



CLIMATE CHANGE

UGANDA NATIONAL ADAPTATION PROGRAMMES OF ACTION



2007





THE REPUBLIC OF UGANDA

CLIMATE CHANGE

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Foreword

The Second World Climate Conference, organized by the World Meteorological Organization and held in November 1990 in Geneva, Switzerland attracted a wide spectrum of participants, including, planners, policy makers and decision makers. This was the beginning of a lifetime relationship between climate and social scientists. The second World Climate Conference, in its Ministerial Declaration adopted on 7th November 1990, urged the Secretary General to institute a mechanism to protect the global climate system. The General Assembly responded by establishing the Inter-Governmental Negotiating Committee (INC) through its resolution 45/212 of 21st December 1990. INC negotiated and adopted the United Nations Framework Convention on Climate Change (UNFCCC) on 9th May 1992 at the United Nations Headquarters, New York, USA.

The Convention recognized the most disadvantaged and least able to respond to challenges of climate change. It urged developed country Parties to take into account the specific needs and special situations of least developed countries (LDCs) (Article 4.9 of the Convention). This group of countries contributed least to the build-up of greenhouse gases in the atmosphere and yet will suffer disproportionately. The operationalisation of paragraph 9 of Article 4 has led to the birth of the National Adaptation Programmes of Action (NAPAs). NAPAs provide a quick channel of communicating urgent and immediate adaptation needs of LDCs to the Conference of the Parties (COP) of UNFCCC. While the NAPAs are for LDCs, they provide an opportunity of learning by doing for the climate change process, which may be used by other developing countries.

The preparation of the Uganda NAPA was guided by the principle of participatory approach, drawing heavily on the views of the vulnerable communities and their knowledge on coping mechanisms. This approach raised the level of awareness and expectations of the rural poor vulnerable communities. Therefore effective implementation of NAPA will go a long way towards meeting the expectations of the rural poor and vulnerable communities. Meeting this expectation is a challenge not only to the LDCs, but the global community.

The Government of Uganda has endorsed the Ugandan NAPA and is committed to its implementation. The well being of its people is a primary responsibility as evidenced by the Poverty Eradication Action Plan (PEAP) and other supporting programmes, such as the Plan for Modernization of Agriculture, Universal Primary Education and Primary Health Care. However, adverse effects of climate change unless taken seriously will negate progress on poverty reduction programmes. There have been increased efforts to support poverty eradication programmes and also compliance with the Millennium Development Goals. Climate change is a serious risk to poverty reduction and threatens to frustrate poverty eradication and the Millennium Development Goal programmes and undo decades of development efforts through destruction of infrastructure, property and lives. Reconstruction of destroyed infrastructure will take time and considerable efforts and divert development resources to recovery programmes.

I am therefore privileged and honoured to submit to you, on behalf of the people and the government of Uganda, the National Adaptation Programmes of Action.



Hon. Jessica Eriyo
MINISTER OF STATE FOR ENVIRONMENT

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Project Managers:

Mr. Philip Gwage and Paul Isabirye

Chair Project Steering Committee:

Mrs Edith Kasajja

Chair NAPA Team:

Mr. S.A.K. Magezi

Reviewers and Editor

Ms Florence Luziraa,

Dr. Moyini Yakobo, Mr. Samuel Otuba and Mr. Mukotani Rugyendo

List of Acronyms/Abbreviations

BINP	Bwindi Impenetrable National Park
BP	Before present
Ca	About
CBO	Community-Based Organisation
CBD	Convention on Biological Diversity of the United Nations
CC	Climate Change
CCD	Convention to Combat Desertification of the United Nations
CCMSWA	Convention on the conservation of migratory species of wild animals
CDF	Comprehensive Development Framework. Another World Banks initiative comparable to the PRSP
CFC	Chlorofluorocarbons
CFRs	Central Forest Reserves
CO ₂	Carbondioxide
COP	Conference of the Parties to the UNFCCC
CSO	Civil Society Organisation
DA	District Administration.
DRC	Democratic Republic of Congo
FAO	Food and Agricultural Organisation of the United Nations
FGDs	Focus Group Discussions
FRs	Forest Reserves
GDP	Gross Domestic Product
GHGs	Green House Gases
GEF	Global Environment Facility
IK	Indigenous Knowledge
INC	Intergovernmental Negotiating Committee
IPCC	Inter-governmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
KM ²	Kilometres squared
LC	Local Council.
LDC	Least Developed Countries
LEG	LDC Expert Group
LFRs	Local Forest Reserves
LGs	Local Governments
LMNP	Lake Mburu National Park
LVEMP	Lake Victoria Environment Management Organisation
MDGs	Millennium Development Goals.
MUIENR	Makerere University Institute of Environment and Natural Resources.
MWLE	Ministry of Water, Lands and Environment
MEAs	Multilateral Environmental Agreements
MTTI	Ministry of Trade, Tourism and Industry
NAPA	National Adaptation Programmes of Action
NEMA	National Environment Management Authority
NFA	National Forestry Authority
NGO	Non-Governmental Organisation
NMT	Non-Motorised Transport
NR	Natural Resources
PAs	Protected Areas

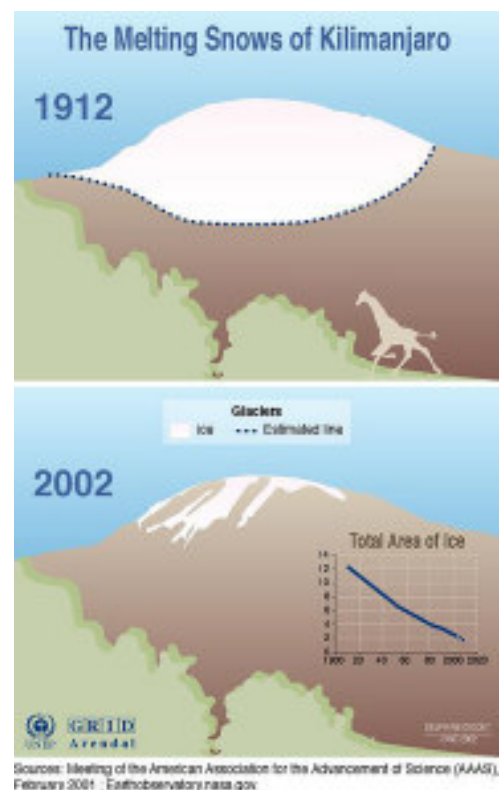
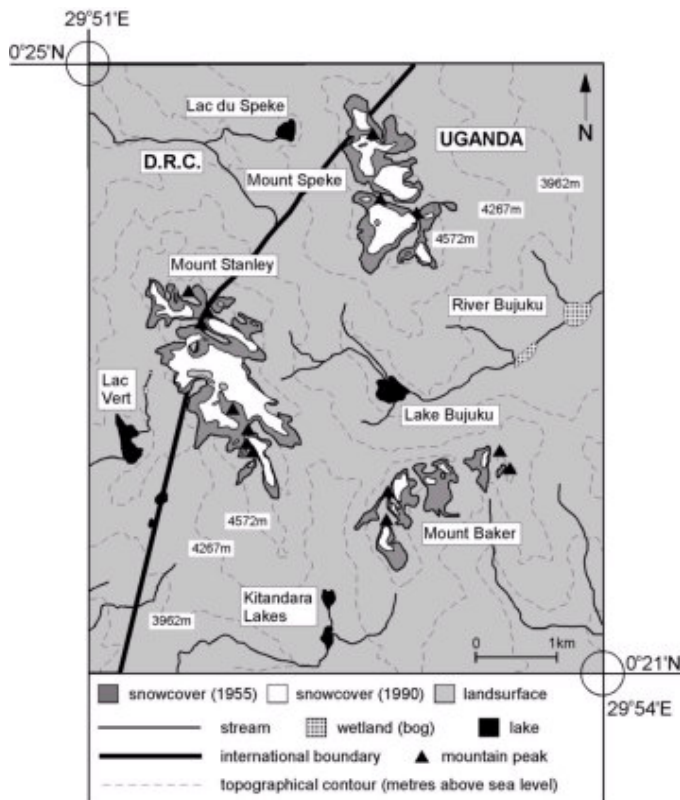
PEAP	Poverty Eradication Action Plan
PFE	Permanent Forest Estate
UPE	Universal Primary Education
PHC	Primary Health Care
PMA	Plan for Modernisation of Agriculture
PMU	Project Management Unit
PRA	Participatory Rural Appraisal
PRSP	Poverty Reduction Strategy Paper
PSC	Project Steering Committee
RMS	Rwenzori Mountaineering Service
TB	Tuberculosis
THF	Tropical High Forest
TORs	Terms of reference
TSWR	Toro-Semliki Wildlife Reserve
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNEP	United Nations Environment Programme
UNPs	Uganda National Parks.
UPE	Universal Primary Education
UWA	Uganda Wildlife Authority
WCP	World Climate Programme
WFP	World Food Programme
WHO	World Health Organization.
WMO	World Meteorological Organization

Executive Summary

Introduction

Global warming, the gradual increase in the average temperature on the earth, affects every sector of development. It is a frightening reality that every country has to come to terms with, as evidenced by the highly destructive hurricanes in the USA (2005), severe droughts in Niger (2005) and the devastating floods in Mozambique (2000). Indeed global warming may be the single most serious global problem of our time. The Intergovernmental Panel on Climate Change (IPCC) has pointed out that human activities are altering the climate system and that global mean temperatures are projected to increase in the range of 1.4 to 5.8 degrees centigrade during the period 1990 to 2100. Among the most prominent examples of the effects of global warming, is the gradual disappearance of the tropical ice caps as illustrated in the figure below. The previous permanence of the ice caps have been cherished sources of water for the communities living on the slopes of Mount Kilimanjaro and Rwenzori Mountains. The melting of ice caps has serious consequences on local social and economic development as well as local ecosystems and ecotourism.

Global warming has far-reaching consequences on social and economic development and the entire global ecosystems. Indeed global warming threatens to undo many years of development efforts and frustrate poverty eradication programmes in developing countries. Although all countries, rich and poor alike, are vulnerable to the adverse effects of climate change, the degree of damage varies from country to country. The poor countries with the least adaptive capacity are expected to suffer most from the impacts of adverse effects of climate change.



Melting of ice caps on mountains Rwenzori and Kilimanjaro

The least developed countries (LDCs) and small island developing states have been identified as the most vulnerable to the adverse effects of climate change. The United Nations Framework Convention on Climate Change recognizes the special and particular circumstances of LDCs and therefore adopted the decision on the National Adaptation Programmes of Action (NAPAs) at its seventh Conference of the Parties (COP7), held in Marrakech, Morocco. NAPAs are a quick channel of communicating urgent and immediate adaptation needs to COP. COP7 established an LDC fund to support the preparation of NAPAs and an LDC Expert Group. The Global Environmental Facility (GEF) was requested to support this process. Uganda is, therefore, responding to this decision by preparing its NAPA.

Extreme mass poverty experienced in developing countries is a global problem that requires a global solution. In the Millennium Declaration, 189 nations resolved to halve extreme poverty by the year 2015. Developing countries individually or jointly have committed themselves to eradicate poverty amongst their people. Despite national and international efforts, poverty has become more widespread in many developing countries in the last decade, making poverty reduction the core challenge today. However, environmental degradation, particularly global warming, is threatening to frustrate these efforts.

National Circumstances

Uganda lies across the equator and occupies 241,038 square kilometres, of which open water and swamps constitute 43,941 square kilometres. This represents 18.2% of the total area. Most parts are on average height of 1,200m above sea level. The lowest altitude is 620m (within the Albert Nile) and the highest altitude (Mt. Rwenzori Peak) is 5,110m above sea level. The climate is equatorial, with moderate humid and hot climatic conditions throughout the year. It has two rain seasons in a year, which merge into one long rainy season as you move northwards from the equator. The first rain season is from March to June, while the second season is from August to November.

Uganda's population was at 24.7 million people with a high average growth rate of 3.4% (2002 Census). The rate of population growth is highest in arid areas, averaging 9.7% in Kotido and 6% in Moroto and Nakapiripirit. Thus the highest growth rates are found in the most vulnerable ecosystems. The urbanization rate is lowest in Uganda compared to other African countries. Over 80% of Uganda's population is rural and depends on rain-fed agriculture, which is vulnerable to impacts of adverse effects of climate change.

The economy of Uganda has been growing at a rate of 5-7% over the past decade. Head count poverty declined from 56% in 1992 to 35% of people living below the poverty line in 2002. However, in 2004 it rose to 38% apparently due to increased frequency of climate variability and conflicts. While Uganda's climate offers a great potential for food production, the prolonged and frequent droughts in many parts of the country, particularly the northeast, have led to almost perpetual dependency on food aid. A typical example is in the arid areas of Karamoja where the World Food Programme (WFP) supplies virtually all the food.

The Vision of Uganda is "**Prosperous People, Harmonious Nation, Beautiful Country**". These six words capture the aspirations of its people. The Vision 2025 has guided and influenced the development of the Poverty Eradication Action Plan (PEAP) and its revisions, and other government programmes such as the Plan for Modernization of Agriculture (PMA), Universal Primary Education (UPE) and Primary Health Care (PHC). The PEAP is a comprehensive planning framework, which guides the development of sectoral policies and investment plans. PEAP

emphasizes participation of the poor in poverty eradication by facilitating them to increase their production, thereby increasing their wealth. However, in a rain-fed agricultural economy increased production by the poor can only be achieved if climate variability and climate change has been taken into account.

The agricultural sector presents great opportunity for poverty eradication because it employs over 80% of the population. It is for this reason that the PMA was developed as the engine to accelerate poverty eradication. The PMA is a holistic, strategic framework for the eradication of poverty through multi-sectoral interventions, enabling the people to improve their livelihoods in a sustainable manner.

National Resources

Natural resources constitute the primary source of livelihood for the majority of the Ugandan population. Indeed, the economy of Uganda depends on exploiting of its natural resources and will remain so for the foreseeable future. Management of these natural resources is therefore important and critical to Uganda's long-term development. "The main strength of Uganda in the environment sector is that it is richly endowed with the bounties of nature – good soils and biodiversity, ample vegetation cover, attractive climate and abundant water resources. In some areas, these gifts of nature still remain intact, thereby availing the opportunity to utilize them sustainably" (Vision 2025). Climate, perhaps Uganda's most valuable natural resource, is the most neglected. The climate of Uganda is not only a natural resource, but a key determinant of the status of other natural resources, such as water resources, forest, agriculture, ecotourism and wildlife. Uganda has diverse and rich biodiversity, which has provided both food and medicine. Unsustainable exploitation of these resources, often driven by external market forces, has resulted in serious biodiversity loss with some species being close to extinction. However, climate change which has started manifesting itself through increased frequency of extreme weather events, such as droughts, floods and landslides, is posing a serious threat to Uganda's natural resources, social and economic development.

