Economic considerations in industrial pollution

As industrialization increases, it is imperative for industries to institutionalize pricing that recognizes the "polluter-pays" principle (PPP). Adopted in 1972 by the industrialized countries, the PPP states that "the polluter should bear the cost of measures to reduce pollution which are decided upon by public authorities to ensure that the environment is in an acceptable state". The principle is widely accepted as a guide for environmental policymaking by government and aid agencies. Its extended interpretation requires that, in addition to paying the full costs of pollution control (standard PPP), the polluter should also compensate citizens for the damages they suffer from pollution.

There are many reasons to advocate the PPP in Uganda. First, the principle satisfies the laws of equity. Second, it may encourage industries to invest in efficient technologies which reduce pollution or recycle valuable materials[1]. Third, if the industry does not pay, then someone else (victim or government) will have to pay. This is tantamount to subsidizing the industry.

The success of the PPP is contingent upon identifying the polluters, setting standards, and monitoring them closely. There are, however, alternative cost-effective methods of dealing with industrial pollution which have been proposed in the Ugandan context. These are economic incentives and motivate desired behaviour. disincentives are intended to discourage behaviour which is not desired. Examples of incentives can be subsidies, tax credits, tax exemptions and price supports. Disincentives can be taxes, fines/charges and penalties. One constraint that is likely to be faced is that of market failure. industrial pollution is not a commodity which is traded on the open market and whose price, therefore, would sufficiently reflect the opportunity cost to the whole society.

According to the 1992 World Development Report, five conditions, all institutionally demanding, are essential if policies are to have the intended effects of reducing pollution: a local framework for negotiation between polluting and polluted parties, a clear and publicly available statement of the standards set and agreements reached, a means of monitoring and spot-checking pollution, a means of penalizing defaulters, and a fair and equitable application of the laws and regulation to all parties. In Uganda, the proposed Water and Sewerage Act gives the National Water and Sewerage

[1] to encourage recycling of valuable materials.

Corporation (NWSC) authority to negotiate "trade waste agreements" with industries, which is in effect a polluter's fee. No mention is made as to who will control or tax the effluent that is not received by NWSC. The Act does not specifically give NWSC the right to require pre-treatment of effluent. The responsibility of granting waste discharge permits is vested in the Commissioner of Water.

Economic failure of public enterprises in Uganda has led the government to seek to divest most of them. At the same time, however, existing policy mandates the NWSC to expand from nine cities to all Uganda's 52 urban areas. This may not be feasible. At the moment, commercial and industrial users pay higher rates than domestic users, and revenues from Kampala and Jinja subsidize the rates for the other seven cities. If the NWSC takes on more urban areas, the two cities may not manage to subsidize all of them. Yet the NWSC statute requires that it pays both the capital and operating costs without government subsidy.

Other countries have used innovative approaches which Uganda could learn from. The Thailand Development Research Institute has proposed the creation of an autonomous Industrial Fund. In line with the PPP, the fund would be financed from waste charges that would first be estimated for each industry and later verified by environmental auditing. Plants that attain lower waste per unit of output, as verified by accredited private environmental firms, would be eligible for rebates. The operation of the treatment and disposal facilities would be contracted to private waste management firms through competitive bidding. Industry would have an incentive to reduce waste and allow private sector participation in waste management[208]. Industrial zoning is another example of a regulation that cannot easily be replaced by pricing mechanisms. The key argument for zoning is that there are economies of scale in dealing with environmental problems when industrial plants are concentrated in one place. As Uganda decentralizes, and industrial development is planned by many local administrations, industrial zoning should be a viable mechanism to control industrial pollution.

The scarce administrative and financial resources both at government and NWSC level suggest that control of industrial pollution should concentrate on the large plants and mines, which generate most of the pollution. Gradually, and with experiences gained, control can be extended to the smaller industries.

8.0 ENVIRONMENTAL LEGISLATION & POLICY

8.1 Evolution of environmental legislation and policy in Uganda

Before the arrival of the British administration at the turn of the last century, it was an inalienable right of every member of the community to have access to forests, pastures and water resources. The British administration imposed a bureaucratic literate state on the pre-literate tribal society. With the state came complex laws and policies that sought to regulate the indigenous people's relations with each other and their environment. Resources that had hitherto been communally owned became Crown Property.

When Uganda gained independence in 1962, most basic aspects of the polices and laws governing natural resources remained intact. All that was done was to substitute words and names such as "public" for "crown" and "Uganda" for "Britain". The failure to develop "home-grown" concepts and laws to govern use of natural resources is now exacting an expensive premium on the environment.

Apart from the forestry and fisheries sectors, the management of other natural resources (soil, water, wildlife and vegetation etc) has been done on the basis of numerous laws and regulations often without a gazetted policy. Moreover, these laws are so scattered that their implementation has often resulted in pitched conflicts between government departments (the similarity of basic principles, interests and goals not withstanding), which in turn undermined their effectiveness on the ground.

Legislation seeking to generate and/or control the use and management of natural resources has evolved along sector lines such as game and fisheries, forestry, soil, water, land, agriculture, livestock and mining. The first regulations were enacted under the "Orders-in-Council" 1889. The principal laws passed by the British Parliament gave "enabling powers" and authority to the Governor and later the Legislative Council of the Uganda Protectorate to make "subsidiary laws for good governance". The second phase, from 1902 up to independence in 1962, was characterized by Ordinances made under "Orders-in-Council" enacted by the Governor and/or the Legislative Council. Independence ushered in a third era consisting of acts of parliament and statutes enacted by Ugandan parliamentarians or decrees enacted in absence of parliament[270]

One weakness has been the "top-down" approach to policy formulation; in the past no effort was made to consult the rural populace which was meant to benefit from the policies. As a result, the "grassroots" did not participate. Poor information flow has also created problems of policy interpretation and implementation. Low levels of literacy and patchy distribution makes the official Uganda gazette a poor channel for communication. The integration of the conservation ethic into customary laws cannot be achieved through such a channel[271]

Because central government generated the legislation and policies, ordinary Ugandans regard many of the natural resources (with the exception of water bodies) as areas of exclusion where their participation is unwelcome. Yet government lacks the resources (money, manpower, transport etc) to ensure effective implementation of its policies. The majority of the population has not the vaguest grasp of why it should know about environment-related policies. Sometimes, the emphasis given to

a policy issue has not matched the needs of the majority. A case in point has been the energy sector where the government has concentrated on hydroelectricity and petroleum products. Yet 94% of the country's energy requirements are met by woodfuel.

Uganda has of late been involved in the NEAP. As a result, an environmental law and policy have been drafted. NEAP's multisectoral and participatory approach has been much better than previous approaches. All laws have been reviewed and gaps identified in light of local, national and international trends. Local, national and regional institutions will implement the new law and policies. Incentives and disincentives have been recommended to supplement the command and control approaches. With these steps, Uganda can expect to see greater commitment to natural resource management from a wider cross-section of the population than has been the case hitherto.

8.2 Environmental legislation

8.2.1 Inventory

The laws applicable in Ugandan courts are the constitution, statutory law, customary law, law of equity, common law and statutes of general application in force in England before 1902.

Uganda has not less than 60 statutes governing natural resource management and the protection of the environment. It also has developed more than 60 instruments to support the statutes. In short, there is both a diversity and multiplicity of legislation[22].

8.2.2 Limitations of existing laws

Most of the existing legislation which addresses the environment is too narrow in scope and content. For example, the laws have paid little attention to the biological diversity outside of protected areas. Further, they generally excluded local communities from sharing the benefits of the wild resources. This includes communities whose sociocultural life was inextricably bound with those resources. The Forests Act 1964, the Game (Preservation and Control) Act 1964 as amended by decree 13 of 1975, and the National Parks Act 1964 take this preservationist approach. As a consequence, local communities regarded the protected areas as an imposition. They felt deprived of resources, and as a result, when conditions permitted, poached and encroached on those areas. Often the main thrust of legislation was geared towards collection of revenue by government from the exploitation of the resources rather than genuine conservation and environmentally-sound management. Public support for sustainable development was not very strong. Most of the amendments that were made were aimed merely to change institutional structures to make them fit the wishes of those in power.

Other areas not covered by legislation are wetlands, management of waste other than sewage, management of industrial chemicals, the working environment outside factories, and maintenance and enhancement of ambient air quality[23]. Issues which are inadequately covered are water quality, aquatic biodiversity other than fish and crocodiles, environmental impacts of settlements, and the management of municipal wastes. Environmental impact assessments, environmental monitoring and audits and environmental standards have virtually been non-existent[24].

In Uganda, as in most of the world, conservation and environmental law has been reactive, it has responded to situations already at crisis stage. For example, the current demand for a uniform land tenure system has come about with the realization that multiple land tenure systems do not promote sustainable agricultural development and other land uses. Furthermore, legislation has tended to be

sector specific, with powers of enforcement mainly vested in the hands of public servants employed in those specific sectors. This has been the case irrespective of whether the stakeholders are multisectoral or whether the resources are indivisible. For example, the enforcing agency of the Forests Act 1964 is the Forestry Department under the Ministry of Natural Resources, that for the Game Act 1964 has been the Game Department. Yet, resources like wildlife move between areas of varied jurisdiction. Such cases lead to duplication of efforts as well as conflict between implementing agencies. It is probably unreasonable to expect all environmental laws to be in one chapter. The subject is so wide and the implementing agencies so many that it would probably be unworkable. However, when laws are scattered among the institutions responsible for their implementation, it is not easy to create consistent and coordinated programs for sustainable natural resource use.

Perhaps the main limitation of existing legislation is that it has underestimated the capability of the population in the management of resources. The legislation has tended to "command" rather than to "motivate" resource users. Nor is the legislation and policy reacted appropriately to sociocultural variables which have negative bearing on resource use. Customary inheritance laws have contributed to land fragmentation. Also despite the fact that women till land more than men, there is no legislation or policy which gives them equal access to, or ownership of land.