Preparation of NAPA

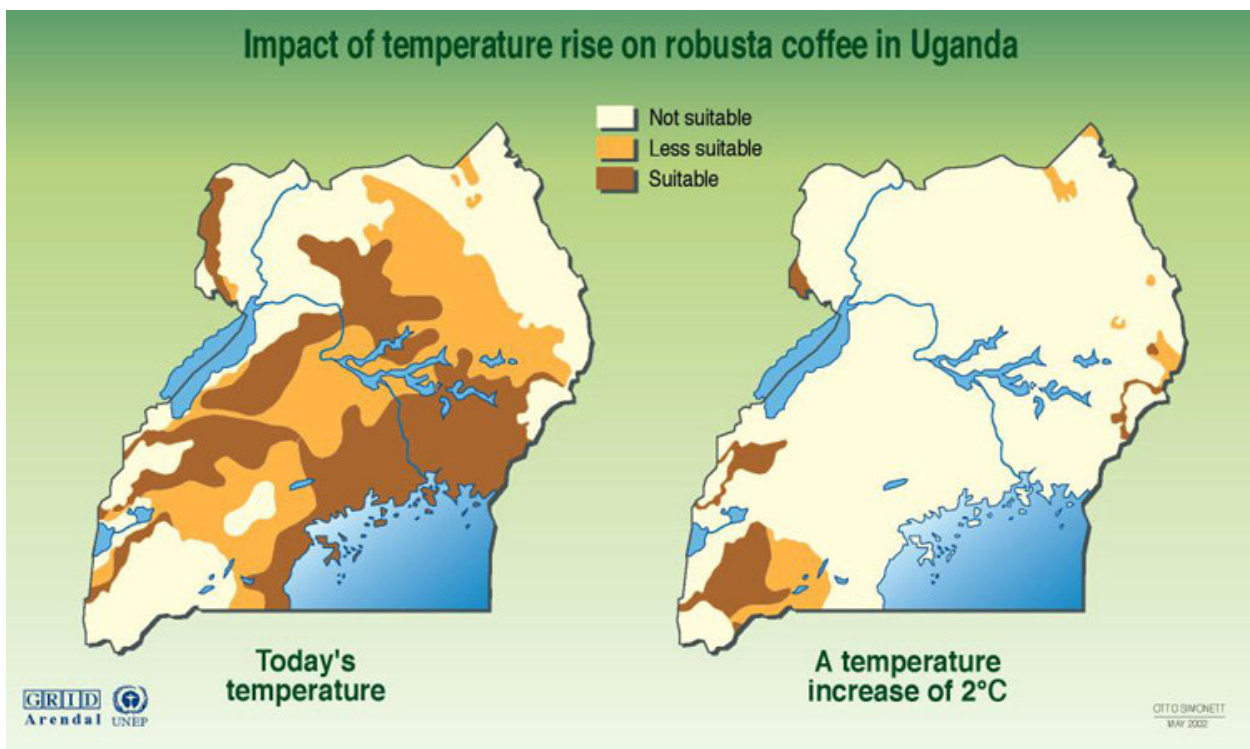
NAPA preparation was guided by two considerations: the need for Uganda to achieve the Millennium Development Goals (MDGs) and the country's development objectives as enshrined in PEAP (2004). Of particular concern were commitments addressing the eradication of extreme poverty and hunger, ensuring environmental sustainability and gender equity and combating major diseases.

The guidelines for preparation of NAPAs and its principles (NAPA) guided the preparation of the Ugandan NAPA. Several committees and teams representing a wide spectrum of stakeholders participated in the execution of the project activities to ensure widest participation. The participatory rural appraisal (PRA) approach was used to collect data/information from communities in selected districts. The selection of study areas, collection of data/information, analysis, interpretation and prioritisation of the adaptation activities were consultative. Although documents on climate variability and climate change-related disasters in Uganda and their impacts were limited, the literature review provided a strong and sound basis for planning of the field consultations. The technical experts screened the identified interventions using simple criteria. The final list of the prioritised interventions was checked for consistency of the criteria. The results showed consistent rating of interventions. For instance Forestry, agriculture and water resources were ranked high throughout all the three criteria.

Vulnerability

Climate change will increase the frequency and intensity of extreme weather events such as droughts, floods, landslides and heat waves. The events of the past few years clearly illustrated the magnitude of the problem. Although rigorous and detailed vulnerability and adaptation options were not done for Uganda, the literature review analysis of empirical information and observations by the communities during the participatory rural appraisal has given interesting results. In Uganda the frequency of droughts has increased, for example seven droughts were experienced between 1991 and 2000. This is confirmed by the results of the PRA, which rated droughts as the most frequent event. An increase in intensities and frequency of heavy rains, floods, landslides in the highland areas as well as outbreaks of associated waterborne diseases with the floods was also observed and confirmed by the PRA results.

Frequent droughts have resulted in lowering of the water table, leading to drying of boreholes. The cattle corridor, stretching from the northeast to the southwest is a fragile ecosystem, and depends on rainwater for human consumption and production. The prolonged and severe drought of 1999/2000 caused severe water shortage, leading to loss of animals, low production of milk, food insecurity, increased food prices and generally negative effects on the economy. Temperature rise has significant impacts on health as well as agriculture. The highlands, which were previously malaria-free, are now invaded by malaria. People in the highlands have not developed immunity for malaria and have therefore been susceptible to it. Equally, rise in temperature can lead to outbreaks of pests and emergence of new pests and diseases or to change of a crop growing area. For instance an increase of 2 degrees centigrade can have dramatic impact on coffee growing areas as depicted in the figure below. This may also apply to other crops. Climate change also impacts negatively on other key sectors and therefore on the social and economic development of Uganda.



Source: Otto Simonett, Potential impacts of global warming, GRID-Geneva, case studies on climatic change. Geneva, 1989.

Potential impacts of temperature rise on coffee growing

Coping Strategies

Climate variability and its impacts have led communities to develop coping strategies. However, frequency of events such as droughts, floods and storms was previously low and therefore coping mechanisms were not documented, developed nor popularized. Coping strategies have been passed from generation to generation through traditional and cultural practices. This practice is no longer practicable because of increased frequency and coverage areas. However, these strategies could be improved, for instance the water harvesting technology (see below) used by the communities in Masaka can be improved and up-scaled at very little effort and cost.



Construction of underground water reservoir

Traditional coping strategies to climate variability risks were discussed during the PRA with the communities. Communities were interviewed and the data/information was collected. Analysis of the data/information showed interesting intervention areas. The list below indicates the ranking of the identified **intervention areas** by the communities.

- 1) IK documentation and awareness creation;
- 2) Farm forestry;
- 3) Water resources;
- 4) Weather and climate information;
- 5) Policy, legislation and planning;
- 6) Land and soil management;
- 7) Disaster preparedness;
- 8) Alternative livelihoods;
- 9) Health; and
- 10) Infrastructure.

Communities used to know their local climate relatively well and indeed relied on this knowledge for planning of their farming activities. Knowledge of local climate was augmented by indigenous knowledge such as appearances of specific bird species, sprouting of particular plants and flowers.

The communities use expert knowledge to deduce good and poor seasons and therefore adequate preparations to cope with climate variability and its adverse effects. However, increased climate variability has rendered this mechanism less effective and hence the demand for weather and climate information. This is evidenced by the communities' observation, "poor state of the climate observing stations and importance of weather and climate information". The areas 1), 2) and 4) could be merged to constitute an early warning system (climate and agricultural early warning system).

These intervention areas formed the basis for the analysis. An analysis of the intervention areas identified by the communities, integration of national development and MDG goals and prioritising these areas gave rise to the prioritised and ranked interventions in the Table below.

Prioritized interventions areas

Intervention area	Rank
Land and land use	1
Farm forestry	2
Water resources	3
Health	4
Weather and climate information	5
IK documentation and awareness creation	6
Policy and legislation	7
Infrastructure	8

Implementation Arrangements

Projects will be implemented by local institutions (local governments, NGOs and CBOs) and supervised by line institutions. The Ministry of Water, Lands and Environment, the focal institution for the UNFCCC and the Kyoto Protocol, will coordinate the implementation of the NAPA projects with line institutions. The National Climate Change Steering Committee Secretariat, under the guidance of National Climate Change Steering Committee will assist the Ministry in the coordination of the implementation of the NAPA. The National Climate Change Steering Committee is a multi-sectoral and multi-disciplinary Committee established to advise the Minister of Water, Lands and Environment on Clean Development Mechanism (CDM) projects and climate change policy issues. The National Climate Change Steering Committee Secretariat will also liaise with the UNFCCC Secretariat and report to the Conference of the Parties on the implementation of the NAPA.

Project profiles

Project profiles have been developed based on the prioritized and ranked intervention strategies. The project profiles are not area specific. The selection of project area will be based on findings of the PRA. For instance priority should be given to:

- (a) community tree growing in the highland areas, which are prone to landslides, and
- (b) adaptation to drought in the semi-arid areas.

Notwithstanding the urgent need to implement the Ugandan NAPA, there are several barriers which hinder effective implementation of the identified and prioritised interventions. Special attention needs to be given to these barriers in the design of the NAPA projects. These barriers include:

- Inadequate understanding of climate change and its impacts, thus creating a barrier to resource allocation;
- Inadequate technical capacity;
- Inadequate financial resources; and
- Weak institutional and coordinating mechanisms.

Funding of NAPA

The preparation of NAPAs has not only raised awareness but also hope and expectations. Successful and immediate implementation of the first set of NAPA projects will serve to demonstrate the need to integrate climate change issues into the development planning process at both central and local government levels. This will reduce the cost of adaptation, particularly for long term measures. The endorsement of the NAPA demonstrates the commitment of the Government of Uganda to combat adverse effects of climate change.

1.1 Genesis of NAPA

The least developed countries (LDCs) and small island developing states have been identified as the most vulnerable to the adverse effects of climate change. This concern was addressed during the Seventh Conference of the Parties (COP7), held in Marrakech, Morocco, by adopting the National Adaptation Programmes of Action (NAPAs). NAPAs are quick channels of communicating urgent and immediate adaptation needs to COP. COP7 adopted a decision to establish an LDC fund to support the preparation and implementation of NAPAs. An LDC Expert Group was also established to assist the LDCs to prepare their NAPAs. COP requested the Global Environmental Facility (GEF) to support the process. Uganda is, therefore, responding to this decision.

Climate, perhaps Uganda's most valuable natural resource, is at the same time the most neglected. The climate of Uganda is not merely a natural resource, but a key determinant of the status of other natural resources, which should be harnessed and effectively utilized for socio-economic development. Climate change greatly contributes to conflicts in Uganda. For example, the frequent scarcity of pasture and water resulting from droughts is a major cause of intra- and inter-district as well as inter-regional conflicts. However, the emerging phenomenon of climate change (CC) is inadequately understood in Uganda as evidenced by the lack of a policy framework. Climate change is mainly understood by the Ministry of Water, Lands and Environment (MWLE). There is a need to raise the level of awareness and build the capacity of various sectors to mainstream CC in development plans.

The NAPA preparation process was guided by two considerations: the need for Uganda to achieve the Millennium Development Goals (MDGs) and the country's development objectives as enshrined in the Poverty Eradication Action Plan (PEAP, 2004). Of particular concern were commitments addressing the eradication of extreme poverty and hunger, ensuring environmental sustainability, gender equity and combating major diseases.

This document presents background information about Uganda, the process of NAPA preparation, the findings and project profiles to enhance adaptive capacity of vulnerable communities.

1.2 Multilateral Agreements

The spirit of multilateralism, enshrined in the United Nations Charter, has guided and influenced international actions on development as well as environmental protection. The charter has been the foundation of many multilateral agreements such as the United Nations Framework Convention on Climate Change (UNFCCC), Convention on Biological Diversity (CBD), Convention to Combat Desertification (CCD) and actions on development, e.g. Agenda 21 and the Millennium Development Goals. While extreme mass poverty is experienced in developing countries, it is a global problem that requires a global solution. In the Millennium Declaration, 189 nations have resolved to halve extreme poverty by 2015. Developing countries individually or jointly have committed themselves to eradicate poverty amongst their people. Despite national and international efforts, poverty has become more widespread in many developing countries in the last decade, making its reduction the core challenge today. However, environmental degradation, particularly global warming, is threatening to frustrate these efforts. Indeed global warming is said to be the most serious global problem today.

Global warming, a frightening reality has far-reaching consequences on social and economic development and the entire global ecosystems. Climate change is expected to have serious impacts on existing and potential development activities by affecting the bio-productive system on which most economic investments in Africa are based. The impacts of increased temperature and decreased rainfall will cause shifts in vegetation zones, impacting on ecosystems. These impacts will be transmitted to various sectors of the world economy, particularly developing country economies, which are dependent on agriculture, tourism, energy and agro-industries. Feeding the rapidly growing global population will remain a serious problem, particularly in developing countries. Actions to increase food production in developing countries will lead to more clearing of land for agriculture. This will result in further land degradation and increased greenhouse gas emissions, which will exacerbate global warming.

1.3 National Circumstances

Uganda occupies 241,038 square kilometres, of which 43,941 square kilometers, representing 18.2% is open water and swamps. Most parts of Uganda lie at an average height of 1,200m above sea level. The minimum altitude is 620m (within the Albert Nile) and the maximum altitude (Mt. Rwenzori Peak) is 5,110m above sea level.

Uganda's population was 24.7 million people with a high average growth rate of 3.4% (2002 Census). Population growth is highest in arid areas, averaging 9.7% in Kotido and 6% in Moroto and Nakapiripirit. Thus most climate change vulnerable communities have the highest growing rates. More than 50% of the population is less than 18 years. The implication of this population structure is that sooner or later, the demand on natural resources is going to increase significantly, leading to NR degradation. Besides, over 80% of Uganda's population is rural, depending on rain-fed agriculture, which is prone to impacts of climate variability and change. The urbanization rate is lowest in Uganda compared to other African countries. Therefore the impact of climate change is likely to be felt more in Uganda than other African countries. Although the population of 24.7 million may appear low, some areas, particularly the highlands, are densely populated, thus creating a lot of pressure on land resources. This has led to land and environmental degradation.

The economy of Uganda has been growing at a rate of 5-7% over the past decade. Liberalization of the market coupled with good macro-economic policies and measures accounted for the high growth rate of the economy. Industry and the service sector have grown at a fast rate of 10.5% and 7.5% respectively (Table 1.1). Head count poverty fell from 56% in 1992 to 35% of people living below the poverty line in 2002. However, in 2004 it increased to 38% apparently due to climate variability and conflicts. If this trend continues, Uganda may not meet its MDG targets.

Table 1.1: Growth rates of selected sectors (Adopted from PEAP 2004)

Sector	Growth Rate in %	Employment in %	Comments
Industry	10.5	8	Impressive growth rate
Service	7.5	23	Impressive growth rate
Agriculture	3.8	69	Slow growth rate but remains an important source of employment

Uganda's climate offers a great potential for food production, but the prolonged and frequent droughts in many parts of the country have led to almost perpetual dependency on food aid. A typical example is in the arid areas of Karamoja where the World Food Programme (WFP) supplies virtually all the food.