8.2.3 Implementation of environmental laws

The machinery for enforcement is available in form of sanctions, penalties and fines. Even local administrations, in collaboration with local committees such as the Busoga Conservation Committee, Local Game Committee etc have enforcement bye-laws. Unfortunately, the legislative system was not immune to the past economic, political, and moral problems.

The implementation and enforcement of environmental laws and policies have been weak because of inadequately-trained personnel, lack of equipment, scarcity of financial resources, attitude or apathy, administration and organizational inadequacies, and absence of comprehensive and well-articulated environmental education programs. These are issues which, though accounting for poor enforcement, are not purely legal. Further, many of the laws are old and stipulate fines and penalties which are out of touch with the present day economic realities and do not act as deterrents. Ridiculously low fines also have had a negative effect on enforcement officers, who tended to feel that there is little point in taking an offender to court and securing a conviction. Finally, fines and imprisonment are by themselves not enough to create a culture of responsiveness to sustainable natural resource use.

When the laws and regulations are revised, there will be a need to supplement them with economic instruments which encourage sound environmental practices.

8.2.4 Coordination

The fact that the laws have been scattered has made coordination difficult. Under the present system, each government department is assigned a function. The ministers responsible for respective departments report to Cabinet and to legislature. All governmental functions, are controlled directly by cabinet, and approved by legislature. Cabinet, therefore, becomes responsible for all policies and measures undertaken by government and acts as the coordinating center for all government functions. The government has formed 10 permanent NRC committees to oversee the implementation of key government functions. One of these committees is the NRC Committee on natural resources and tourism.

8.2.5 Uganda's participation in global conventions

Uganda is a signatory to a number of international conventions & protocols protecting the environment. These include:

1. Convention on the Continental Shelf (1958).
2. Convention on Fishing and Conservation of the Living Resources of the High Seas (1958).
3. Convention on the High Seas (1958).
4. Treaty Banning Nuclear Weapons Tests in the Atmosphere in Outer Space and under Water (1963).
5. Treaty on the 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 Water Fowl Habitat (1971).
8. Convention Concerning the Protection of the World Cultural and Natural Heritage (1972).
9. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1973).
10. Vienna Convention for the Protection of the Ozone Layer (1985).
11. Montreal Protocol on Substances that Deplete the Ozone Layer (1985).
12. Convention Concerning Safety in the Use of Asbestos (1986).
13. The Convention on Biological Diversity (1992)
14. The Framework Convention on Climate Change (1992)

Source: NEAP (1992) Review of Existing Legislation in the Field of Environment

As with domestic laws, the above conventions have also been poorly implemented and for largely the same reasons.

The government has to decide which of the many conventions Uganda should accede to and participate in. In choosing, Uganda should consider its own circumstances, including the type of natural resources within its borders; its location on the globe, its financial resources, and benefits to be derived from membership. The government must always be aware that it benefits from international conventions and treaties in her own law enforcement. Conventions suffer from second limitations.

building on international consensus is often slow and costly; it is difficult to quantify the balance of benefits and costs to a country; and there is no central monitoring body and no courts with compulsory jurisdiction[275]. In 1990, for example, a number of chimpanzees were exported illegally from Uganda to Russia. But due to pressure from the press and CITES, the chimpanzees returned to Uganda after a full year (**Box 8.1**).

8.2.6 Legal reforms

Much legislative reform is taking place in Uganda, including The Constitution, land tenure legislation, the investment code and the mining act. A study of legislation on water resources has been completed. A bill on wildlife and national parks has been formulated. These reforms and new laws are being made at a time when the national environmental law is being finalized.

Box 8.1
The role of international conventions and the press in environmental protection

In October 1991, one female and three male chimpanzees were returned to Uganda from the Soviet Union to which they had been smuggled on 10 September 1990. The main reason for their return is that Uganda is committed to the conservation of wildlife, and in pursuance of that goal, it imposed a total ban on export of wildlife and wildlife trophies. The commitment was shown when Uganda acceded to the Convention on International Trade in Endangered Species of Fauna and Flora (CITES) on 16 October 1991, whose terms it declared it shall strictly adhere to. It was CITES which intensified the investigations for the recovery of the chimpanzees.

At home, the press was very instrumental in drawing the attention of the local and international community to the above case. Uganda has in the last seven years witnessed an improved situation in the freedom of the press. Many environmental issues have been reported, the public has been educated and informed, and those who have committed offenses or participated in illegal transactions have been reported.

This has shown that responsible and objective journalism can contribute positively to sustainable natural resource use. One Ugandan journalist, Mr. Ndyakira Amooti, consistently and authoritatively reported about the illegal chimpanzee trade. He has also reported on other aspects of the environment. It did not come as surprise when United Nations Environment Program (UNEP) recognized him for his outstanding work in helping to protect the environment. He was elected to UNEP's Global 500 Roll of Honour. About 41 such awards were awarded in 1993. Mr. Ndyakira Amooti received his award at the main international ceremony held in Beijing, China on 5th June 1993. This award should be looked at as another form of incentive.

The Draft Constitution embraces the principle that every Ugandan has a right to a clean environment. It advocates for the protection of the environment from abuse, degradation and pollution (**Box 8.2**).

8.3 Institutional framework

In 1986 government created the Ministry of Environment Protection (MEP). This ministry was charged with the responsibility of coordinating and enhancing natural resource management, harmonizing the interests of the resource users, monitoring pollution levels, and advising government on policy and legislative reforms for ensuring sound environmental management. The mandate was laudable as far as its coordination role was concerned.

The ministry was later absorbed in a larger Ministry of Water, Energy, Minerals and Environment Protection (MWEMEP), which in 1993 became the Ministry of Natural Resources (MNR). The responsibility for environmental management has been given to Environment Protection(DEP) Department in the new Directorate of Environment. However, the present institutional framework, being sectoral and "equal" to others, does not give environmental management the place it deserves.

Box 8.2

Draft Constitution Environment Clause

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, including provision for:

Clause 36 The Environment

(i) It shall be the duty of the State to ensure that all persons enjoy a clean and healthy environment;

(ii) In order to attain sustainable development, environmental protection and improvement shall form an integral part of the development process;

(iii) Uganda's socio-economic development strategy shall aim at achieving a balance between growth, poverty alleviation and environmental protection;

(iv) The people are entitled to be consulted when any policy and program which may affect their environment is being drawn up or implemented;

(v) The utilisation of the natural resources of Uganda shall be managed in such a way as to meet the development and environmental needs of present and future generations of Ugandans;

(vi) All Ugandans are entitled to accessibility and readily affordable energy resources which meet their basic needs and the needs of environmental preservation;

(vii) The organs of both central and local government shall create and develop parks, reserves and recreation areas so as to ensure the conservation of natural resources, including animals, plants and fish to promote the rational use of natural resources and safeguard their capacity of renewal, regeneration and stability of the ecology.

Clause 37 Environmental Awareness

Public awareness and participation in environmental protection and preservation shall be facilitated and encouraged by making information regarding the environment readily and easily available to the population and by promoting environmental education in schools.

Clause 66 Right to clean a healthy environment

(i) Every Ugandan shall have the right to a clean and healthy environment;

(ii) Parliament shall for the purposes of this article enact laws for the taking of necessary measures against pollution and destruction of the environment, and generally for the protection of the environment.

The administrative location of the DEP in the MNR makes it difficult to carry out its mandate of coordinating, supervising and advising other ministries on environment management issues.

Aside from the MNR, there are currently a number of other sectoral institutions, which are directly concerned with the environment. These sector-based institutions are all highly centralized, and generally far removed from their clientele. Also, there is lack of communication resulting in poor planning and implementation.

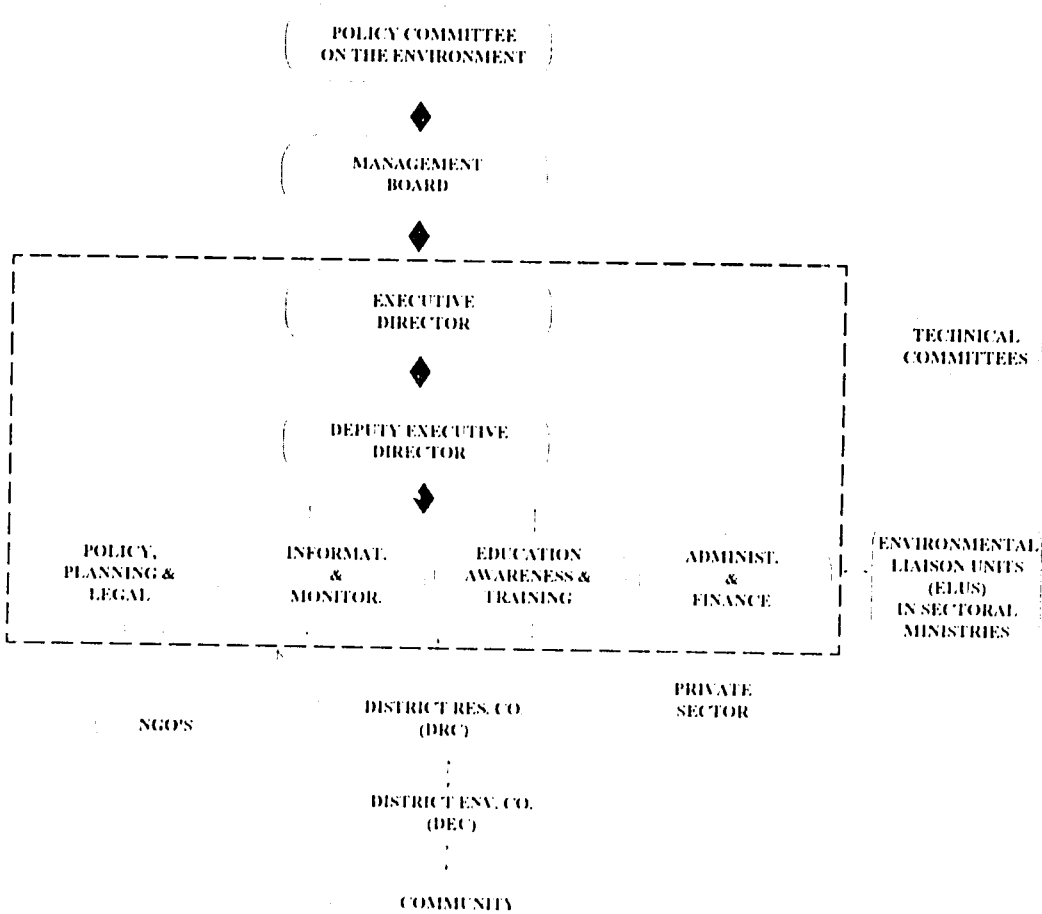
The result is that environmental monitoring, coordination, supervision and management are *ad hoc*, sector-based and with considerable duplication of effort. There are also conflicts in responsibility and rivalry in management of resources. Many areas (such as environmental planning, policy, impact assessments, legislation, integration of environmental concerns in socioeconomic planning and coordination among conflicting interests) are not covered under any institution's jurisdiction. This will eventually lead to more environmental degradation.

In the proposed Environment Management Statute, a corporate body, the National Environment Management Authority (NEMA), would be chaired by the Prime Minister. It would become the principal and authoritative agency of the government for the management of the environment. Its governing body would be the Cabinet Committee on the Environment. A district environment committee under the District Resistance Council is proposed. It would ensure that environmental issues are integrated in local projects and plans. Environmental committees are proposed in urban authorities, counties and subcounties (see **Figure 8.1**).

Sustainable natural resource management depends on an enabling environmental law that gives different stakeholders an opportunity to participate. In the past, individuals, households and the private sector have not participated as they might have wished. Indigenous knowledge and practices have not been relied upon in formulation and implementation of environmental policies, and legislation by government and public offices.

It is now increasingly accepted that "centralization" of natural resource management is not the best institutional arrangement. It denies the general population access to knowledge and information about the environment. The absence of incentives, which would have stimulated private innovation, aggravated the problem. Since 1986, however, a growing number of local and international NGOs have started environmental-related programs and projects in Uganda. This is a positive development: NGOs, especially international ones, provide resources which can supplement those of government. When incentives and disincentives come into place, they can also influence private sector participation.

Figure 8.1: Proposed Organisation Chart for the National Environment Management Authority



8.3.1 Incentives/disincentives

Uganda's economy is heavily dependent on natural resources. Ugandans aspire to exploit the natural resource base. These expectations focus attention on short-term achievements causing long-term implications of some activities to be neglected. Environment is no longer a "free good" suggesting that costs for a good quality environment should be borne in proportion to the degree of pollution while benefits should be enjoyed in proportion to the sustainability of natural resource use.

The government can supplement the current tendency to rely heavily on regulation and enforcement with a system of economic incentives and disincentives. Incentives can be subsidies, tax credits, loans, material goods, tax exemptions or price supports. Disincentives can be taxes, fines/charges and penalties. In Uganda no economic policy or incentives have been put in place to set prices/values of natural resources to levels which reflect their true values. Instead the practice has been to rely on the tools of command and control to achieve objectives, which could otherwise be attained more effectively through pricing and incentives. The proposed environmental policy strongly emphasizes the use of incentives and disincentives. Their absence has led to discharge of untreated industrial effluents, land degradation and low investment in projects with benefits that take a long time to be

realized such as reforestation, research and environmentally-friendly technologies. Where such investments have been undertaken, they have been predominantly government initiatives.

The government has recently realized that it must analyze the environmental costs and benefits of its projects. For example, the tariffs charged by Uganda Electricity Board (UEB) have recently been raised to make them reflect the long-run marginal costs. Likewise, the water rates rose after subsidies were removed. These price increases have environmental implications. The introduction of incentives and disincentives reflects the opportunity cost of resource use to the society. The private sector is likely to be motivated to invest in new areas or areas which hitherto were controlled by government such as conversion of garbage into manure for sale, or its collection, recycling and disposal.

Response to incentives and disincentives depends on three factors: ownership, competition and ability of the users to respond to changes in prices in differing ways as is characteristic of private firms and households. This will necessitate the creation of sound environmental management by granting user rights to resources such as fisheries and wetlands which have been poorly managed because they are communal. It is established, for example, that Uganda's four land tenure systems have negative impacts on land utilization[77]. Similar studies need to be carried out for other resources like fisheries, water, and rangelands.

It must be emphasized, however, that for these policies to have effect, they must be supported by government institutions. This is especially true in the case of paying for polluting. The present approach under the Structural Adjustment Program is to rely on the market to allocate resources. Pollution, however, is a case of market failure: the true costs of polluting cannot be determined by the market. Experience from other countries shows that institutionally-demanding conditions are essential if policies are to work. These are: a local framework for negotiation between polluting and polluted parties, a clear and publicly available statement of the standards set and agreements reached, means of penalizing defaulters, and fair and equitable application of the laws and regulations to all parties[77]. It may not be administratively feasible to introduce the polluter-pays principle for all industries or polluters. It is practical to start with a few industries with major environmental impacts.

8.3.2 International aspects of incentives

The entire world benefits from certain natural resources in Uganda. Biological diversity is the best example. However, it is the local communities and the government which must bear the costs of conservation. The government is preoccupied with mobilizing its own resources to support its programs, including conservation for the benefit of the global community. At the same time, it has to meet its debt obligations to the international community, a factor that reduces the financial resources of the government. Currently, the external debt stands at $ 2.6 billion and the debt-service ratio at 60% before providing for interest. The "debt crisis" is, in this case, one of the most pervasive disincentives for conserving biological resources. The debt crisis and the environmental crisis both stem from the same root cause: the attempt to increase consumption above levels the economy and environment can sustain. Since significant benefits from Uganda's resources are enjoyed by people elsewhere in the world, these people should be willing to help pay for their conservation. Incentives and disincentives can be applied in such situations. Direct incentives like grants and debt swaps can be used. Indirect incentives like technical assistance, equipment and information can also be applied. In Uganda the $4 million Bwindi Trust is an example of international support to conservation of biological diversity using a grant. Widescale debt cancellation could also be profoundly helpful.

However, the longterm solutions lie in applying policies that are based on better development paradigms[278].

8.4 Environmental education and public awareness

In a developing country such as Uganda, problems concerning the environment include the struggle against hunger, disease and poverty and the improvement of the living conditions of the population. These problems are compounded by a lack of basic education and a general lack of understanding of the overall social, moral, economic and cultural heritages. And yet, the survival of Ugandans will continue to depend on the rational utilization of natural resources and sound management of the environment. To ensure that the public understands, is sympathetic to and aware of, and participates in sound environmental management, a conscious and deliberate effort of environmental education and awareness must be created and maintained.

Environmental education is relatively new in Uganda as elsewhere. Only now in East Africa are scattered efforts being made to integrate environmental issues into the university system, teacher training and curriculum development for primary and secondary schools[279].

There is a need to expand public awareness of environmental issues as an essential part of global education effort to strengthen attitudes, values and actions which are compatible with sustainable development. In creating an appropriate public awareness program, the principles of accountability and devolving resources to the most appropriate level must be observed with preference given to local responsibility and control over awareness-building activities[280].

In Uganda there are scattered and often uncoordinated environmental education activities in a number of educational establishments. However, environmental education and public awareness outside educational establishments is not strong. For example, little environmental education or awareness is received through family members, youth camps or cultural activities.

Environmental education and public awareness in Uganda is provided through three principal fora; formal education institutions, non-formal channels and informal channels.

Formal educational institutions are the primary, secondary, and tertiary non-university and university establishments. The Uganda White Paper on education has included environmental protection as one of the broad aims of education. More specifically, in:

- *Primary schools* - The revised 1990 Syllabus contains environmental course units incorporated in social studies, basic science and health education subjects. Unfortunately, the main weakness faced by primary schools is that teachers have often not been trained in this new material.

- *Secondary schools* - A range of subjects offers elements of environmental education. However, the effectiveness of these subjects is limited because although knowledge is acquired, skills required for the wise use of natural resources are lacking. Therefore, there is a need to revise the secondary school syllabus.

- *Tertiary (non-university institutions)* - There are no special programs being offered except at two of the institutions.

- *Tertiary (universities)* - At Makerere University, the Departments of Geography and Forestry, the Faculty of Technology, and the Institute of Environment and Natural Resources offer courses dealing with environmental protection and management. Some science courses at Mbarara University also contain environmental protection elements.

In promoting environmental education in the formal education system, Uganda faces three problems: lack of clear policy; lack of funds; and the lack of trained human resources. Despite these, some environmental education activities are taking place in the formal education system as shown in **Table 8.1**.

Informal and non-formal education on the environment are essential complements to formal education. Non-formal education is essentially instruction outside the formal classroom structure. It may consist of seminars, workshops, conferences or specialized instructions (**Box 8.3**).

Box 8.3

The importance of environmental education

Education including formal education, public awareness and training should be recognised as a process by which human beings and societies can reach their fullest potential. Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues. While basic education provides the underpinning for any environmental and development education, the latter needs to be incorporated as an essential part of learning. Both formal and non-formal education are indispensable to changing peoples' attitudes so that they have the capacity to assess and address their sustainable development concerns. It is also critical for achieving environmental and ethical awareness, values and attitudes, skills and behavior consistent with sustainable development and for effective public participation in decisionmaking. To be effective, environment and development education should deal with the dynamics of both the physical/biological, and socioeconomic environment. Environmental and human (which may include spiritual) development should be integrated in all disciplines and should employ formal and non-formal methods and effective means of communication.