Climate change may affect men, women and the youth differently. Women have a key role of looking after the households. They spend long hours during drought in search of water and firewood depriving them of productive hours for other productive economic activities. During floods, water and sanitation-related diseases are more prevalent. The women spend more time attending to sick family members. This predisposes women to increased health risks and reduced income generation.

The Vision of Uganda is “**Prosperous People, Harmonious Nation, Beautiful Country**”. These six words capture the aspirations of its people. The expansion of the Vision 2025 is given in the Table 1.2. Vision 2025 has guided and influenced the development of the Poverty Eradication Action Plan (PEAP) and its revisions, and other government programmes such as the Plan for Modernization of Agriculture (PMA), Universal Primary Education (UPE) and Primary Health Care (PHC).

The PEAP is a comprehensive planning framework, which guides the development of sectoral policies and investment plans. Poverty eradication will depend on economic growth; and although redistribution of wealth would reduce poverty, it would not by any means eliminate it. The poor must be involved in poverty eradication programme by supporting them to increase their production and wealth. The agricultural sector presents great opportunity for poverty eradication because it employs over 80% of the population. It is for this reason that the PMA was developed as the engine to accelerate poverty eradication. The PMA is a holistic, strategic framework for the eradication of poverty through multi-sectoral interventions, enabling the people to improve their livelihoods in a sustainable manner. The PMA also takes into account other factors such as human resources and infrastructure that may increase production.

Table 1.2: Components of Uganda’s Vision 2025

Component of Vision	Aspirations of the Component
Prosperous People	<ul style="list-style-type: none"> ▪ Technologically advanced, competitive, self-sustaining and growing economy; ▪ A healthy, well educated society with high quality of life; and ▪ Regional integration and international co-operation, with Uganda as a regional hub.
Harmonious Nation	<ul style="list-style-type: none"> ▪ Harmonious coexistence within a dynamic society where citizenry is responsible, accountable, hardworking and peaceful; ▪ Effective, participatory and democratic governance; and ▪ Equal opportunities, empowerment and poverty eradication among people.
Beautiful Country	<ul style="list-style-type: none"> ▪ Focuses on the management of the environment emphasizing sustainable use of natural resources to conserve Uganda’s beauty.

1.4 Natural Resources

Natural resources constitute the primary source of livelihood for the majority of the Ugandans. Indeed, the economy of Uganda depends on exploiting of its natural resources and will remain so for the foreseeable future. Management of these natural resources is therefore important and critical to Uganda’s long-term development. “The main strength of Uganda in the environment sector is that it is richly endowed with the bounties of nature – good soils and biodiversity, ample vegetation cover, attractive climate and abundant water resources. In some areas, these gifts of nature still remain intact, thereby availing the opportunity to utilize them sustainably” (Vision 2025). Uganda has a good climate, which has supported other natural resources such as biodiversity, water resources, fish, forests and ecotourism. Uganda has a diverse and rich biodiversity, which has provided both food and medicine. Unsustainable exploitation of these resources, frequently driven by external market forces, has resulted in serious biodiversity loss with some species being

close to extinction. However, climate change which has started manifesting itself through increased frequency of extreme weather events such as droughts, floods and landslides, is posing a serious threat to Uganda's natural resources, social and economic development.

1.4.1 Climate

Uganda experiences equatorial climate with moderate temperatures and humid conditions throughout the year. Its location across the Equator gives it two rain seasons in a year, which merge into one long rainy season as you move northwards from the Equator. The first rainy season ranges from March to June, while the second one ranges from August to November. The rainfall level ranges from 400 to 2200 mm per year. Uganda's climate can be broadly subdivided into:

- i. Highland climate;
- ii. Savannah tropical climate, including the lake basin climate; and
- iii. Semi-arid climate.

i) Highland climate

The Highland climate has cool temperatures and moderate rainfall (mean annual rainfall of over 900mm). For instance, temperatures in Kabale can be as low as 4 degrees Centigrade. In the Rwenzori Mountains, which have a permanent ice cap, temperatures of below 0 degrees Centigrade are experienced. The beauty of this climate is reflected in its natural resources as illustrated by Fig. 1.1.

Fig. 1.1

*Sipi Falls in
Kapchorwa*



ii) Savannah tropical climate

The Savannah tropical climate, including the lake basin has moderate average temperatures of 28 degrees Centigrade and high mean annual rainfall of over 1200mm. The tropical rainforest is found in this climate. Swamps, found mostly in this climatic zone, provide an excellent habitat for birds; the most notable being the Crested Crane (Fig. 1.2), the national bird of Uganda (which graces the Court-of-Arms). Reclaiming of wetlands has resulted in decimation of many aquatic animals and migration of the Crested Crane.

Fig. 1.2

Wetlands in Pallisa (habitat for Crested Cranes)



iii) Semi-arid climate

The semi-arid climate has relatively high average temperatures, ranging from 26.3 to 29.0 degrees Centigrade in Mbarara and Moroto respectively. However, extreme temperatures of 33.3 and 35.6 degrees Centigrade have been recorded in these areas. The mean annual rainfall is relatively low, ranging from 887 mm in Moroto to 905mm in Mbarara. Animal rearing is the dominant activity in this climate. The high animal population has led to serious land degradation. Although the mean annual rainfall is relatively low, some drought-tolerant land races can still grow.

The subdivision of the Ugandan climate is reflected in the distribution of natural resources such as water, forest and vegetation. The Cattle Corridor (shaded brown in Fig.1.3), which lies in the semi-arid climate, is predominantly a pastoralist area although the rainfall is sufficient to support the growing of food for consumption in the area and neighbouring regions.

Fig. 1.3

The Cattle Corridor

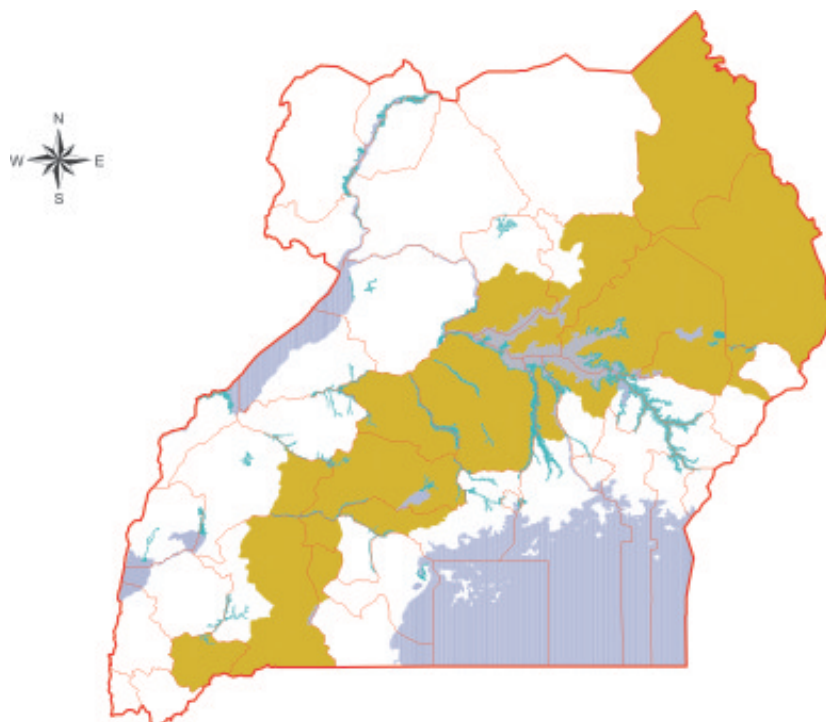
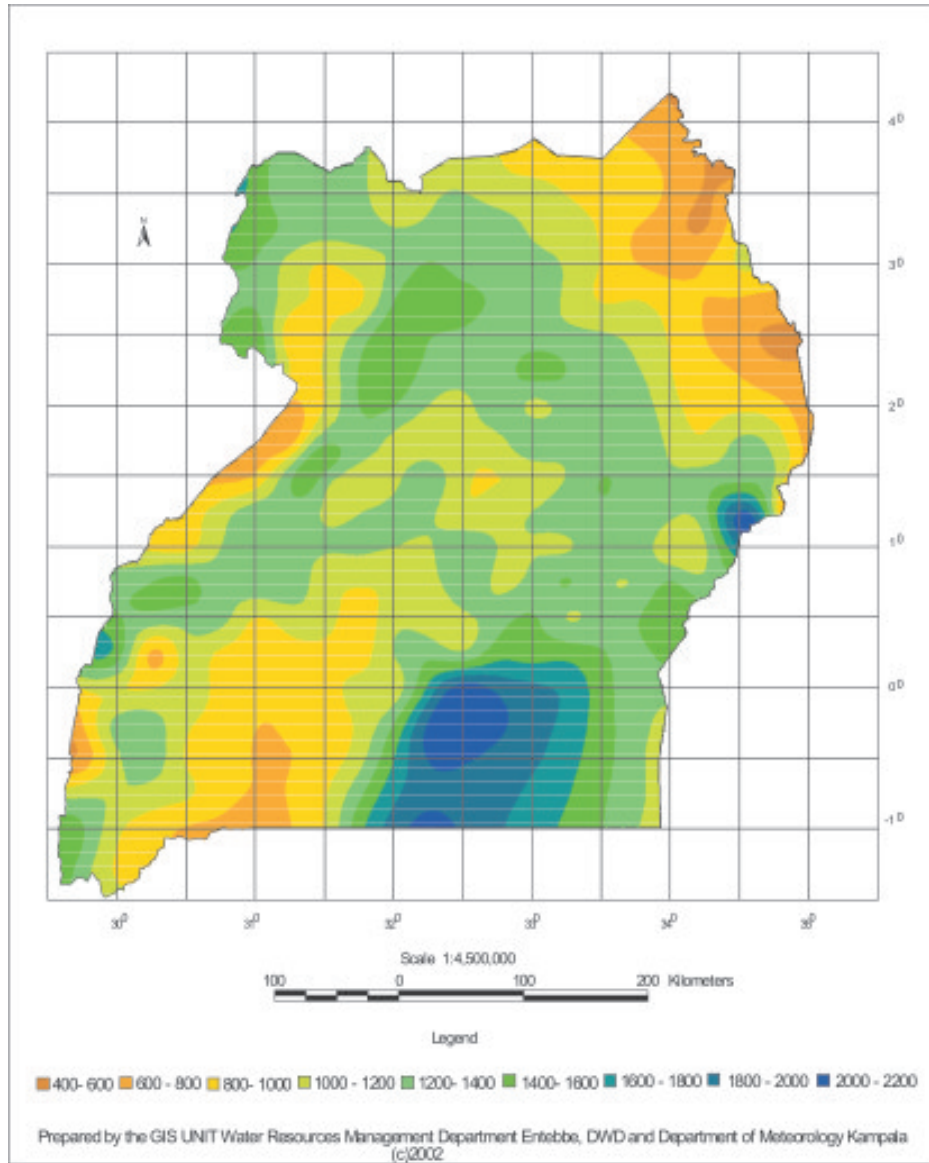


Fig. 1.4*Mean annual rainfall**Source: Department of Meteorology***a) Rainfall**

In Uganda, rainfall is the most sensitive climate variable that affects social and economic activities. Fig. 1.4 shows the mean annual rainfall distribution in Uganda. The wettest districts are located within the Lake Victoria Basin, eastern and the northwestern parts of Uganda. These areas include Kalangala, Kampala, Mpigi, Mukono, Jinja, part of Masaka and Bugiri (Lake Basin), Mbale and Kapchorwa (eastern) and Arua (northwestern). It has also been observed that falls are heavier and more violent. This is consistent with the Intergovernmental Panel on Climate Change (IPCCC) prediction that wetter areas will become wetter. The western, northern and northeastern districts are experiencing long droughts, which are becoming more frequent. The eastern region including Pallisa, Kumi, Soroti, Tororo, Busia and Bugiri receive moderate rainfall. The average long-term annual rainfall for Uganda is about 1318 mm, which is adequate to support agricultural activities. However, recent years have witnessed erratic onset and cessation of rainfall seasons. This coupled with increasing frequency of droughts has made Uganda more vulnerable to climate change.

b) Temperature

Uganda experiences moderate temperatures throughout the year. The mean daily temperature is 28°C. Extreme temperatures as low as 4°C are experienced in Kabale, which is located in the western highlands. However, temperatures below 0°C are experienced on the mountain ranges of

Rwenzori and Mount Elgon. Rwenzori has a permanent ice cap, which is vulnerable to global warming. Highest temperatures (over 30°C) are experienced in Gulu, Kitgum and Moroto in the north and North Eastern part of the country.

1.4.2 Forests

Forest products (timber, poles, rattan, bamboo, food, fodder, medicine, and firewood etc) and services (biodiversity habitat, moderating of micro climate, shade and wind breaks for enhancing agricultural productivity) play a very important role in the social and economic development of Uganda. Conservative estimates of the contribution of forestry to the nation's GDP is 6.1%, made up of a formal sector contribution of 1.9%, an informal sector contribution of 2.75% and non-marketable outputs amounting to 1.45%. Forests are especially pivotal to the rural communities' livelihoods. For example, over 99% of Uganda's rural people use wood or charcoal as fuel. In economic terms, the work by subsistence users of firewood and charcoal is equivalent to about 725,000 jobs. Similarly, commercial users of forest products provide work equivalent to 120,000 jobs. Moyini's (2005) in-depth valuation of the contribution of forest goods and services to GDP has strengthened the standing of forests in the economy of Uganda.

Forests play an important role in moderating climate, particularly microclimate, for example, the Congo tropical forest influences the climate of Uganda, particularly in western and northwestern Uganda. As mentioned above, these forests also have the greatest tropical biodiversity. Their protection therefore should be of great concern to all countries in this region. In addition, Uganda has also a large network of highly degraded and/or deforested (Table 3.3) Forest Reserves (FRs) that include central and local FRs managed by the National Forestry Authority (NFA) and Local Governments (LGs), respectively. A significant proportion (70%) of Uganda's forests are privately owned and a source of employment.

Today, deforestation is the main environmental issue confronting Uganda's forests, Savannah woodlands and bush land. Deforestation is caused by a number of factors, including population increase and poor agricultural practices. The colonial administration viewed forest resources as sources of revenue and building materials; and the exploitation of the Bunyoro forests by various government departments began in 1910. Mahogany trees were felled, timber pit-sawn and with no replanting. Again this destroyed the mechanisms of protecting forests, previously instituted by the indigenous people through cultural practices. Despite efforts by post-independence governments to protect forest resources, the strong chain, which ensured sustainable use of forest resources, was broken. Deforestation is a special form of land degradation that occurs in forest ecosystems from where communities derive goods for livelihoods (food, fodder, building materials and fuel) and environmental services that enhance their agricultural production. Here the reasons that lead to land degradation are different. First, the unsustainable exploitation of forest products and encroachment on gazetted forest reserves for expanding agriculture or settlement, are at the forefront. Of the two, encroachment poses the greatest threat to forests.