Table 8.1 describes the current state of non-formal education. One of the major deliverers of non-formal environmental education and public awareness is the Wildlife Clubs of Uganda (**Box 8.4**).

Informal education is also provided outside the formal classroom structure. A key component is the traditional passing of knowledge from one generation to another. The instability that characterized the last two decades in Uganda rendered the social, political and economic environment not conducive to informal learning. The current state of informal environmental education and public awareness is also described in **Table 8.1**. Due to the importance of the traditional mechanisms of knowledge transmission, the extent of indigenous knowledge of Ugandans in specific natural resources areas is shown in **Table 8.2**.

Box 8.4

Wildlife clubs of Uganda

The Wildlife Clubs of Uganda were formed in the 1960s, but unfortunately became dormant for over ten years, and were only rejuvenated in 1975. Since then, the main focus has been on practical field campaigns against poaching and decimation of wildlife. From over 381 clubs in 1988, the number of registered clubs has risen to 784 in 1993; they are found in schools, institutions of higher learning and adult groups. The Wildlife clubs of Uganda have been singled out as the most active group in disseminating environmental knowledge and information.

The aim of these clubs is to:

a) cultivate a desire for environmental conservation amongst the people of Uganda and East Africa as a whole;

b) promote appreciation and scientific study of the country's wildlife and environment;

c) promote the realisation of the economic, recreational and aesthetic values of the country's natural resources.

The Wildlife Clubs are under the patronage of the Ministry of Tourism and Antiquities, and consist of three trustees, a governing council, a national Secretariat, district association, and individual clubs in schools and colleges and other organisations.

The activities and roles of the Wildlife Clubs include: wildlife education, public awareness through lectures, seminars and workshops, films, magazines and the notable Conservation Awareness Week held once every year, tree planting and soil conservation and lobbying on issues that may adversely affect wildlife and particularly endangered species (which include the Mountain Gorilla, Shoebill Storks, Sitatungas, falcons, crocodiles, leopards and the Grey Parrot).

The major constraints which the Clubs have faced include: lack of funds, equipment and facilities and turnout during the years of war. Despite these, the clubs have been able to publish and distribute information to schools and the public and carry out projects with the Global Environment Facility (GEF) project on Biodiversity, and the UNDP project for institutional building and extension work. With the Panda Clubs of Italy, they joined to exchange knowledge through a project called Young People United Project.

Institutions which work with the Wildlife Clubs of Uganda include: NEAP, JEEP, women groups, World Wildlife Fund, World Conservation Union (IUCN) and the East African Wildlife Society.

Table 8.1: Current status of environmental education and awareness in Uganda

EDUCATION TYPE AND LEVEL	ON-GOING ACTIVITIES	REMARKS/CONSTRAINTS
A. FORMAL A1. Primary schools	1. Planting grass on bare parts of school compounds to control soil erosion in such areas. 2. Tree planting in school compounds to provide shade, cool atmospherere, and windbreaks. 3. Proper disposal of waste eg. use of compost pits which have led to the formation of manure on school farms.. 4. Personal hygiene achieved through proper use of pit latrines. 5. Environmental protection competitions through dance and drama.	1. Not all students in all schools are involved. 2. Many pupils do not take it seriously because it is not examinable. 3. Lack of tools, supervisory manpower. 4. Natural factors such as termites frustrate tree planting efforts.
A2. Secondary school level	1. Community work which helps to keep schools clean. 2. House cleanliness (especially in boarding schools) and competitions 3. Essay writing competitions. 4. Public lectures. 5. Tree planting for perimeter school fences, compound shade and windbreaks. 6. Introduction of biogas as a substitute for woodfuels. 7. Soil conservation through mulching and contour ploughing. 8. Paddock grazing stall feeding 9. Visits to areas where environmental education and public awareness issues are being tackled (eg. National Parks and Forest Reserves). 10. Environment day, marked by cleaning of the school premises and care of trees. 11. Proper waste disposal in school compounds 12. Growing of crops to control soil erosion. 13. Pasture maintenance through rotational grazing 14. Soil improvement on the school farms through the use of manure leading to higher crop yields.	1. Few teachers organize practial activities that enable students to acquire skills for environmental protection. 2. Very few teachers are conscious of environmental degradation problems, women are not aware of the environmental protection activities of the schools. 3. Major limitations to promoting environmental management practical activities in secondary schools include: * lack of equipment; * limited space for tree planting; * lack of visual aids in areas that cannot be visited; * negative attitudes towards manual work by both students and staff; * lack of transport to visit places with environmental problems; * limited time for practical activities to be carried out effectively; * staff not qualified to teach practical environmental management activities.
A3. Tertialry institutions (non-university), teaching training	1. No major extra-curricular activities devoted to environmental protection on a regular basis, although in some cases it is an optional club activity	1. Many of the institutions regard environmental education as a new idea. Hence little or nothing is included in their syllabi.
A4. Universities		
B. INFORMAL	1. The Ministry of Information and Broadcasting is working with the Department of Environment Protection (Ministry of Natural Resources) in the formulation, planning and transmission of environmental education and public awareness packages on themes such as: * our environment; * population and environment; * industry and environment; * health and sanitaiton; * wetlands of Uganda. Drama, songs, interviews and documentaries are used to broadcast these programs	1. Constraints that affect effectiveness include: * inadequate logistical support and infrastructural facilities to facilitate large-scale research and comprehensive program design; * concentration of media facilities, especially T.V in a few urban areas.
C. NON-FORMAL	1. Over 170 local and foreign NGOs are reported to have programs aimed at promoting public awareness of the environment and increased public commitment to effective natural resources management. 2. Through its ministries of Agriculture, Animal Industry and Fisheries (MAAIF), and Natural Resources, the government also engages in environmental awareness and campaign.	1. Although many of the NGOs are indigenous organizations, many of them are still new and struggling to establish themselves as credible change agents. 2.Improvements are needed in working relations between government and NGOs at district level so that efforts can be consolidated for greater impact

Source: NEAP Secretariat, Task Force No.2 (1993)

Table 8.2: Indigenous knowledge of specific natural resources

RESOURCES		DESCRIPTION
1. **Climate**	1.	Local knowledge of climatic patterns, their variability in space and time and the ways in which they are predicted forms an indispensable part of the information farmers need to survive.
	2.	Climatic predictions based on many years of observations of weather related phenomena.
2. **Land and soils**	1.	High indigenous knowledge of soil types, their quality and potential for cultivation.
	2.	Indigenous knowledge uses some plants as indicators of fertile soils. In dry areas certain plants indicate water below the ground.
	3.	Shifting/fallow systems are based on indigenous knowledge.
3. **Plants**	1.	Knowledge of plants is perhaps the most refined of indigenous information.
	2.	On the whole, local people's names, knowledge and classification of plants is more pragmatic and immediately utilitarian than the formal scientists.
	3.	Virtually all plant species are used for something.
4. **Wild animals and insects**		
	1.	In most cases, wild animals are classified and named at the species level although generic names for non-important species can also be found.
	2.	Both animals and insects are used as food. Animal parts are used as tools and medicines, in religious rituals and as status symbols. They have also served as indicators of ecological dynamics.
	3	Hunters exploit detailed knowledge of the characteristics, scent, behaviour and habitats of wildlife. Traditional herbalists and priests possess knowledge suited for their purposes.
5. **Human and animal medicine**		
	1.	Knowledge of diseases and their cures are found among all rural populations who depend on local means to mitigate the effects of ill health.
	2.	One plant may be used in many medicines (eg. *Cassia occidentale* used as diuretic, laxative, tonic and arbotificant. It is used in asthma, jaundice, cataracts and kwashio kor).
	3	Indigenous medicinal knowledge has now extended to introduced exotic plants such as *Eucalyptus spp.* and *Callistemon citrinus* commonly used in treating coughs and flu.
	4.	There are medicines for domestic animals, especially cattle, sheep and goats (eg. *Microdesmis puberula* and *Vernonia sp.* used to treat stomach aches).
	5.	Many plant species used by traditional healers are not yet scientifically identified. Therefore, the chances of information loss are very high.
6. **Management practices**		
6.1 **Rangelands**	1.	One major resource in which indigenous knowledge and practices are applied to a great extent are the rangelands where one finds the traditional pastoralists of Uganda - the Karimojong and Bahima.
	2.	The strategy of mobility is one of the most adapted and deliberate means of obtaining what livestock need in an ever-variable environment.
6.2 **Plants**	1.	Trees as food, religious and symbolic functions are the least disturbed and are even deliberately protected.
	2.	Regeneration is left to nature through seeds or cropping but protection of certain "valuable" trees can be specifically undertaken.
	3.	Certain forests are preserved for religious, mystical or ancestral purposes.
	4.	For fuelwood the tendency is to gather dead and dry pieces, so that large quantities can be transported home.
	5.	Some harvesting techniques can be damaging to the plants such as debarking to make ropes, medicine or other products.

RESOURCES		DESCRIPTION
	6	Large clearances now associated with shifting cultivation. Wildfires cause serious damage to vegetation and prevent regrowth.
6.3 **Food and medicine**	1.	Only the needed amounts of food collected on individual basis except where group uniting occurs
	2.	In many places hunting is done during the dry season when fires may be set for this purposes
	3.	In many places wild foods which are critical during the dry season have greatly declined due to conversion of bushland to other uses
	4.	For medicine, it is not known how much material is collected annually. Taboos may restrict over-exploitation.
6.4 **General ecology**	1.	Almost all groups are familiar with ecological associations such as the relations between climate, soils, vegetation, wildlife and human activities with gaps in knowledge filled by religion, mythology and mysticism.
	2.	The process of environmental degradation is understood to some degree, although there is no evidence people have taken preventive steps on their own.
	3.	The value of natural resources is relative to what is available and what tradition dictates.

Source: NEAP Secretariat: Task Force No.8 (1993)

8.5 Environmental information, research and monitoring

8.5.1 Information

According to the United Nations Conference on Environment and Development (UNCED)[281], everyone is a user and provider of information in the broad sense. Furthermore, the need for this information extends from the national and international levels of decisionmaking to the grassroots and individual levels.

Uganda's environmental problems include soil degradation, drainage of wetlands, poaching of wildlife, pollution of water bodies from mine wastes, the water hyacinth, deforestation outside forest reserves, over fishing in certain areas and poor housing conditions and sanitation. These need urgent attention before they become bottlenecks to development. Rational decisionmaking and concerted efforts from government agencies, NGOs and the private sector are essential. But what will the decisions be based on? Sound decisions depend on the availability of environmental data[282]. But even if the data were available, Uganda lacks the arrangements to disseminate the information from the data source to the users. Like developing countries such as Nigeria[283], Uganda's current arrangement for the dissemination of environmental information is *ad hoc*. It has also been observed that the gap in the availability, quality, coherence, standardization and accessibility of data between developed and developing countries is widening[284]. This seriously impairs the capacity of developing countries to make informed decisions regarding environmental issues(see **Box 8.5**).

It is obvious that Uganda's environmental information could be improved in quantity, quality, reliability, consistency and circulation. More specifically:

- those involved in information gathering need assistance with dissemination.
- there is a serious lack of useful environmental information at the policy making level.

- relevant information in various government departments is hardly transmitted to the extension staff who are the principal change agents.

- while some environmental information does trickle down from the top to the grassroots, very little information collected at the subcounty or district levels reaches the national level (absence of the reverse transmission).

- a number of development projects generate significant and useful environmental information. However, up to now there is no system in place to harness project-related environmental information. In most cases, once a project is completed, the available environmental information is lost.

Uganda needs to establish an Environmental Information System (EIS) which can provide the data to:

- monitor the quantity and quality of the environmental resources.
- establish environmental guidelines and standards.
- conduct economic and other types of analyses of various policy alternatives for environmental management.

Within the EIS system, environmental information and data could be grouped under the following headings[285]:

- geology and topography.
- land.
- water.
- climate and weather.
- agriculture, rangelands and forestry.
- ecology.
- pollution and wastes
- socioeconomic data.
- energy.

As a first step to establishing an EIS, there is a need to carry out an inventory and assessment of existing stock of data and examine the institutional framework for generating such data. From the assessment, any significant gaps in the available data stock, reliability of existing statistics and timeliness of existing data can be determined. Plans for improving collection, analysis and distribution can then be developed

8.5.2 Research

From the colonial period and up to the early 1970s, Uganda's research capability was well known and internationally recognized. Up to the time of the breakup of the East African Community in 1977, Uganda shared research facilities and research programs and priorities with the other two member states, Kenya and Tanzania. Research activities of the East African Community were divided into two groups.

- **Natural Resources Research**
  - agriculture and forestry research.
  - fisheries research.
  - industrial research.
  - veterinary research.
  - pesticides research.
  - meterological research.

- **Medical research**
  - Virus research.
  - Leprosy research.
  - Bilharzia research.

Community-wide research organizations based in Uganda were: the East African Freshwater Fisheries Research Organization, Jinja; East African Trypanosomiasis Research Organization, Tororo; and East African Virus Research Institute, Entebbe. After the collapse of the East African Community, these became national organizations. Their ability was severely curtailed by lack of funding and international support. Much of their staff left during the 1970s and early 1980s.

At present a number of established research institutions exist in the country either as extensions of government departments or part of universities. These institutions are carrying out some research related to the environment. Most are government-run. In addition international and regional bodies conduct or sponsor individuals to carry out research in fields related to natural resource management and environment protection. Donor-funded projects also have research components related to environmental protection.

But environmental research is just now finding its way into the traditional research agenda. An indication of the current status of environmental research is illustrated in **Table 8.3** based on a sample of projects approved under the National Council for Science and Technology. Clearly, there is much room for improvement. The environmental research system in Uganda is not responsive and productive. Second, the dissemination of research results is poor, usually consisting of personal contacts between researchers. Research networks virtually do not exist. Third, there is no central place where research results are stored and catalogued for easy accessibility.

Environmental research in Uganda suffers from lack of research facilities, insufficient manpower and lack of support services. Research facilities are lacking because for years buildings were not maintained and government failed to invest in new equipment and facilities. Donors are alleviating this somewhat by providing research facilities.

Uganda once had highly-trained researching staff. But in the 1970s and early 1980s, many fled as a result of civil wars, collapse of government institutions and general insecurity. Those who remained were undermined by poor remuneration. In an absolute sense, Uganda needs additional highly-trained staff to effectively conduct and manage environmental research. Particularly lacking are qualified and competent personnel to carry out research planning and management, documentation and information services management, animal production and nutrition, fish breeding, sanitary engineering, pollution analysis, environmental impact assessments, and environmental policy and economics analysis.

Box 8.5

Environmental Data and Information in Uganda

A. ECONOLOGY AND TOPOGRAPHY

A1 Geology

- Source of geological inforamtion: Department of Geology and Mines, Makerere University and Industry
- Available maps 1:120,000, 1:100,000 and 1:50,000

A2 Topography

- Surveys and Works Department
- Medium scale topographic maps as well as cadastrall maps for urban areas
- Coverage, timliness are issues of concern;
- Number of maps printed with or without contours (planimetric are also needed;
- Scale 1: 250,000 and 1:50,000 maps

B. LAND AND SOIL DATA

- Currently no comprehensive land use map,
- Available maps are outdated or project-oriented;
- Urban maps exist with varying qualities;

C. WATER

- Water Development Department collects data;
- Availability of data at district levels lacking;
- Ministry of Works, Transportation and Telecommunications also collects some data on water an so does the National Water and Sewerage
- Spatial coverage limited.

D. CLIMATE AND WEATHER

- Meterolgical Department responsible, but many of the stations currently out of operation and so the density of weather stations in some parts is below the recommended by the World Meterological Organisation.

E. AGRICULTURE

- Data generated at the national, district and local levels
- MAAIF, Bank of Uganda, MFEP carry out agricultural surveys and census;
- Much of the data is untimely and incomplete. Reliability of data is also of concern.

F. FISHERIES

- Data principally Fisheries Department and the Fisheries Research Institute (FIRI);
- Data reliability is due to problems of collection and the changing ecological dynamics of the fisheries resources;
- Data provided by fishermen are also often unreliable.

G. FORESTRY

- Data sources: Forest Department, Makerere University, NGOs;
- Forest Department carries periodic national forest inventories;
- Characterized by irregular data collection
- Currently the National Biomass Study and Natural Forest Management Projects are generating detailed resources data.

H. LIVESTOCK

- Data source: Uganda Livestock Serivce, Bank of Uganda, MFEP and individual projects;
- Uganda Livestock Service carries out census;
- Need more accurate information on a number of animals slaughtered, livestock vaccination, and poultry statistics;

I. WILDLIFE:

- Data source: Uganda National Parks, Game Department and Makerere University;
- Data gaps due to the general insecurity of the 1970s and the early 1980s.

J. BIODIVERSITY/ECOLOGY

- Until NEAP no agency responsible. Data was ad hoc and sectoral.

L. POLLUTION AND WASTE

- Data from various government departments, MLHENR, Urban Authorities;
- Limited data on effluent quality, air emission qulity and solid waste generation rates.

M. ENERGY

- Government departments (Ministry of Natural Resources), UEB Industry

N. SOCIOECONOMIC

- MFEP, Statistics Department is responsible for collecting, collating and dissemination data on all aspects of life in the country;
- Together with Bank of Uganda MFEP generates historical time series data on national accounts, monetary and financial statistics, foreign trade and sectoral economic data and price indices. These constitute the bulk of the socioeconomic data in the country;
- Often data sets have different base years, coupled with significant gaps;

Source: National Environment Information Center

Support services are crucial to the smooth running of a research institution. These generally include management and administrative staff and logistics such as vehicles and equipment. These are lacking in Uganda's research institutions generally and environmental research in particular.

8.5.3 Monitoring

Monitoring the state of environment has two major components. First, monitoring consist of repeated measurements of the agents of environmental degradation and their impacts on the resource. Second, monitoring involves the collation and interpretation of the data with a view to detect changes or trends in the status of the resource[280]. Only with analysis can changes in the natural environment be related to social welfare.

The major reason for monitoring Uganda's environment is the fact that the country's economy is largely natural resource-based. Second, Uganda's population is largely rural and existing at a subsistence level with rampant poverty. Poverty degrades natural resources and environmental degradation damages peoples' welfare. Third, Uganda is a signatory to several regional and international environmental conventions including those agreed upon during the Earth Summit and contained in Agenda 21. Implicit or explicit in the latter convention is the need for each signatory country to prepare a regular State of Environment (SOE) publication. An adequate monitoring system would greatly enhance the production of SOEs.

Table 8.3: Environmental content of a sample of projects of the National Council for Science and Technology

	% OF PROJECTS HAVING IN-BUILT ENVIRONMENTAL CONSIOUSNESS
ECOLOGY	
Forests	35
Wildlife management	40
Water resources/fisheries	10
Land use	4
Other environmental sensitivity	8
MEDICAL RESEARCH	
Community health/environmental sanitation	18
Health at work	3
SOCIAL SCIENCE	
Community health	3
Land use	0.5
Natural resources conservation	1
SCIENTIFIC AND INDUSTRIAL RESEARCH	
Energy conservation	14
Water resources	6
AGRICULTURAL RESEARCH	
Crop and livestock production and land use	4.6
Forestry	3
CULTURAL RESEARCH	
Cultural research	0

Source: NEAP Secretariat, Task Force No.2 (1992) p.26

Fifth, Ugandans need to know the state of their environment in order to:

- gain information about present levels of harmful or potentially harmful stressors.
- assess the extent, use and value of their natural resources.
- identify environmental risks and impacts not previously known so that they can be brought under control;
- assess known environmental risks and evaluate their control measures; and
- identify and promote activities that are beneficial to the environment and so fulfil the principle of sustainable use of natural resources[287]

Ugandans also need to monitor adherence to and implementation of environmental policies and legislation. Although the physical state of the environment is a reflection of compliance with policy and legislation, often there is a delayed reaction from the time of failure of the latter and its manifestation in the physical environment.