Statistics about deforestation vary greatly because degradation and deforestation are invariably pinned on guesswork. Available information suggests that at the start of the 20th century, both forests and woodlands covered over 50% of the land and now the coverage is about 24%. The current deforestation onslaught on the reserved forest estates is presented in Table 1.3. Local forest reserves are under high pressure. For example 33.1% of the local forests have been completely (100%) deforested compared to 6.0% in central forest reserves and 16.8% of the central forest reserves are intact compared to only 1.2% in local forest reserves. This high rate of deforestation and forest degradation suggests that if nothing is done, Uganda may lose her natural forests by the end of this century. This will be very expensive because the consequences of deforestation are many; and include: desertification, loss of biodiversity, erosion of gene pools,

increase vulnerability of local communities to climate extremes, and reduction of livelihood assets for rural communities.

Table 1.3: Deforestation in central forest reserves (CFR) and local forest reserves (LFR)

State of Deforestation (%)	% in CFR	% in LFR
100	6.0	33.1
>50	11.0	22.0
>20	15.0	13.6
<10	47.8	1.1
0	16.8	1.2

Dry conditions and prolonged droughts frequently lead to outbreaks of fire that degrade forests resulting to serious environmental consequences. Similarly, increased electricity tariffs leads to increased demand for firewood and charcoal, which in turn leads to increased deforestation, soil erosion, damage to vital watersheds, flooding and silting of rivers and lakes.

Notwithstanding the unrepresentative statistics of the contribution of forests to the development of Uganda, the impacts of climate change and climate change-induced activities will directly and indirectly reduce the contribution of the sector to Uganda's development. Reduction in forest products such as timber, poles and fuel (direct) and services such as habitat, agricultural productivity and watershed protection, will lead to reduction of the contribution of forests to the development of Uganda.

Although some measures are being taken to evict encroachers, they are unlikely to achieve their full objective because of the political and social sensitivity of the issues and weak policies and institutions, including weak enforcement agencies. Examples of encroached areas include:

- The encroachment of Maramagambo Forest reserve by illegal settlements in the Kiyanga and Kikarara areas. In 1995, 500 families settled on 94 sq. km of the reserve;
- By 1990, in Mabira Forest, approximately 10,000 hectares had been slashed and burnt;
- Busoga Forest reserve lost 6,000 ha; and
- In 1990, about 3,100 ha of the then Mt Elgon Forest Reserve was converted into farmland.

1.4.3 Wildlife

Uganda, with a convergence of seven major biogeographic regions, is extremely rich in biodiversity, having over 1,000 bird species (over 11% of the world total). There are at least 345 known mammal species, 165 reptile species, 43 amphibian species, 49 fish species and 4900 known species of higher plants. Uganda's Wildlife Protected Areas include 10 National Parks, 13 Wildlife Reserves, 13 Wildlife Sanctuaries and 5 Community Wildlife Areas. These areas occupy over 25,000 sq. km. Uganda is known among other things, for being home to rare and endangered species such as the Mountain Gorilla, half of the global population being found in Uganda's Bwindi Impenetrable and Mgahinga Gorilla National Parks. Uganda Wildlife Authority (UWA) is in charge of managing the country's network of Wildlife Protected Areas (WPAs).

As with forests, the colonial administration viewed wildlife as an opportunity to generate revenue, which led to the commercialization of wildlife hunting. Initially, the European hunters sought authority from the African chiefs to hunt in their areas. However, this authorization was abused by over-exploitation of the wildlife and trade in its products. The first half of the 20th century saw increased trade in wildlife, which became a major source of revenue to the colonial administration.

Between 1920 and 1924, the protectorate administration earned UK Pounds 98,048 from the sale of ivory, rhino horn and hippo teeth. Poaching and illegal wildlife trade was prevalent after animal sanctuaries, game reserves and national parks were introduced. This action by the colonialists destroyed the sustainable mechanism constituted by the indigenous people.

Post-independence governments have tried to protect wildlife, which has proved very difficult because of a weak institutional framework. The decimation of wildlife through poaching has been widespread. Uganda, which used to boast of having between 40,000 and 60,000 elephants in the late 1960s, saw its elephant populations reduced to less than 1,000 at the beginning of the 1980s. At Kidepo National Park, poachers reduced the numbers of giraffe to only 3 from an estimated 400 in 1971 and 160 in 1981. However, national and international efforts to stop trade in endangered species are yielding some results.

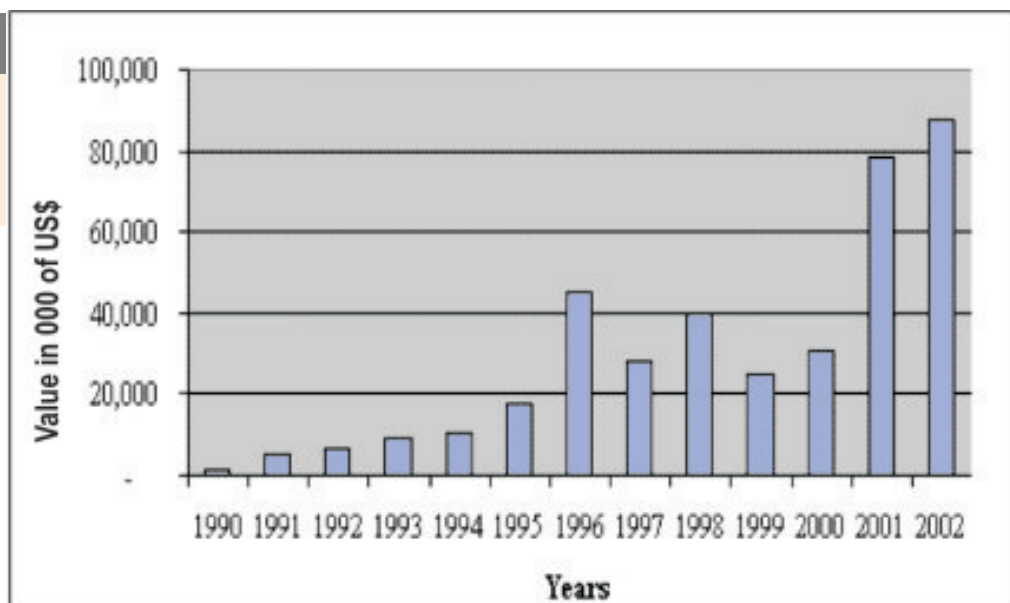
1.4.4 Water resources

Uganda has abundant water resources although its distribution is not even, particularly in the semi-arid areas of the country. Up to 15% of Uganda's total area is covered with water, 80% of which is accounted for by Lake Victoria. In addition, Uganda has a mean annual rainfall ranging from 700mm in the drier areas to about 1500mm in the humid areas. The rainfall in good years offsets the water distribution problems particularly during the rainy season. A large proportion of the population depends on streams, which tend to dry up during droughts causing serious water stress for a large proportion of the rural communities. The scarcity of water in such areas has resulted in movements into neighbouring districts in search for pasture and water. These movements have frequently led to ethnic conflicts and disruption of production, affecting the development of these communities. The water scarcity in the dry land areas is likely to worsen with climate change.

The abundant water resources, including swamps, cover a total area of 43,942 sq. km. This represents 18% of Uganda's total surface area and provides an excellent habitat for fish. Fishery is a key sector in the Ugandan economy, as well as source of food for the population. It contributes to food security, increased household income and economic growth. It is estimated that over 200,000 people, most of who are poor men and women are directly involved in the fishing industry. This number does not include people engaged in the added value of the industry such as transport, trading and processing.

Fig. 1.5

*Uganda Fish export
1990 - 2002*



The fish trade grew from a humble US \$1.4m in 1990 to US \$87m in 2002 as illustrated in Fig. 1.5. It is now estimated that the sector contributes 2.4% to total GDP (Background to the Budget 2003). It has also been argued that this figure may be as high as 5.8%.

The increased population, coupled with migration to urban centres, is putting additional stress on already overstretched physical resources and facilities such as water, land and waste disposal infrastructure. Poor urban physical planning and limited financial resources have led to the growth of slums. There is an increase in settlements, particularly by the urban poor, in marginal land areas. Waste disposal infrastructure is almost non-existent in these settlements. Heavy rains coupled with poor land use planning lead to flash floods, resulting in pollution of water sources with serious consequences for human health. Indeed, communities living in such areas are vulnerable to outbreaks of waterborne diseases. Climate change will exacerbate their vulnerability.

1.4.5 Agriculture

Agriculture is the backbone of Uganda's economy. It constitutes about 42% of GDP, over 90% of export earnings and employs over 80% of the labour force. The contribution of agriculture to total GDP has decreased from 45.7 percent in 1995/96 to 41.5 percent in 1999/00. The decline in agricultural contribution to GDP is not a sign of a diversified economy, but due to the impact of factors that influence agricultural production.

The major factors that influence agricultural production include soils, climate, agricultural implements, management practices and access to markets (both domestic and international). The decline in agricultural production in 1999/2000 is partly explained by the 1999/2000 drought. Non-traditional crops such as maize, sesame and soya beans have gained value in the last ten years, which has enabled farmers to make a choice of what type of crop to grow depending on demand, thus improving their incomes. Agricultural performance fluctuates with climate variability and climate change, and is also adversely affected by rudimentary means of production, poor markets and storage facilities.

In Uganda land degradation is predominantly caused by agriculture, which is the main economic activity of rural communities. Subsistence agriculture mines the soil nutrients and causes soil erosion, thus making the land unproductive in the long run. High human populations tend to degrade highland ecosystems, while animals degrade marginal lands such as the cattle corridor, semi-arid ecosystem, which stretches from Rakai in southern Uganda to Karamoja in the northeast.

The rapid human population growth has led to increased demand for food, energy and other social services. This has led to the expansion of land under agriculture (shifting cultivation) resulting in loss of vegetation. No deliberate efforts have been made by the people to increase production through better agricultural practices. The backlash is degraded soils, quest to clear more bush and to encroach on forest reserves. The expansion of agriculture on previously forested steep terrains has led to soil erosion, which has resulted in the silting of rivers and lakes and the loss of water catchment areas. This mode of land degradation has seriously affected many areas in Mbale, Kapchorwa, Kisoro and Kabale. Soil erosion accounts for over 80% of the annual cost of environmental degradation, representing 4-10% of GNP and estimated at about US\$ 625 million per annum. Landslides, wildfires, armed conflicts and land fragmentation also cause land degradation. Hence land degradation leads to low production of food and livestock, desertification, migration of rural folk to towns to look for employment, loss of biodiversity and erosion of gene pools in agro ecosystem.

The agricultural sector also contributes to pollution through improper disposal of agricultural waste. Huge amounts of fresh, unprocessed foodstuffs (banana, cassava, potatoes, beans and fruits) are transported daily into towns and urban centres where they are processed and consumed. Processing these foodstuffs generates large quantities of agricultural wastes, which invariably are dumped in unplanned sites close to human dwellings. These dumps form mountains of fermenting refuse that produce an unpleasant smell. Severe flooding experienced in urban centres such as Kampala is a result of poor solid waste disposal and clogs the recently opened Nakivubo Channel.

1.5 Impact of climate change on Uganda's development

1.5.1 Health sector

Human capital is an important asset to families and nations. In many African societies, the size of a family is viewed as an indicator of wealth. This thinking can be extrapolated to nations. Densely populated countries provide large markets for goods and services. Indeed, the high population of China is an asset to the country, with many western companies investing there to produce for the big market. However, undeveloped human capital has very little economic value. In modern societies, large amounts of resources are invested in development of human capital because it can generate significant wealth. A country such as Japan has developed because of its highly developed and skilled human capital.

The high population and growth rate of Uganda is not matched with growth in health services and wealth. Similarly, the high population puts additional stress on the natural resources and weak health infrastructure. Climate change imposes additional burden on the health services (human stress and capital) with consequences of loss of human lives, particularly the most vulnerable age groups, the young and the elderly. Over the last few decades, Uganda has experienced an increase in the frequency and intensity of extreme weather events seriously affecting the health sector. Heavy rainfall that leads to flash floods and floods has resulted in the outbreak of waterborne diseases such as diarrhea and cholera, while prolonged dry spells have resulted in outbreaks of respiratory diseases. Climate change may lead to reduction in food production with serious consequences of malnutrition, particularly in children. This will lead to impaired child development and decreased adult activity. This will in turn lead to severe reduction in economic productivity and hence negative impact on the country's social and economic development.

1.5.2 Water resources

Although Uganda has abundant water resources, its distribution is uneven. The semi-arid areas of the country experience water stress. Prolonged and severe droughts lead to low water levels in rivers, underground aquifers and reservoirs, affecting the hydrology, biodiversity and water supply. The severe drought of 2004/05 contributed to the reduction of the Lake and Nile River level with serious impacts on power generation leading to power rationing in the domestic and commercial sectors, and thus resulting in the interruption of economic activities and a decline in manufacturing outputs. The cattle corridor, a fragile ecosystem, is dependent on rainwater for human consumption and production. The rural poor depend on streams and swamps. These sources will dry up during severe droughts resulting in the diversion of resources to emergency operations. Climate change will exacerbate water scarcity problems, particularly in the semi-arid areas as well as pollution of water supplies, particularly in urban centres. The prolonged and severe drought of 1999/2000 caused severe water shortage leading to loss of animals, low production of milk, food insecurity, increased food prices and thus negatively affecting the economy. Therefore, effective utilization of weather and climate information in the management of water resources can yield substantial socio-economic benefits, particularly during drought periods and floods.

Floods and droughts have negative effect on water resources. A large proportion of the rural poor does not have pit latrines. Floods may pollute sources of drinking water and lead to outbreaks of waterborne diseases such as cholera, typhoid and dysentery. The poor are the most affected by outbreaks of such diseases.

1.5.3 Agriculture

The increase in human population has increased the demand for food increasing pressure on natural ecosystems. Climate change puts additional pressure on the world food supply system. The system, which has yielded an increasing food per capita over the past 4 decades has shown signs of faltering over the past decade.

Uganda's agriculture is subsistent, rain-fed and, therefore, vulnerable to climate variability and climate change. Although it is predicted that climate change will lead to increased rainfall in Uganda, its distribution during a season is critical to agricultural production. Erratic rain seasons have been observed in the past few years. Floods lead to waterlogged fields or washing away of crops. Poor people frequently settle in or close to wetlands and during floods such families are vulnerable because their source of livelihood is no longer accessible for agricultural production.

Prolonged droughts can have serious impacts on agricultural production. Even long dry spells during the rainy season are sufficient to reduce agricultural production, thus seriously impacting on livelihoods of the rural communities. Poor agricultural production has direct negative effects on the:

- national economy; increases in food prices leading to an unstable macro economy and resulting into inflation, which discourages foreign investment;
- feeding, leading to frequent health breakdowns, thus affecting production; and
- incomes leading to poor health and decreased standard of living.

Poor seasons and occurrences of droughts, therefore, exacerbate poverty. The impact of drought on a maize crop is indicated in Fig. 1.6.