At the present time, the environmental monitoring system in Uganda is not capable of giving early warning signals. For example, the introduction and subsequent ecological impact of the Nile Perch was inadequately monitored. Similarly, the pollution by the water hyacinth could also have been monitored better. Its spread could have perhaps been pre-empted.

For historical reasons, Uganda's environmental monitoring is *ad hoc*, uncoordinated and sectoral. Standards against which variables can be measured are lacking. Now efforts are being made to better monitor the environment. However, these are constrained by lack of resources (manpower, equipment, materials and operating funds). Nevertheless, some environmental monitoring activities, largely sectoral, do take place. Examples are shown in **Table 8.4**

Table 8.4: Examples of monitoring activities with the institutions responsible

AREA	MONITORING INDICATORS	INSTITUTIONS RESPONSIBLE
Geology & topography	- Working environment in mines; - Discharge management (waste, pollution); - Mineral deposits, and exploitation activities; - Siting of industrial activities; - Land use planning; - Landscaping and land pollution	- Department of Geology & Mines; - Makerere University; - Industry; - Surveys & Works; - Dept. of Lands and Surveys;
Water	- Pollution of water bodies; - Industrial and domestic effluents to sewage tanks; - Water quality and quantity control; - Water supply in rural and urban areas for various uses; - Effluent discharge from sewerage works; - Biological oxygen demand (BOD)	- National Water and Sewerage Corporation; -Directorate of Water - Water Quality Control Labaratory.
Climate & weather	- Atmospheric pollution; - Drought, floods, desertification; - Rainfall regime.	- Department of Meteorology; - Agriculture Dept - Agrometeorological stations
Agriculture	- Soil analysis; - Pesticide residues in food; - Crop census; - Food processing and preservation; - Fruit and vegetable improvement; - Appropriate technology (eg draft animal power)	- Agricultural research stations; - Department of Agriculture (NARO); - District Farm Institutes.
Fisheries	- Chemical residues in fish; - Pollutin of spawning areas; - Water hyacinth; - Nile Perch; - Maximum and optimum sustainable yields; - Exploitation, processing and post-harvest losses	- Uganda Fresh Water Fisheries Research Organization; - Fisheries Dept
Forestry	- Forest cover and deforestation; - Forest ecology; - Sustainability of biomass energy resources; - Silviculture; - Agro forestry	- Forest Dept; - Nakawa Forestry Research Institute; - NGOs; - Makerere University
Livestock	- Chemical residues in meat; - Trypanosomiasis, CBPP, rinderpest and other parasitic & infectious diseases; - Animal nutrition/pasture management; - Land carrying capacity	- Dept of Animal Industry; - Uganda Livestock Services; - Bank of Uganda; - MFED; - Pan African Rinderpest Campaign Organization; - Faculty of Veterinary Medicine, Makerere University
Wildlife	- Biodiversity & environmental conservation; - Endangered plant and animal species	- Game Department; - Uganda National Parks; - Makerere University.
Biodiversity & ecology	- Exploitation of plant and animal species; - Natural habitat and encroachment by man	Until NEAP was initiated, no agency was responsible

Table 8.4 cont'd

AREA	MONITORING INDICATORS	INSTITUTIONS RESPONSIBLE
Wetlands	- Wetlands diversity (fauna and flora) - Functions and values/uses of wetlands; - Reclamation for cultivation, brickwork, fuel and building materials; - Conservation (sanctuaries); -Polllution; - Ownership and management - Sustainable use options	- Dept. of Environment Protection -Dept. of Fisheries; - Dept. of Forestry; -NEAP; -Dept of Agriculture; Dept of Animal Industry; -Dept of Mines; - Dept of Energy; -UEB; - MUIENR; -UFFRO
Pollution and waste	- Garbage dumps; - Effluents to sewers and sewer management, and effluent quality; -Fresh water pollution; -Land pollution; -Chemical residues; -Industrial and domestic waste management and waste generation rates; -Biochemical Oxygen Demand (BOD)	-Urban authorities; -MUIENR; -Water quality control laboratory; -Water Development Department - National Water and Sewerage Corporation; -Department of . Meteorology; - Laboratory of the Government Chemist
Energy	-Fuel resources and their utilisation; -Alternative sources of energy, -Biomassenergy resource sustainability, -Electricity potential; -Fuel-saving technology; -Consumer demand and energy supply	- UEB; - Ministry of Natural Resources -Forestry Department
Socio-economic	- Population growth and resource use; -Investment in various sectros of the economy, GDP, inflation rates; -Dept-servicing and taxation, -Foreign trade, money market	-MFEP, Statistical Department -Bank of Uganda

Source: NEAP Secretariat, Environment Education Research, Information and monitoring, 1992. Topical Paper FISHIN Notes and Records: Management of Fisheries on L. Victoria UGA 87 007 Occasional Paper No. 5

REFERENCES

1. World Bank (1987) World Tables, 1987 edition.
2. MFEP (1993) Background to the budget 1993-94.
3. World Bank (1993a) Uganda - Growing out of Poverty p.59.
4. World Bank (1993) World Development Report, 1993.
5. World Tables,1987.
6. World Bank (1992) World Development Report,1992.
7. World Bank (1979) World Development Report, 1979.
8. Bank of Uganda(1982) Annual Report 1981/92.
9. MFEP (1992) Rehabilitation and Development Plan 1991/1992-1994/95. Vol I; Macro-economic and sectoral policy.
10. Budget speech, 1993.
11. World Bank (1993) Agricultural Sector Memorandum.
12. World Bank (1992) World Development Report, 1992.
13. NEAP: Energy Paper.
14. Dhatemwa C.M.(1992) The Export of Fish and Fish Products in Uganda: A need for capacity building- A paper presented at a Foreign Investment Seminar.
15. UNDP (1990) A Perspective plan for Uganda Tourism Development Plan p.7.
16. GOU (1991) National Agricultural Research Strategy and plan Vol II Priorities and programs 1991;
17. Ministry of Finance and Economic Planning (MFEP).1993.Background to the Budget. Economic Performance in 1991-92 and Prospects for 1992-93. Government Printer.
18. B.W. Langlands,"Soil productivity and land avallability studies", Makerere, 1974.
19. Kyamanywa, C. 1987, Case Studies in Environmental Management of Urban Areas. Ecosystems Management in Developing Countries Vol.IV: 243.
20. Parsons, D.1970. Agricultural systems. In J.D. Jameson, Agriculture in Uganda. Oxford University Press.
21. National Environment Action Plan (NEAP) . 1992. NEAP Draft Topic Paper in Land Management: Agriculture, livestock and rangelands. Report by Task Force Np 3
22. Danish International Development Agency (DANIDA).1989. Environmental Issues in Agriculture in Humid Areas (A plan of Action for Integration of Environmental Considerations into Danish Development Assistance - A strategy for Agriculture in Humid Areas) DANIDA Department of International Development Co-operation 66p
23. The World Bank 1993b. Uganda Agricultural Sector Memorandum vol II: Main Report. Washington D.C. 152p.
24. Ministry of Agriculture, Animal Industry and fisheries (MAAIF). 1992. Report on National Census of Agriculture and Livestock (1990-91) Vol II: Crop area, yield and production. Entebbe, Uganda 91.p.
25. National Environment Action Plan (NEAP), 1992. NEAP Draft Topic Paper on Land Management, Agriculture, Livestock and Rangelands. Report by Task Force No. 3
26. Ministry of Agriculture, Mechanization Division, 1990. Agriculture, livestock and rangelands, December,1992. Uganda, 243p.
27. World Bank, (1993b) *op cit.*
28. Bank of Uganda, Agricultural Secretariat. 1992. Report on Agricultural Inputs Situation (July, 1991-March,1992) National Inputs Co-ordination Unit. Kampala, Uganda.
29. World Bank (1993) *op. cit.*
30. Makerere Institute Of Social Research (MISR), Makerere University, Uganda and Land Tenure Center of University of Wisconsin, Madison, USA. 1988 Settlement in forest Reserves, Game Reserves, and National Parks in Uganda - A study of social, economic and tenure factors affecting land use and deforestation. Kampala, Uganda 116p
31. Jarawanm Eva. 1991. women in agriculture - Current issues and agenda for further research. AF2PH,Working Paper.
32. World Bank (1993b) *op.cit*
33. Makerere University Institute of Environment and Natural Resources (MUIENR)/World Resources Institute (WRI). 1992.
34. National Environment Action Plan (NEAP). Task Force No.4. Issue paper of Wetlands, Water Resources,Fisheries, Aquatic Biodiversity and Irrigated Agriculture. Kampala, Uganda.
35. Uganda Working Group 9A, Agricultural Policy Committee.1991. National Agricultural Research Strategy and Plan. Vol I: Strategy, Organization and Management. ISNAR. The Hague 177p.
36. Sergeant, A and S, Caiger, 1993. Opportunities for non-traditional agricultural exports form Uganda. Vol 3 - spices and essential Oils. Submitted by International Science and Technology Institute Inc. Washington, D.C./High Value Horticulture Plc, Uxbridge, U.K. to Export Policy Analysis and Development Unit (EPADU) Ministry of Finance and Economic Planning, Kampala, Uganda,56+p
37. White, F. 1983. *The Vegetation of Africa* (Paris, UNESCO)
38. Langdale Brown *et al. The Vegetation of Uganda and its bearing on land-use.* Entebbe. Government of Uganda. (1964).

39. Struhsaker (1987) Forestry Issues and Conservation in Uganda. *Biological Conservation* 39.
40. Aluma, J.R.W. 1976. *Productivity of manual and semi-mechanized logging and transport methods in Uganda.* M.Sc. Thesis . Makerere University.
41. Aluma, J.R.W. 1987
42. Plumptre, R.A. and J.Carvalho 1991. *The Marketing of Uganda Hardwoods.* Kampala, Uganda.
43. Lockwood Consultants Ltd, 1973. *Forest Resource Development Study - Republic of Uganda.* CIDA
44. UNDP/World Bank . Energy Assessment Program 1983 Energy Assessment program - Uganda.
45. Aluma, J.R.W. 1989 *Uganda's Energy Crisis: A Case Study of Fuelwood and charcoal Consumption.*
46. Plumptre, R.A and J.Carvalho (1991) *op.cit*
47. Weit, Keith and Grant Slade, 1991. *Uganda Environmental Issues and Options.* A Masters Dissertation (Unpublished).
48. Aluma, J.R.W. (1987) *op.cit.*
49. Uganda forest Department. 1992. *Annual Report - Natural Forest Management and Conservation Project.*
50. Hamilton, A.C. *Deforestation in Uganda.* (1984).
51. Aluma. J .R. W. 1991
52. Peden, D.G. *et.al* 1991
53. Makerere University institute of Environment and Natural Resources (MUIENR)/The world Resources Institute (WRI). 1992. Uganda-Environmental and Natural Resources Management Policy and Law: Issues and Options. II Documentation 89p
54. United Nations Environment Programme (UNEP) 1988 *Strategic Resource Planning in Uganda. Forest Vol. III.*
55 .Howard, P.C. 1991.
56. National Environment Action Plan (NEAP). 1992 *Biodiversity, Forestry, Wildlife and Tourism.* Report by Task Force No. 5
57. National Environment Action Plan (NEAP) 1992 *ibid*
58. Mackinon, *et al.*
59. WCMC 1991. *Animals of Uganda.* Conservation status Listing
60. WCMC 1991. *Animals of Uganda* Conservation status Listing.
61 UNDP/World Tourism Organization 1993
62. MUIENR/WRI 1992 *op. cit.*
63. MUIENR/WRI 1992 *op. cit*
64 Uganda Travel & Tourism 1992 July-sept Issue
65 NEAP (1992) *Water Resources and Biodiversity.* Task force No.4.
66. NEAP (1992) *ibid*
67 Uganda Atlas (1967)
68 Hughes, R.H. and J.S.Hughes 1992 *A Directory of African Wetlands.* IUCN, Gland, Switzerland and Cambridge U.K /UNEP, Nairobi, Kenya
69. Ministry of Energy, Minerals and Environment Protection (Ministry of Natural Resources). 1991. *National Report on Environment and Development.* Prepared for the UN Conference in Brazil.
70 Water Development Department (1992)
71. NEAP Secretariat (1992) *Water Resources and Biodiversity.* Task Force No.4.
72. NEAP Secretariat. *Water Resources and Biodiversity.* Task force No. 4. December 1992.
73. NEAP Secretariat (1992) *Water Resources and Biodiversity.*
74 Water Development Department (1993).
75. Water Development Department 1993. *Uganda Water Action Plan.*
76 EPA (United states Environment Protection Agency), 1989 *Risk Assessment, Management and Communication of drinking water contamination.* EPA/625/4 - 89/024.
77. NEAP Secretariat *Water resources and biodiversity.* Task Force No.4. December 1992
78. Ministry of Energy, Minerals and Environment Protection (Ministry of Natural Resources), 1991. *Op. cit.*
79. Water Development Department 1993 *ibid.*
80 Mott & McDonald (1992)
81. Ssali, W.M. *et.al* 1990 Finish Notes and Records, socio-economic Field Reports No. 17. Fish and Fuel, Food and Forests: *Perspectives on Post - Harvest Issues in Uganda*
82 Ministry of Planning and Economic Development (MPED) 1990 Background to the Budget 1990 - 1991
83 Ministry of Finance and Economic Planning (MFEP) 1993 Background to the Budget 1993-1994
84 FAO (United Nations Food and Agriculture Organization) 1990 Source book for the Inland Fishery Resources of Africa CIFA Technical paper 18.1
85 MPED 1990 *op. cit*
86 United Nations Environment Programme(UNEP) 1988 *Strategic Resources in Planning in Uganda.* Vol. VI: Fisheries 47p
87 MPED 1991 Background to the Budget 1991 1992
88 MPED 1991 *ibid*
89 Reynolds, J.E. and W.M.Ssali (1990) Socio-economic field report *op.cit.*

90. UNEP 1988.*op. cit.*
91. FAO (1990).
92. Reynolds, J.E and W.M.Ssali 1990.*ibid.*
93. Kudhongania, A.W.and E.J.Coenen 1991.*Trends in Fisheries Development, Prospects and limitations for lake victoria (Uganda).*
94. Graham 1929. *The Victoria Nyanza and its fisheries.* A Report on the fishery survey of Lake Victoria 1927-1928. crown Agents, London.
95. Mann(1969)
96. Kudhonganis, A.W.and E.J.Coenen. 1991. *ibid.*
97. Mann. 1970. *A Resume of the Evolution of the Tilapia Fisheries of Lake victoria up to the year 1960.* In: EAFFRO,Annual report, 1969, Jinja, Uganda. App. B: 21-27.
98. Tropical Development and Research Institute (TDRI). 1983. *Fisheries Rehabilitation study:* Uganda. London. 285p; and FISHIN project Field Observations 1989-90.
99. Crutchfield (1959); and Semakula (1967) . *Survey of the present status of fish handling preservation and marketing.* In occasional papers No.1 of 1967 . Fisheries Department. Ministry of Animal Industry, Game and Fisheries. Entebbe.
100. Dunn. 1989. *Fisheries Management Study in the Queen Elizabeth National Park.* Mission report for EEC project No. 4100.037. 42.44, Conservation of Natural Resources. Rome, AGRICONSULTING: 35P.
101. New Vision 1993
102. Kitakule, J.S *et.al* 1991. *Findings of the Fishing Community Surveys on Lake Victoria and Albert.* Uganda. 1991. Republic of Uganda/FAO/UNDP.
103. Twongo, *et.al. Management issues, options and strategies for lake Victoria fisheries.* No. 5 (FISHIN). (1991).
104. Greboval, D. 1990. *Principles of Fisheries Management and Legislation of Legislation of Relevance to the Great Lakes of East Africa.* Introduction and case studies. RAF/87/099 - TD/90, IFIP.41p.
105. Twongo *et. al.*(1991) *ibid. Management issues, options and strategies for lake Victoria fisheries.* No.5 (FISHIN).(1991).
106. Twongo *et. al.*(1991) *ibid.*
107. Twongo, *et.al.* 1991.*ibid.*
108. Makerere University Institute of Environment and Natural Resources (MUIENR)/The World Resources Institute (WRI). 1992.
109. Ministry of Planning and Economic Development (MPED). 1989. Background to the Budget 1989 - 1990.
110. MUIENR/WRI. 1992. *op. cit.*
111. MUIENR/WRI. 1992. *op. cit.*
112. MUIENR/WRI. 1992. *op. cit.*
113. Twongo *et.al Management issues, options, and strategies for Lake Victoria fisheries.* No.5 (FISHIN). (1991).
114. MUIENR/WRI. 1992. *ibid.*
115. Bugenyi. 1993. Personal Communications.
116. NEAP Secretariat, Task force No.4 Water Resources and Biodiversity. Nov, 1992.
117. NEAP Secretariat *op. cit.* pg.62.
118. Ministry of Environment Protection *ibid* pg.14.
119. S.S.S.E.A. 8th Agm Soil Science Society of East Africa.
120. Ministry of environment Protection (1991) *op. cit.*
121. World Resources Institute (1991), *op. cit.*
122. Ministry of Environment Protection (1991), *op. cit.*
123. Makerere University Institute of Environment and Natural resources (MUIENR)/The World Resources Institute (WRI), 1992.
124. Hughes & Hughes. 1992. *op. cit.*
125. Hughes & Hughes, *ibid.*
126. Dugan, P.J. 1991.
127. Dugan, P.J. 1991. *ibid.*
128. MUIENR/WRI. 1992.
129. Dugan, P.J, 1991.*op. cit.*
130. Ministry of Environment Protection. 1991. *op. cit.*
131. Ellenbroek,G.A. 1987. *Ecology and productivity of an African wetland System - the Kafue flats,* Zambia. Dr. W. Junk Publishers, Dordrecht. 267p.
132. NEAP Secretariat *Water Resources and Biodiversity.* Task force Bo.4 November 1992
133. UNEP. 1988. *Land Tenure Systems and Environmental Laws. Strategic Resources Planning in Uganda.* Vol. II.
134. UNEP. 1988. *ibid*
135. Tukahirwa, E.(ed). *Uganda Environmental and Natural Resources Management Policy and Laws. Issues and Options.* 89p.
136. Murene, P.
137. Ministry of Environment Protection. 1991. *op. cit.*