Fig. 1.6

Maize crop failure in Masaka

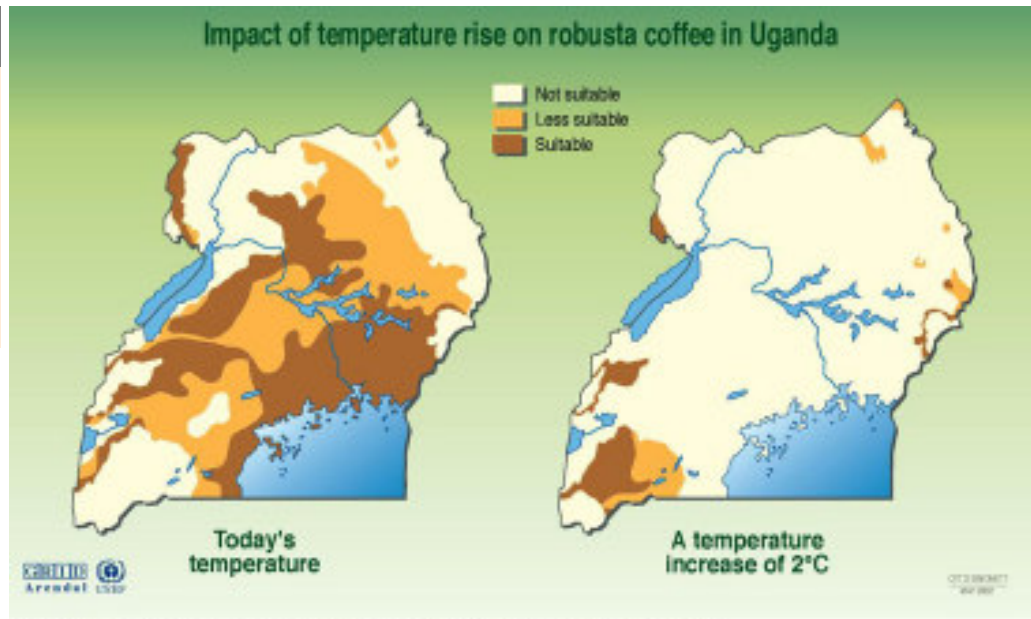


Current temperatures and rainfall permit the cultivation of coffee in most parts of Uganda. However, an increase of 2 degrees Centigrade can have significant impact on coffee growing (Fig.1.7). Other crops like cassava and soya may be sensitive to temperature increases. Increase in temperatures may lead to emergence of new pests. There is, therefore, need to orient and widen the research focus to meet future challenges.

Fig. 1.7

Potential impacts of temperature rise on coffee

Source: UNEP



Source: Otto Simovet, Potential impacts of global warming, GRID-Geneva, case studies on climatic change, Geneva, 1999.

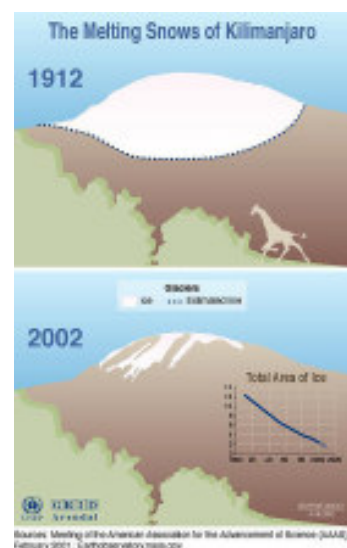
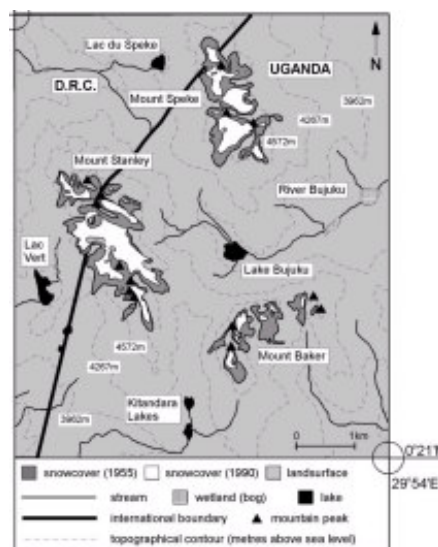
1.5.4 Wildlife, mountains and rivers

Global warming is causing retreating of glaciers, particularly in the tropics. In East Africa the ice caps on Mt. Kilimanjaro and Rwenzori Mountains are retreating. About 82% of the 1912 ice cap on Mt Kilimanjaro has already melted. By 1990, glaciers on the Rwenzori Mountains had receded to about 40% of their 1955 recorded cover. A recent study carried out by researchers from University College London and their Ugandan partners suggests that all the glaciers in the Rwenzori Mountains could disappear within the next two decades. Fig.1.8 shows the melting of ice on Rwenzori and Kilimanjaro mountains. The melting of the ice cap on tropical mountains has a negative effect on both the water catchments and eco-tourism, as well as on the overall economy. The melting of ice caps on Rwenzori Mountains has increased the erosive power of river Semliki. This erosive power and associated siltation downstream, compounded by the intensive cultivation along the river course, has enabled Semliki to disproportionately erode the Ugandan side and literally block its original course. The result is that the course of Semliki River has shifted almost one kilometre into Uganda. There is now an on-going dispute on the actual border between the Democratic Republic of the Congo and Uganda. This is a clear example that climate change is a potential source of regional conflict and war. In addition, the associated cultural loss due to melting of the ice cap is immeasurable.

Fig. 1.8

Melting of ice caps on Rwenzori Mountains and Mount Kilimanjaro

Source: UNEP



The mountains provide vital water catchments for humans and wildlife; such changes could drastically affect wildlife species. The Mountain Gorilla, of which half of the world's population is found in Uganda, is also under threat from climate change. The Rwenzori mountains are a habitat for important endemic and restricted species that, among other factors, could be there as a result of the unique climate. Among the alpine and sub-alpine species are Giant Lobelia, Tree Senecio (plants), Rwenzori Leopard and Rwenzori Red Duiker (or Rwenzori Black-fronted Duiker (animals). The Rwenzori Red Duiker, *Cephalophus rubidus*, is a rare and unique duiker subspecies only found in these Mountains. It is not well studied but it inhabits alpine and sub-alpine zones at altitudes above 3000m, corresponding with colder climate. Unique species of chameleons are also found on the Mountains, including the three-horned chameleon, *Chamaeleon johnstoni* (Fig 1.9), whose range is reportedly shifting upward as a result of rising temperatures. The same kind of shift is reported for the *Senecio* tree species.

Fig. 1.9

*Three-horned
chameleon*

Source: UWA



Wildlife-based tourism is a central source of foreign exchange for Uganda, and in 2004 tourism was recorded for the first time after so many years as the leading foreign exchange earner for the country, bringing in over US\$ 300 million. It accounted for about 64.1% of the service export receipts for the country. Any losses due to climate change and other factors would therefore be negatively affecting the social and economic development of Uganda. Therefore the loss of the ice cap on the Rwenzori Mountains has serious social and economic consequences and indeed an impact on the social development of the country.

1.5.5 Forests

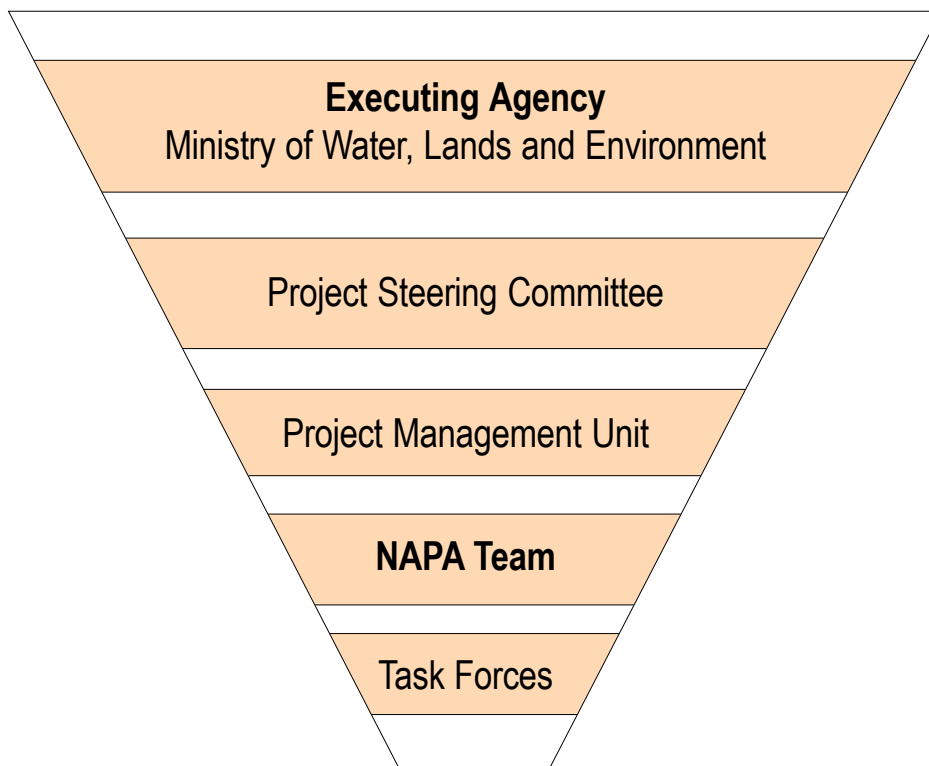
Forests play a very important role in the social and economic development of Uganda because of their products (timber, poles, medicine and firewood) and services (habitat for other diversity, moderating of micro climate, shade and enhancing productivity). Forests could also provide a sustainable source of power. Dry conditions and prolonged droughts create conducive conditions for spread of wild fires thus destroying forests with serious consequences. Increased population growth has also led to increased deforestation because of increased demand for food and fuel. Firewood provides 95% of Uganda's energy needs. Increased electricity tariffs lead to increased demand for fuel wood and charcoal, leading to increased soil erosion, damage to vital watershed, flooding and silting of rivers and lakes.

2.0 Introduction

The guidelines for preparation of NAPAs and annotated guidelines of the LDC Expert Group (LEG) characterized the implementation of the Ugandan National Adaptation Programmes of Action (NAPA) project. Indeed, the principles contained in the guidelines guided the development of the screening criteria for prioritizing and ranking of identified adaptation interventions. Several committees and teams representing a wide spectrum of stakeholders participated in the execution of the project activities, to ensure ownership of the project output. The selection of study areas, collection of data/information, analysis, interpretation and prioritization of the adaptation activities were consultative. The Participatory rural appraisal (PRA) approach was used for collection of data/information from communities of selected districts. Where necessary groups were segregated by sex to ensure active participation of women. Although documents on climate variability and climate change-related disasters and their impacts was limited, the literature review undertaken by the task forces provided a strong and sound basis for the planning of field consultations.

2.1 Institutional arrangements

The project was implemented by UNEP and executed by the Department of Meteorology in the Ministry of Water, Lands and Environment. The institutional arrangements took cognizance of the crosscutting nature of climate and therefore its impacts on many sectors. Key stakeholders were included in the project steering committee and National NAPA Team (NT). The diagram below shows the structure of the institutional arrangements.



A Project Steering Committee (PSC), a high profile committee chaired by the Permanent Secretary of the Ministry of Water, Lands and Environment, provided policy guidance for smooth implementation of the project. The PSC was drawn from the following institutions:

- Ministry of Agriculture, Animal Industry and Fisheries;
- Ministry of Health;
- Ministry of Finance, Planning and Economic Development;
- Ministry of Tourism, Trade and Industry (or Wildlife Authority);
- Ministry of Water, Lands and Environment;
- Department of Disaster Preparedness;
- Ministry of Education and Sports;
- Ministry of Local Government;
- Ministry of Justice and Constitutional Affairs;
- NGOs (represented by Environmental Alert); and
- Focal Points for UNFCCC, UNCBD and UNCCD.

The Project Management Unit, made of two project managers and chairs of the task forces, drawn from different disciplines, were responsible for planning of activities. This proved to be very useful because of the wide range of issues based on ecosystems and sectors. The Project Manager chaired meetings of the Project Management Unit.

A broad-based NAPA Team (NT), composed of technical officers drawn from key stakeholders, and in line with the guidelines for preparation of the NAPAs, was established. The NT was responsible for executing the NAPA activities. However, during project design the large size of the NT was recognized and therefore the concept of task forces was built into the project design. The Task Forces carried out literature review, data collection and analysis but submitted their outputs at every stage to the NT to ensure active participation of the NT in the entire process.

2.2 Formation of Taskforces

Resource allocation by the Ministry of Finance, Planning and Economic Development is based on a sectoral framework. This guided the preparation of the NAPA. Key sectors driving Uganda's economy were identified for the NAPA study. These include Agriculture, Water Resources, Health, Forestry and Wildlife. However, considering the close sectoral inter-linkages, three task forces on Agriculture and Water resources, Health, Forestry and Wildlife, with a maximum of five technical experts each, were established. The Task Forces appointed by the Permanent Secretary on the advice of the Project Manager, were responsible for literature review, data/information collection, analysis and interpretation and development of screening criteria. Members of the task forces were drawn from within the NT and outside it based on expertise requirement.

The Task Forces submitted their outputs to the NT through the Project Manager. Although the task forces were based on sectors, the implementation of the activities considered the following ecosystems:

- Highland ecosystem;
- Lowland ecosystem;
- Aquatic ecosystem;
- Semi-arid ecosystem; and
- Lake Victoria Basin ecosystem.

2.3 Selection of Study Sites

Twelve districts were selected for the collection of data/information. The selection criterion took into account the five ecosystems and, where possible, geographical balance. The selected districts are shown in the map below. The PMU organized a planning meeting in which the 12 selected districts participated. The primary purpose of the meeting was to:

- Establish a link with the districts;
- Brief district technical officers;
- Plan the field activities; and
- Identify persons to be interviewed (knowledge of occurrences of extreme weather and climate events and experiences on coping mechanisms).

The established contact persons, referred to as district NAPA focal points, and the PMU identified the counties (lower level administrative units) to be included in the data/information collection. The counties were selected on the basis of their vulnerability to adverse impacts of climate change-related disasters and represented one or more of the selected ecosystems.

Fig. 2.1

NAPA Study area
(selected districts)



2.4 Data collection and analysis

Literature review for secondary data/information

The taskforces reviewed relevant literature on climate change, related disasters, impacts and adaptation strategies in the respective sectors. They also critically analysed national development strategies, sectoral policies and programmes in order to assess Uganda's adaptive capacity to various climate change-related vulnerabilities, including floods, droughts and temperature increase. This analysis formed a basis for the planning of the field data/information collection.

Surveys and participatory rural appraisals

Taskforces developed interview schedules with lead questions to address gaps identified in a) above. Interviews were conducted in selected sub-counties on selected respondents (including elderly women and men, opinion leaders, NGOs and CBOs operating in the study areas). These persons were believed to be depositories of knowledge on occurrences of disasters and coping mechanism. Focused group discussions (FGDs) were organized for a wider audience including the youth to enrich and check consistency of the surveys. This information was also enriched with data/information compiled from meetings with the district political leaders and technical officers.