138. Lind, E.M. 1956.
139. World Bank (1984) World Report, 1984.
140. Green, Cynthia, P. (1992) "The Environment and Population Growth: Decade for Action: Population Reports M-10 (May): 10
141. World Bank (1992), World Development Report, 1992.
142. World Bank (1993) World Development Report, 1993.
143. MOH (1989) Demographic and Health Survey 1988/89 p.11.
144. World Bank (1992) Uganda Social Sector Strategy Vol 1 p.1
145. Ministry of Health (1988) Demographic and Health survey
146. MOH (1989) Demographic and Health Survey 1988/1989 p.11p
147. World Bank (1993) World Development Report 1993.
148. *ibid.*
149. World Bank (1993) Uganda Social Sector Strategy, Vol I. The Main Report p.12.
150. World Bank (1993) *op.cit.* p.18
151. Ministry of Planning and Economic Development (1989) *op. cit.* P.37.
152. Ministry of Planning and Economic Development [1989] Uganda: Population Factors in National Reconstruction and Development, p.39
153. Uganda [1990] Demographic and Health survey 1988/1989, Summary Report
154 *.ibid.*
155. MPED, The population Secretariat Strategies towards integration of population factors in development planning in Uganda. A paper presented at the National conference on Population Policy Consideration Uganda's Development 23-27 March, 1992, Mukono, Uganda.
156. *ibid.*
157. Ministry of Health (1989) Monitoring the Strategies for Health for all by the year 2000.
158. MPED (1989) *op. cit.*
159. Government of Uganda. The Population Census Results, 1969. The Analytical Report.
160 *.ibid.*
161 Kabera [1985] "The Demographic Patterns and Their Consequences". Report of the Seminar of Renewable Natural resources, Ecology and Conservation. Kampala, MPED GOU pp-110.
162. Uganda Government (1967) Atlas of Uganda Entebbe P.20-24
163. Uganda Government (1967) Atlas of Uganda, Lands and Surveys, Entebbe. Government Printer.
164. World Bank (1992) World Development report, 1992.
165. MPED (1992) Uganda National Program of Action for Children - Priorities for Social Services Sector Development in the 1990s and Implementation Plan 1992/93 p.56.
166. *Ibid.*
167. *Ibi.I*
168. *Ibid*
169. *Ibid*
170. *Ibid.*
171. World Bank [1992] World Development report 1992 The expression low income countries excludes China and India.
172. UNDP [1990] Human Development report 1990 p. 9 - 13
173. World Bank (1990) World Development report 1990, P.56
174. World Bank (1993) Uganda Agricultural Sector Memorandum
175. MFED (1993) HBS
176. Based on projections from two earlier surveys: The National Manpower Survey of 1988 and Census of Civil Service of 1987
177. World Bank staff computations based on data from Agricultural Secretariat, and from their report "Report on Export Crops and Producer Prices 1991 quoted in Country Study, 1993
178. Ministry of Planning and Economic Development (1988) National Manpower Survey
179. *Ibid.*
180. Republic of Uganda (1990) Report of the Public Service Review and reorganization Commission 1989-90 vol 1. Main report
181. *Ibid.*
182 National Manpower Survey 1988.
183. MPED (1980) *op cit.* p.244
184. MPED (1988) *op. cit.* p 244-5
185. DHS 1988/89 p 55
186 1991 Population and Housing Census.
187. MFEP (1992) Uganda National Program of Action for Children - Priorities for Social Services Sector Development in the 1990s and Implementation Plan 1992/93-1994/95 p.iv
188. MFEP (1992) *ibid.*
189. UNICEF (1988) Children and Women in Uganda A situational analysis p. 40

190. MOH (1993) Health Planning Unit p.18
191. MFED (1992) *op.cit.*
192. MOH (1993) Health Planning Unit
193. MFED [1992] Uganda National Programme of Action for Children - Priorities for Social Services Sector Development in the 1990s and Implementation Plan 1992/93-1994/5 p.19
194. UNICEF [1989] Children and Women in Uganda p.37
195. NEAP Topic Paper on "Population, Health and Human Settlement"
196. NEAP *op.cit.* p 18
197. World Development report, 1993
198. Andrew Tomkens and Fiona Watson "Malnutrition and Infection: A Review"
199. Ministry of Health
200. MOH: Health Planning Unit Feb. 1993.
201. Ministry of Health (1992) Uganda Health Bulletin. A Ministry of Health Journal. Vol 1 No. 1 July- Sept. 1991 p.16
202. *Ibid* p. 17
203. UNICEF (1989) *op. cit* p. 58.
204. WRI (1993) World Resources 1993 P 84
205. UNICEF *op. cit* p.52
206. p.ix
207. p.ix
208. MLHUD (1992) A National Shelter Strategy for Uganda Vol p. 10
209. *Ibid p 10*
210. MLHUD (1992) *op. cit.* Vol I p.iii
211. MLHUD [1992] Volume I *op. cit p.iii*
212. MLHUD, (1992) *op. cit* Vol II, P. 19-23
213. Ministry of Finance and Economic Development: Customs.
214. MLHUD (1992) *op. cit* Vol I p.42
215. MLHUD (1992) *op. cit.* Vol II p 26
216. MLHUD (1992) Vol I p 1-2
217. MLHUD (1992) *op.cit* Vol I P 3
218. MLHUD (1992) *op.cit* Vol I P 9
219. MLHUD (1992) *op.cit* Vol I, P 13
220. Background to the Budget, 1993/94
221. World Bank (1993) Uganda Transport Sector Memorandum
222. Uganda Civil Aviation Reconstruction Proposal (1990)
223. Civil Aviation Authority
224. Ministry of Finance and Economic Planning *Background to the Budget.* (1993)
225. UNDP/World Bank (1983)
226. FAO Consultancy Report (1984)
227. NEAP Secretariat *Topic Paper on Energy and Climate change.* Task Force No. 8 December 1992
228. CODA (Unpublished report) 1990
229. NEAP Secretariat *Topic Paper on Energy and Climate Change.* Task Force No.8 December 1992
230 Ministry of Agriculture, Animal Industry and Fisheries (1992)
231. NEAP Secretariat *Topic Paper on Energy and Climate Change*, Task Force No. 8 December 1992
232 UNDP/World Bank. *Uganda: Issues and Options in Energy Sector.* 1988
233. World Bank (1984) *op cit*
234 Abraham, L G (1987)
235 World Bank (1987)
236. UNDP/World Bank *Uganda: Issues and Options in Energy sector.* 1988
237. CODA. *Household Energy Planning Program Main Sectoral Report.* Volume II. December 1990.
238. UNDP/World Bank (1983)
239 UN Report of Mission to Uganda *Evaluation of small hydropower sites in Uganda.* 13 Nov-14 Dec. 1988.
240. Based on firm flow available for power of 630 m^3/s at Owen Falls
241. Uganda Forest Department, 1992
242. Forest Department: *National Biomass Study Phase I.* Technical Report. November 1989- December 1991.
243 *Ibid*
244 UNDP/World Bank *Uganda: Issues and Options in Energy Sector.* 1988
245 Ministry of Finance and Economic Planning, (1992)
246 World Bank (1992) World Development Report, 1992
247 WRI (1993) World Resources 1992-93
248 Republic of Uganda (1990) Report of the Public Service Review and Reorganisation Commission 1989 Vol 1, Main Report p. 290
249. Ministry of Justice

250. Budget Speech, 1993
251. World Bank (1985) Uganda Industrial Sector Memo 1985 Report No. 5633-UG
252. Information Unit
253. UIA (1992) Natural Resource Endowment in Uganda and Comparative Advantages
254. UNIDO (1992) Uganda, industrial Revitalisation and Reorientation
255. Ministry of Industry (1985) Industrial Sector Memorandum 1985
256. Ministry of Trade and Industry (1987) Evaluation of Scrap Availability and Demand, Design, financial Evaluation and Practical Alternatives for Establishing a Scrap Processing Facility in Uganda.
257. Quoted by NEAP Topic Paper No. 6 p. 27
258. Commonwealth Secretariat (1989) Uganda Rehabilitation and Development of Small Scale Industries p.
259. *Ibid* p.2
260. Kannan, T.S. & Hartland Peel, C.W. (1900) Small Enterprises Development
261. Ministry of Planning and Economic Development (1992) Review of Government Policy as it affects Small Scale Enterprises in Uganda
262. MFEP (1989) Manpower and Employment in Uganda Report of the National Manpower Survey 1989.
263. ILO.
264. UNIDO (1992) Uganda Industrial Revitalisation and Reorientation p 32 Most of the problems of SSI were also discussed in a workshop organised by Friedrich Ebert Foundation on "Strategy for the Development of Small Scale Industries in Uganda", 3-5 April, 1989
265. Ministry of Economic Planning & Development Background to the Budget, 1982-83
266. MPED (1993) Background to the Budget 1993/94
267. UIA (1993) Natural Resources Endowment and Comparative Advantage
268. Ministry of Economic Planning & Development: Background to the Budget, 1982-83
269. World Development Report, 1992 P. 132
270. Kamugisha, J.R. (1993) Management of Natural Resources and Environment in Uganda: Policy and Legislation Landmarks, 1980-1990
271. Tukahirwa, E.M. (ed) 1992 Uganda Environmental and Natural Resource Management Policy and Law: Issues and Options Vol II: Documentation
272. NEAP (1993) Review of Existing Legislation in the field of Environment and Draft Framework for Environmental legislation
273. NEAP (1992) Review of Existing Legislation in the Field of Environment and Draft Framework for Environmental legislation p. 12
274. *Ibid* p. 14
275. World Bank (1992) World Development Report, 1993
276. Bank of Uganda, Agricultural Secretariat (1993) Report of the Technical Committee on Land Tenure Law Reform, Draft Report
277. World Bank (1992) World Development Report, 1993 p. 130
278. Shilling J.D. (1992) Reflections on debt and the environment in finance and development Inn 1992, Vol 29 No.
279. Herrick and Green (1993)
280. United Nations conference on Environment and Development (1992)
281. United Nations Conference on Environment and Development (1992)
282. Adegbulugbe, A.O. (1992) A Framework for an effective environmental information management in Nigeria, pp: 135-149. *Environmental Consciousness for Nigeria National Development*. Abuja, Nigeria.
283. Adegbulugbe, A.O. (1992) *ibid*
284. United Nations Conference on Environment and Development (1992). Chapter 36 Environmental Education and Public Awareness. Agenda 21
285. Adegbulugbe, A.O (1992)
286. Ogaram, D (1993) Personal communications
287. Ogaram, D (1993) *ibid*.