Analysis and consultations

The data/information (qualitative) collected from the field was subjected to quality control. Tables, summarizing the collected data/information, were produced for further discussions with districts in workshops. The objective of this workshop was to validate the collected data/information and to seek inputs from districts, which did not participate in the field data/information collection. The PMU developed criteria, which were discussed and used at the workshop to screen identified activities. After the regional workshop, the improved report was subjected to further consultations through national technical, policy and legislators' workshops.

2.5 Prioritization and Ranking of Interventions

There are several approaches to prioritization and ranking of activities. This could include cost-benefit analysis, which would require multivariable data sets such as scientific, economic and social data. Such an approach also requires substantial amount of resources and time and therefore could not be used to analyse the identified interventions. However, reasonable and acceptable results can be obtained through simple qualitative and parametric analysis of the collected data/information. This approach has a strong advantage in that it is participatory. Therefore Uganda took this approach for the analysis, prioritization and ranking of identified interventions.

A preliminary analysis of the collected data/information revealed that the participants gave preference (respondents expressed as %) to ten intervention areas:

- Indigenous knowledge documentation and awareness creation (20%)
- Farm forestry (18%)
- Water resources (16%)
- Weather and climate information (11%)
- Policy and legislation (11%)
- Land and land use (9%)
- Disaster preparedness (7%)
- Alternative livelihoods (4%)
- Health (2%), and
- Infrastructure (2%)

This simple and empirical rating could be improved; for instance, health is rated low (2%) whereas it plays an important part in coping with impacts of adverse effects of climate change. Three tiers were developed for prioritizing and ranking of the identified interventions. These were validated by the regional workshop participants and used to prioritize the identified interventions. The tiers are described briefly below.

a) First tier criteria (national level)

This tier considers consistency, relevance and importance of an identified intervention area to the national development priorities and takes into account the following elements:

- Development priorities (Poverty Eradication Action Plan (PEAP) and Millennium Development Goals (MDGs);
- Environment concerns, including multilateral environmental agreements (MEAs); and
- Equity and gender issues, taking into consideration disadvantaged groups.

The first tier is used to establish the relevance of an intervention area. The total scores are used to weight identified key intervention activities to enable determination of the overall ranking. The third tier is then applied to the first 10 key intervention activities to determine urgency and immediacy of the activities. Project profiles are developed for the first nine key interventions.

b) Second tier criteria (community/ecosystem level)

The second tier focuses on community/sectoral level and the following elements were identified:

- Enhancing resilience to impacts of climate change;
- Multiple benefits;
- Replication;
- Sustainability;
- Cost-effectiveness; and
- Cultural acceptance.

The following scores were adopted for the first and second tiers:

Description	Value
Irrelevant	0
Low	1
Medium	2
High	3
Very high	4

c) Third tier criteria (urgency and immediacy)

This tier focuses on urgency and immediacy of an identified and ranked intervention. The elements and scores below were adopted:

Elements

- Urgency
- Magnitude (coverage and severity/intensity) and
- Immediacy.

Scores

Description	Value
Low	1
Medium	2
High	3
Very high	4

The third tier was applied to the first 17 key intervention activities (section 5.1) to determine urgency and immediacy of the activities. The total scores are used to select the first set of interventions for immediate implementation. Project profiles are developed for the selected interventions.

Chapter 3. Vulnerability to Climate Change

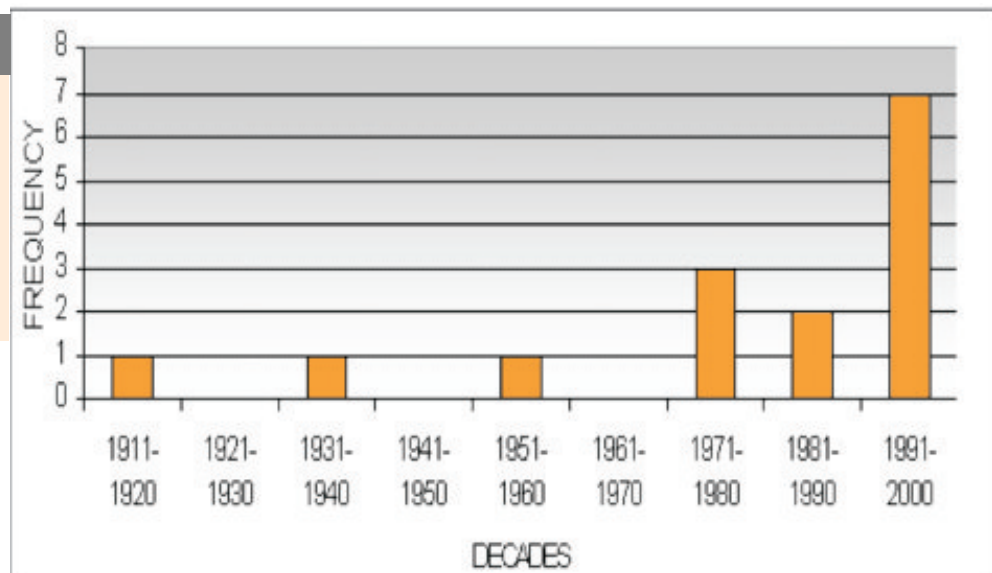
3.0 Climate Variability

Climate has varied in the past and is expected to continue to do so in the future. However, climate change will increase climate variability resulting in frequent and intense extreme weather and climate events such as droughts, floods, landslides and heat waves. The events of the past few years have clearly demonstrated the increased frequency and intensity and also the magnitude of the problem (climate change). Uganda experienced seven droughts in a period of ten years (1991 to 2000) as shown in Fig.3.1.

Fig. 3.1

Occurrence of droughts in Uganda

Source: Department of meteorology



a) Rainfall variability

Rainfall seasons have become more variable as depicted by the analysis of the cumulative average ten-day totals and cumulative ten-day totals (Figs 3.2 to 3.5).

Although the western, central and northern parts of Uganda experienced good rainfall seasons the eastern region experienced drought (Fig. 3.2) in 1997. The country experienced above normal rainfall in 1998 (El Nino year), as depicted in Fig. 3.3, resulting in floods. The floods had serious negative impacts on several sectors, particularly the health (Fig. 3.9) and transport sectors. The flooding of 1998 was followed by severe drought in western region (Fig. 3.4) with Mbarara district being the most affected. The rest of the country had good seasons (Fig. 3.4 b to Fig. 3.4.d). In 2000 Uganda again experienced wide spread drought. The drought was more severe in eastern and northern regions with Arua district being the most affected (Fig. 3.5d). However, the western region experienced good seasons. The analysis of the rainfall (Fig. 3.2 to 3.5) clearly indicates that not all parts of the country are affected by droughts at any given time. Therefore overall impact of climate variability and climate change can significantly be mitigated through provision of climate information and promoting its utilization so as to take advantage of good seasons in some parts of the country. These figures show inter-annual variations (across) and inter-regional variations (vertically).

Increased frequency, intensity and widespread climate variability and climate change pose serious threat to food security and social and economic development. However, despite the eminent threat the analysis of the seasonal rainfall variability indicates that impacts of climate variability and climate change can be significantly reduced through wide use of weather and climate information. Development, production and dissemination of weather and climate information, including promotion of its utilization at various levels is of particular importance. The rural communities, the most vulnerable group, must be accorded high priority. It is therefore necessary to strengthen the capacity of the Department of Meteorology to enable it provide efficient, timely and reliable weather and climate information.

The year-to-year variation of rainfall over different zones is shown in Table 3.1. The table shows the distribution of very wet, wet, dry and very dry years by region between 1943 and 1999. The records show increasing variability in most regions of Uganda other than the central region. This analysis of rainfall variability does not show any significant trends. On the other hand there is clear evidence of an increased frequency of droughts in recent years as shown by Fig. 3.1.

Whereas there are still higher chances of normal rainfall, particularly in Central and South West, the probability of dry conditions is more than wet conditions in all the regions (Table 3.2). This implies higher probability of crop failure. This is an interesting result. It is consistent with increasing frequency of droughts in Uganda as shown in Fig. 3.1. This requires further investigation to ascertain possibility of a trend in dry conditions. The probability of very dry season is generally low in all the regions. The probability of very wet seasons is higher in Central and Eastern. This is supported by observations and confirmed by the results of the PRA (Table 3.3, 50% of respondents (numbers 2,3, 6 and 7) indicate increased observed heavy falls. The frequency of landslides in eastern Uganda has also increased.

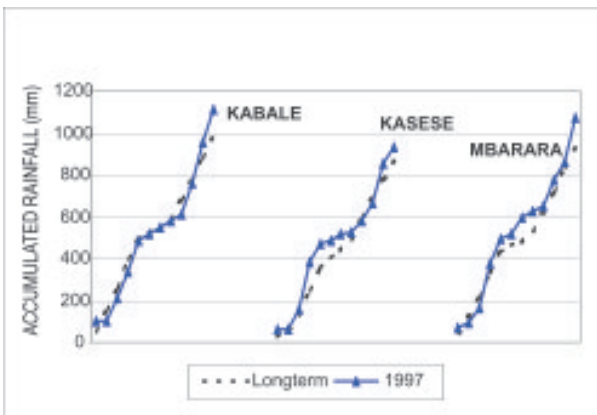


Fig. 3.2 a Western Region

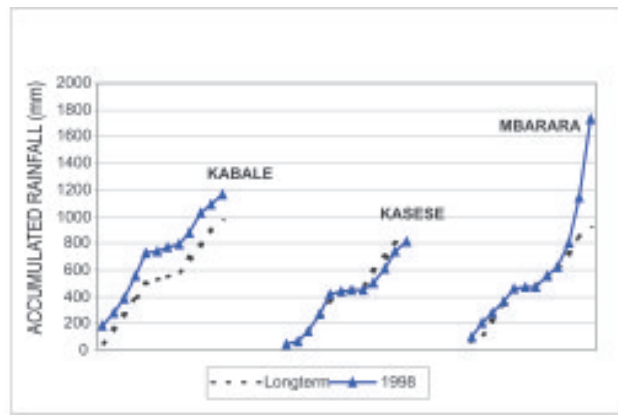


Fig. 3.3 a Western Region

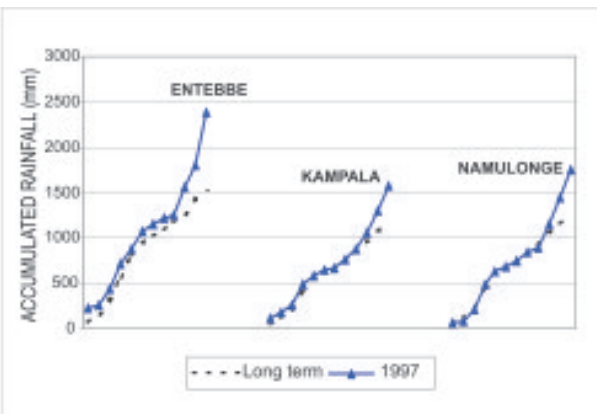


Fig. 3.2 b Central Region

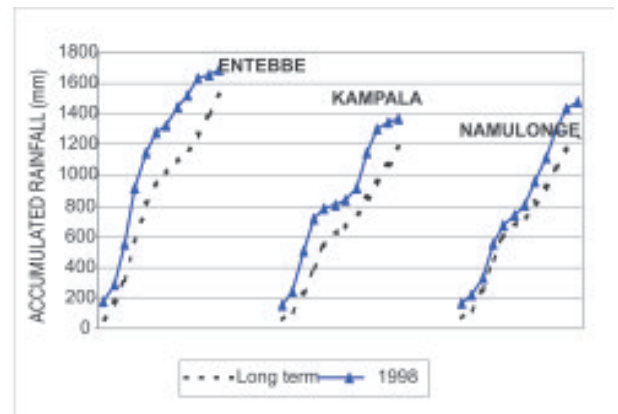


Fig. 3.3 b Central Region

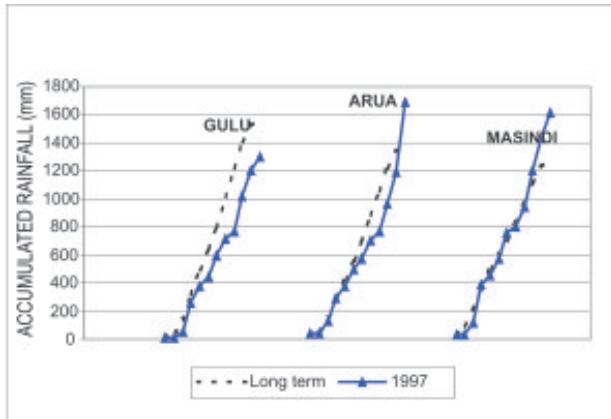


Fig. 3.2 c Eastern Region

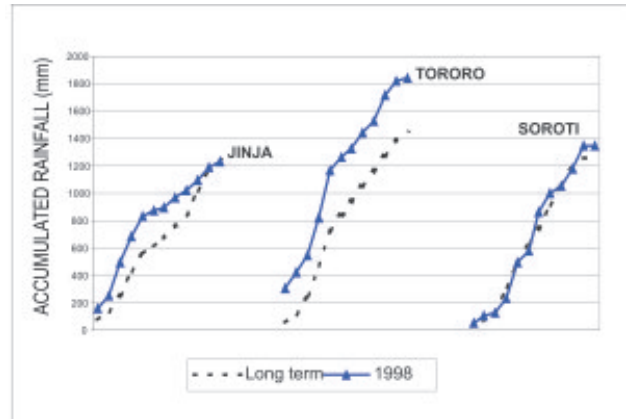


Fig. 3.3 c Eastern Region

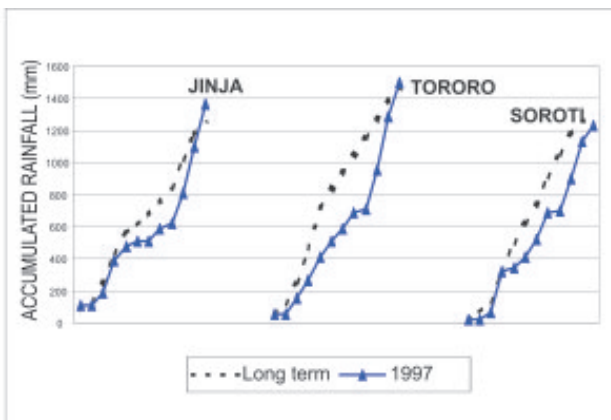


Fig. 3.2 d Northern Region

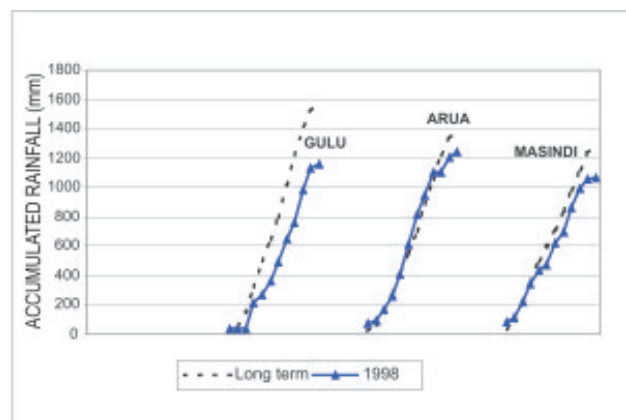


Fig. 3.3 d Northern Region

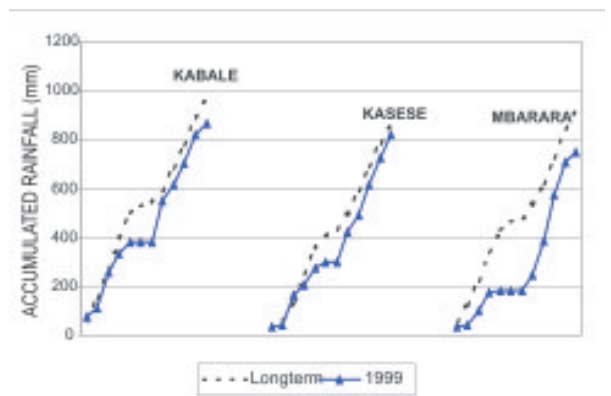


Fig. 3.4 a Western Region

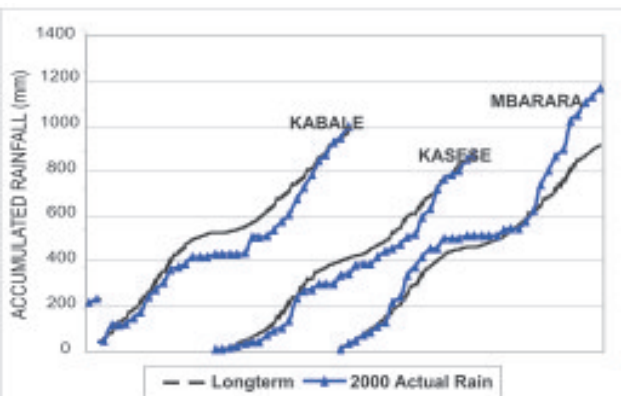


Fig. 3.5 a Western Region

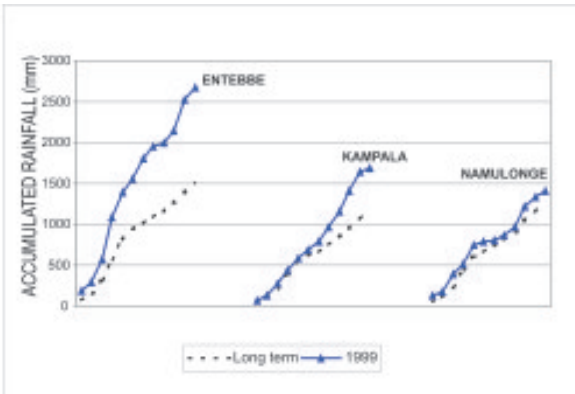


Fig. 3.4 b Central Region

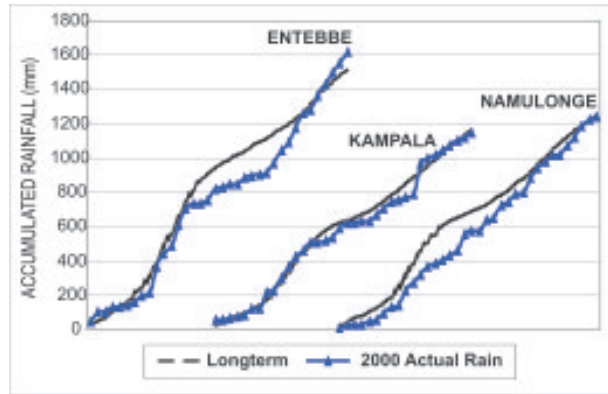


Fig. 3.5 b Central Region

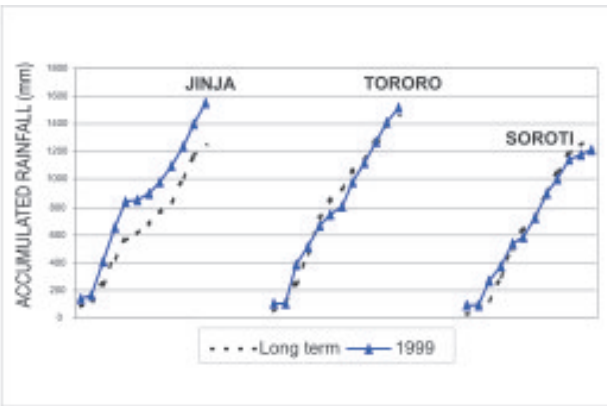


Fig. 3.4 c Eastern Region

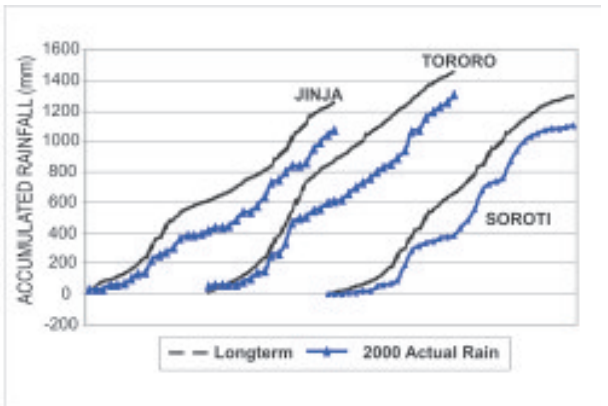


Fig. 3.5 c Eastern Region

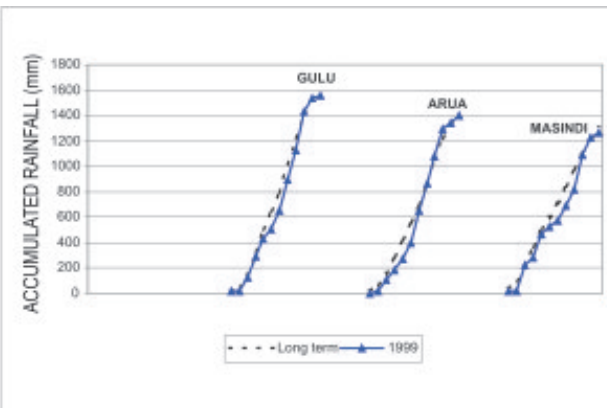


Fig. 3.4 d Northern Region

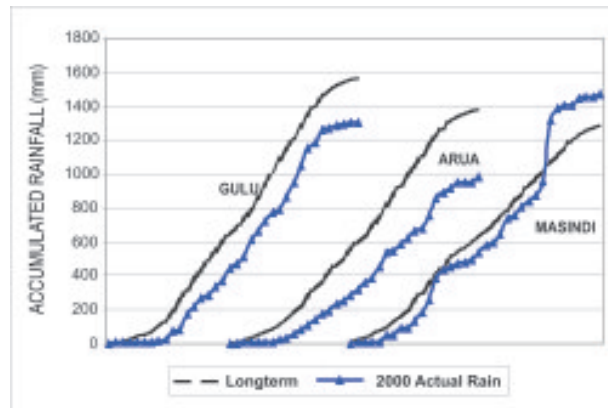


Fig. 3.5 d Northern Region

Table 3.1: Regional dry and wet years between 1943 and 1999

Source: State of the Environment Report 2000/01

Years	South western	Central	Eastern	Central northern
1943		D	VD	D
1946				W
1949	D	D		
1951	VW	VW	VW	W
1952	D			
1953			D	D
1954			D	
1957				D
1961	W	VW	VW	VW
1963	VW	VW	VW	W
1965	D			D
1967			W	W
1972	W			
1973			VD	D
1974			D	
1975	W			
1977	W		W	W
1978		VW	W	W
1979	D		D	D
1980			D	
1981	VD			
1982			W	VW
1983		VD		
1984		D		D
1985	D	VD		
1986	VD		D	VD
1987				VD
1988			VW	
1989			D	
1991				VW
1992		D		D
1993	D			D
1994				W
1997		W	D	
1998		W	W	
1999	VD			
Summary				
D	6	4	8	9
VD	3	2	2	2
W	4	2	5	7
VD	2	4	4	3

Key

D = dry; VD = very dry; W = wet; VW = very wet; Clear cell = normal

Table 3.2 Probability distribution of dry spells adopted from Table 3.

Source: Philip M. Gwage (unpublished)

Category	South West	Central	Eastern	Central North
Normal	0.58	0.67	0.47	0.42
Wet	0.11	0.06	0.14	0.19
Very Wet	0.06	0.11	0.11	0.08
Dry	0.17	0.11	0.22	0.25
Very Dry	0.08	0.06	0.06	0.06

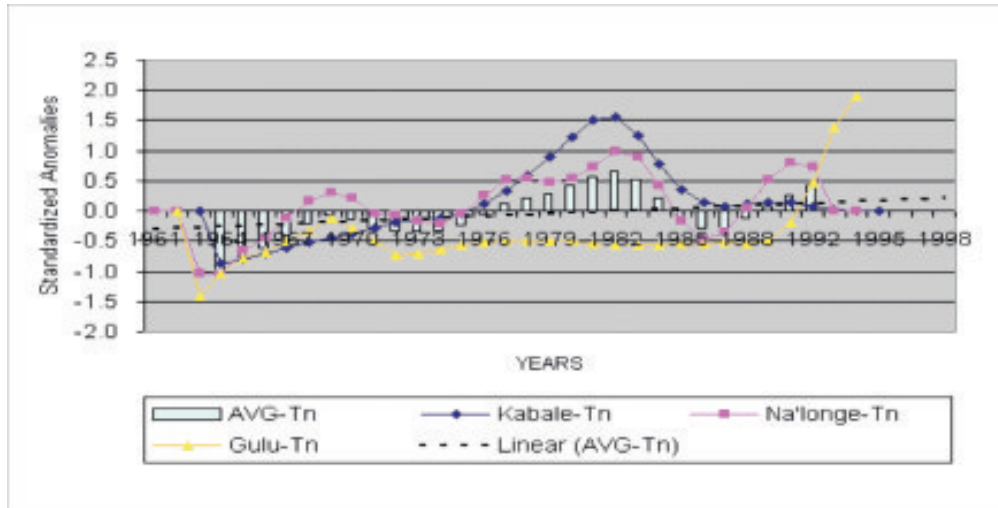
b) Temperature variability

This analysis shows sustained warming particularly over southern parts of Uganda. The fastest warming regions are in the Southwest of the country where the rate is of the order of 0.3°C per decade. The minimum temperature is rising faster than the maximum temperature. The year-to-year variation in annual mean, maximum and minimum temperatures over selected stations in Uganda are shown in Figure 3.6.

Figure 3.6

Mean minimum temperature anomalies: selected regions

Source: department of meteorology



3.1 Vulnerability

This section describes the vulnerability of Uganda to climate change and how climate change impacts its natural resources, livelihoods and socio economic development. It relates major findings from the field PRA to information obtained from the literature review. The community PRA findings are summarized in Tables 3.3 to 3.5. The majority of issues raised by the communities was crosscutting and therefore referred to across the various sections of this document to include agriculture, water, health, wildlife and forestry. The results show that impacts of adverse effects of climate change negatively affect Uganda mainly through extreme weather and climate events such as droughts, storms (wind, rain, thunder and dust), floods, extreme high temperatures and landslides (Table 3.3). The Table also shows that Uganda is most affected by droughts followed by storms and landslides, which are confined to highland ecosystems. Table 3.4 shows impacts of disasters based on the outputs of the PRA. Again impacts related to droughts represent a high percentage about 36% (2,3,6,8,15 have drought impact relation). Implementation of the NAPA activities must take into account the major disasters and impacts of these disasters (Tables 3.3. and 3.4).

Table 3.3: Major disasters based on PRA

Occurrence of disasters

Disasters reported in sampled districts	Respondents in %
1. Droughts (frequent and prolonged)	25
2. Storms (wind, rain, thunder, lightning and hailstones)	21
3. Floods	12
4. High temperatures	12
5. Pests and disease epidemics	12
6. Heavy rains	10
7. Landslides	7

The reports across the country indicate that there has been increased rainfall variability, reduction in amounts (rainfall) and rise in temperatures. Occurrence of landslides was concentrated in the highland ecosystems, while flooding was in lowland ecosystems. Prolonged droughts were reported across the country. This explains the relatively higher reporting percentage of droughts as indicated in Table 3.3. It has also been observed that droughts have become more frequent and severe as shown in Fig. 3.1. The disasters cited by the communities are interlinked in that they cause similar effects. The rains are decreasing in amount, and yet they fall in concentrated heavy showers and storms, leading to landslides, floods, storms and soil erosion (Table 3.4).

Table 3.4: Major impacts of disasters based on PRA

Impacts reported in sampled districts	%
1 Destruction of infrastructure	9
2 Famine	9
3 Lack and disappearance of pastures	9
4 Deforestation	6
5 Destruction of biodiversity	6
6 Wild fires and burning leading to destruction of natural vegetation	6
7 Erratic seasons and rains	6
8 Drop in water level in our water bodies	6
9 Epidemics of pests and diseases	6
10 Direct loss of lives	6
11 Low production and productivity of crops and animals	6
12 Poor health	6
13 Poverty	6
14 Soil erosion and land degradation	6
15 Water shortage and drying up of water sources such as wells	6

3.1.1 Vulnerability of water resources

Although it is predicted (IPCC Assessment Reports 1995/2001) that precipitation will increase in some areas of East Africa as a result of climate change, evapotranspiration will also increase due to a rise in temperatures thus reducing the benefit of the increase. Prolonged and severe droughts can lead to low water levels in rivers, underground aquifers and reservoirs, impacting on the hydrology, biodiversity and water supply. Low reservoir levels can also reduce the potential for hydropower generation leading to power rationing in the domestic and commercial sectors, thus resulting in interruption of economic activities and decline in manufacturing output. Droughts have resulted in lowering of water table, and drying of boreholes as indicated in Fig. 3.7

Fig. 3.7

Dry borehole in Masaka in 2005



The cattle corridor (Fig. 1.4), a fragile ecosystem, depends on rainwater for human consumption and production. The prolonged and severe drought of 1999/2000 caused severe water shortage leading to loss of animals, low production of milk, food insecurity, increased food prices and generally had negative effect on the economy. Fig 3.8 shows the impact of the 2005 drought on cattle in Nakasongola (in the Cattle Corridor). The rural poor depend on streams and swamps, which dry up during droughts. Therefore, climate change will exacerbate water scarcity and pollution problems, particularly in the semi-arid areas, urban centres and rural communities.

Fig 3.8

Drought in Nakasongola 2005



Floods like droughts have negative effect on water resources. A large proportion of rural poor do not have pit latrines. Floods pose serious pollution problems to sources of drinking water, with the potential danger of outbreaks of waterborne diseases such as cholera, typhoid and dysentery. The poor are the most affected by outbreaks of such diseases. Therefore, effective utilization of weather and climate information in the management of water resources can yield substantial socio-economic benefits, particularly during droughts and floods. Thus the need to strengthen data collection, analysis and dissemination of weather and climate information to support implementation of adaptation activities.

3.1.2 Vulnerability of the agricultural sector

The intergovernmental panel on climate change predicts a decrease in world food production of 5 – 11% by 2020 and 11 – 46% by 2050. The shortfall in the world's staple foods supply is estimated at 400 to 600 million tons by the 2080s and will increase hunger and poverty, particularly in the poor countries. Three-quarters of people who are at risk of hunger as a result of climate change are in Africa.

Climate change affects agricultural production in a diverse and complex manner. For example, an increase in temperature escalates soil chemical reactions leading to increase in decomposition of organic matter and therefore release of greenhouse gases into atmosphere. This process also results in loss of fertility thus affecting yield negatively. Increased concentrations of CO₂ on the other hand improve rice, wheat and soybean production, however, its effect on corn, sorghum, sugarcane and millet yield are rather negative. While temperature increases lead to extension of

growing period for crops in high-latitudes and an increase in yield at higher than normal CO₂ level in colder conditions, it is associated with increased prevalence and emergency of pests and vectors resulting into escalation of diseases. Thus, the effects of climate change are difficult to predict.

a) Food security

The United Nations Food and Agriculture Organization (FAO) report on food insecurity has identified population groups, countries, and regions that are vulnerable. For example, nearly half the population in countries of central, southern, and east Africa is undernourished. In the late 1990s, 790 million people in developing countries did not have enough to eat. Climate change represents an additional pressure on the world food supply system. That system, which has yielded an overall increase in per capita food supplies over the past 4 decades, has shown signs of faltering over the past decade. The NAPA studies in Uganda have had similar observations, namely food insecurity and malnutrition of both humans and animals, being exacerbated by climate change. Many of the major impacts listed in Table 3.4 do lead to food insecurity.

b) Temperature rise

The PRA findings revealed rising environmental temperatures (Table 3.3). This was particularly evident in the colder highland ecosystems. In Kabale for example, the rise in temperatures have favoured the proliferation and breeding of mosquitoes, increasing malaria prevalence and reducing labour and agricultural productivity. In the Rwenzori Mountains, crops such as cassava, which hitherto did not do well in the cold zones of this mountain are now being grown.

c) Pest and disease epidemics

Climate variables control the geographical distribution of pests and diseases, and therefore expand their distributions to new areas. In semi-arid Karamoja for example, tickborne diseases have been reported. The tsetse belt has expanded resulting into higher morbidity of Nagana and sleeping sickness and associated drug resistance. Climate change induced escalation in epidemics of pests and diseases were reported across districts in both livestock and crops as major causes of low productivity (Tables 3.3 – 3.4). In Katakwi district, grasshopper epidemics in 2005 destroyed all cereals, the main source of food security in Osuku County. Armyworms have been reported in Wakiso, Tororo and Pallisa districts. Newcastle disease epidemics in poultry have been more frequent in poultry keeping areas such as Rakai and Soroti. Similarly, an increase in the occurrence of Nagana and tickborne diseases among others was reported in the cold mountainous ecosystems (Tables 3.7, 3.9, 3.10). Temperature rise in cold mountain areas enables vector and pests to increase their ecological range to areas where they would otherwise be limited by low temperatures. This causes more infestation during the following production season, as the new hosts will not have had immunity. Altered wind patterns also change the spread of wind-borne pests, vectors and pathogens for crop, livestock and human diseases. PRA findings revealed an increase in drought and flood-related diseases (Tables 3.5, 3.6, 3.7). Newcastle disease epidemics and malnutrition in poultry farming areas were more prevalent. Reports from livestock farmers indicated that worms and vector-borne diseases are more prevalent. During floods, waterborne diseases such as respiratory infections and calf diarrhoea escalate.

d) Biodiversity loss

Disappearance of plant species, particularly medicinal plants and pasture, has been observed. This is related to changes in the ecosystems and land degradation resulting from extreme droughts and unsustainable agricultural practices. Despite efforts to introduce exotic pasture, crop and livestock species, farmers have tended to cling to their traditional crops and livestock species, because of their water and heat stress resistant qualities. Loss of herbal plants, life and physical injuries are most prominent in highland ecosystems (Table 3.5). This is mainly due to high

population density leading to pressure for arable land (over cultivation), deforestation and soil degradation resulting in frequent landslides. Table 3.5 shows the highland ecosystem as the most vulnerable followed by the semi-arid ecosystem.

Table 3.5 Production and health concerns related to climate change disasters

Parameter	Ecosystems (%)				
	Highland	Lowland	Semi-arid	Lake Basin	Aquatic
Loss of life	71	0	14	0	14
Food insufficiency and malnutrition	37	20	32	12	0
Loss of herbal plants	100	0	0	0	0
Damage to homestead and infrastructure	36	21	29	13	2
Physical injuries	67	0	0	33	0
Dust storm, respiratory and eye diseases	14	29	43	14	0
Sanitation and hygiene related diseases	33	27	20	7	13
Water pollution and stress	27	19	16	11	27

e) Soil fertility

Higher environmental temperatures increase soil temperatures leading to increase in soil chemical reactions (Buol *et al.*, 1990). They also increase the rate of microbial decomposition of organic matter and release of CO₂ to the atmosphere. This enhances leaching and erosion, thereby adversely affecting soil fertility. Similarly, increased rainfall in moist regions could increase leaching of minerals, especially nitrates. On the other hand, decrease in rainfall, could have more dramatic effect, through the increased frequency of dry spells leading to increased proneness to wind erosion. The fast decline in soil fertility and low productivity reported in all ecosystems could be related to these observations. Appropriate soil protection approaches are needed to reverse this situation.

f) Crop yield

Crops such as potatoes, with indeterminate growth habit, may increase in yield with increasing temperatures, provided these do not exceed optimum temperatures for crop development. This may partly explain the high yields of Irish potatoes, sorghum, maize and wheat reported in the highland ecosystems of Mbale, Kapchorwa, Kisoro and Kabale in the PRA.

g) Livestock production

Climate and annual weather patterns are key factors in livestock productivity. Despite technological advances, such as improved animal breeds and management systems productivity is still low due to severe reduction in quantity and quality of pastures and drinking water and increased disease and vector prevalence. These lead to death of animals during extreme drought and flood periods. Lack of water accounts for 72% of livestock production issues (droughts) (Table 3.6). Malnutrition and worm infection accounts for 41% of livestock health issues. Other important diseases are Tick borne and Newcastle representing 29% (Table 3.7). Therefore improving access to water, sanitation and hygiene in the pastoral drylands ecosystems can yield substantial results.

Table 3.6. Major livestock production issues based on PRA

Production issues	%
1. Pasture insufficiency and malnutrition	28
2. Water, Sanitation and Hygiene diseases	23
3. Water pollution and stress	21
4. Deaths (direct loss of life)	13
5. Damage to infrastructure (e.g. kraals)	11
6. Physical injuries of individuals	3
7. Loss of medicinal plants	1

Table 3.7: Major livestock health issues

Livestock Health Issues	%
1. Malnutrition and starvation	25
2. Worm infestations	16
3. Tick borne diseases	15
4. Newcastle disease	14
5. Respiratory diseases and diarrhea in calves	12
6. Poor hygiene, sanitation and zoonoses	11
7. Insect disease vectors	4
8. Sleeping sickness	3

h) Water availability

Climate change modifies rainfall, evaporation, runoff, and soil moisture storage. The amount and availability of water stored in the soil is crucial for crop growth. Too much precipitation can cause disease infestation in crops especially legumes, while too little can be detrimental to crop yields, especially if dry spells occur during critical development stages. Fig 1.5 shows the impact of severe drought on a maize field in Masaka in 2005. Moisture stress during the flowering, pollination, and grain-filling stages is especially harmful to cereals and legumes (Decker et al, 1986). Similarly, livestock are affected by both weather extremes. For every kg of dry-matter intake, 3 kg of water must be available to the animal. Shortage of water escalates infertility and lowers growth and milk production.

Likewise, global warming is expected to cause rise in water level and flooding of agricultural land in shorelines. A decrease in water levels seems to be the most long-term effect in Uganda's water bodies (Tables 3.5-3.6). PRA revealed a decrease in water levels in most lakes, complete drying of fish ponds, complete disappearance of wetlands, drying up of valley dams and lowering of water tables resulting in drying and closure of boreholes. The lack of water for livestock, humans and backyard crop irrigation impacts negatively on productivity and livelihoods. Extreme floods associated with El Nino rains like those which occurred in 1961/63 and 1997/98 cause rise in water table further inland and can submerge agricultural land, crops and livestock, resulting into enormous losses. This is frequent in areas around Lake Kyoga. Floods promote diseases such as foot rot, worms, respiratory infections and diarrhea.

3.1.3 Vulnerability of the health sector

The long-term good health of populations depends on the continued stability and functioning of the biosphere's ecological and physical systems, often referred to as life-support systems. Extreme weather events directly cause death and injury and have substantial indirect health impacts. Indirect impacts result from damage to the local infrastructure, population displacement and ecological change. Direct and indirect impacts can lead to impairment of the public health infrastructure, psychological and social effects, and reduced access to health care services. The Table 3.8 summarizes the potential impacts of climate change on the health sector.

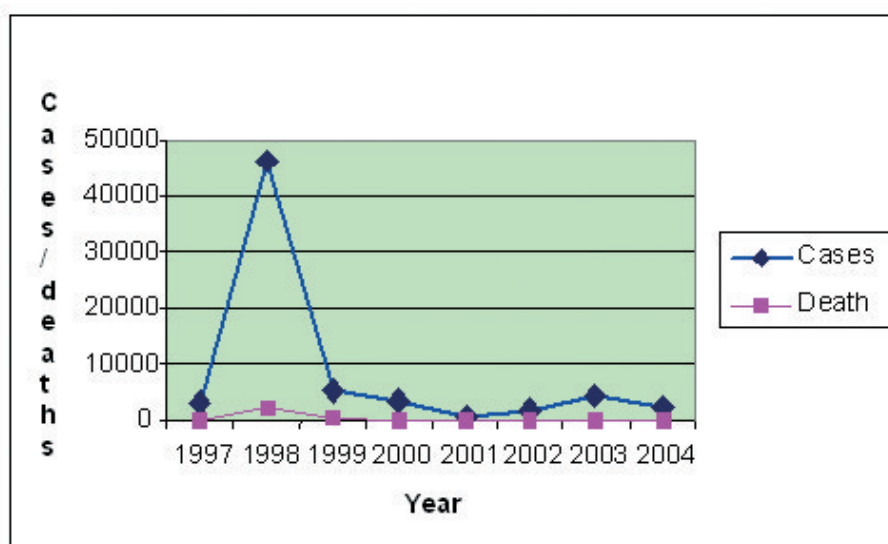
IPCC (2001) indicates that many vector, food and water-borne diseases are sensitive to changes in climatic conditions. Results of predictive models have shown that under climate change scenarios, there would be a net increase in the geographical range of potential transmission of malaria and dengue – two vector-borne infectious diseases, each of which currently affect 40-50% of the world population. Within their present ranges, these and many other infectious diseases would tend to increase in incidence and seasonality – although regional decreases would occur in some infectious diseases. The IPCC paper also argues that projected climate change will be accompanied by an increase in heat waves, often exacerbated by increased humidity and urban air pollution, which would cause an increase in heat-related deaths and illnesses.

Table 3.8 Potential impacts of climate change on health sector.

Mode of impact	Mediating process	Health outcome
Direct	<ul style="list-style-type: none"> ▪ Exposure to thermal extremes especially heat waves ▪ Altered frequency and/or intensity of other extreme weather conditions (floods, storms etc) 	<ul style="list-style-type: none"> ▪ Altered rates of heat and cold-related illness especially cardiovascular and respiratory diseases ▪ Deaths, injuries and psychological disorders, damage to public health infrastructure
Indirect due to disturbances of ecological systems	<ul style="list-style-type: none"> ▪ Effects on ranges and activity of vectors and infective parasite ▪ Altered local ecology of water-borne and food-borne infective agents ▪ Altered food (especially crop) productivity due to changes in climate, weather, and associated pests and diseases ▪ Fresh water vulnerability ▪ Sea level rise with population displacement and damage to infrastructure e.g. sanitation ▪ Levels and biological impacts of air pollution including pollens and spores ▪ Social, economic and demographic dislocations due to adverse climate change impacts on the economy, infrastructure and resource supply 	<ul style="list-style-type: none"> ▪ Change in geographic ranges and incidence of vector-borne diseases e.g. an increase in temperature of 1.2° C can shift potential malaria risk areas from the traditional tropical to temperate zones ▪ Changed incidences of diarrhea and infectious diseases ▪ Regional malnutrition and hunger with consequent impairment of child growth and development especially in vulnerable communities ▪ Injuries, increased risk of various infectious diseases (due to migration, overcrowding, contamination of drinking water), psychological disorders ▪ Asthma and allergic disorders, other acute and chronic respiratory disorders and deaths ▪ Wide range of public health consequences e.g. mental health, nutritional impairment, infectious diseases, civil strife

Fig. 3.9**Cholera outbreaks in Uganda 1997-2004**

Source:
Ministry of Health

**a) Communicable and vector-borne diseases**

Over the last few decades, Uganda has experienced an increase in the frequency and intensity of extreme weather events with serious consequences on the health sector. For example, during the 1997/8 El Nino there were outbreaks of water-borne and water-related diseases (Figure 3.9 and PRA data summarized in Tables 3.9 & 11) in particular cholera and malaria in most districts, leading to the death of many people.

(i) Cholera

A cholera epidemic, first reported in October 1997 in Lolwe and Sigulu islands of Bugiri District, hit Kampala City in December and subsequently spread to 39 districts. By 15 July 1998, 41,857 people had been taken ill, of whom 1,682 died (Ministry of Health, 1998). An estimated 11,000 people were hospitalized and treated for cholera triggered by the 1997/8 El Nino floods (Figure 3.9) and landslides. The outbreak was controlled and cases steadily declined until the second El Nino of 2002. During the El Nino of 2002, cholera outbreaks were localized to 14 out of the 56 districts. This was due to the good preparedness. There were very few cases in the preceding years.

The floodwaters caused destruction of homesteads, latrines, destruction of landing sites, for example along Lake Bunyonyi in Kabale leading to outbreaks of dysentery and diarrhea. The situation was similar in Nakasongola and Soroti where poor sanitation led to increase in diarrhoeal diseases. Rocky terrain and collapsing soils in highland areas make construction of latrines difficult. This effect is similar to the high-water table areas along water bodies such as the landing sites. In lowland, aquatic and Lake Basin ecosystems, increased outbreaks of malaria, bilharzia and other water-borne diseases were reported during and immediately after floods.

Table 3.9: Health concerns related to climate change based on PRS

Issues	(%) of Respondents
1. Malaria	25.0
2. Bloody diarrhoea and dysentery	18.8
3. Poor hygiene and sanitation	18.8
4. Cholera	15.6
5. Bilharzia	6.3
6. Helminthic infestations	3.1
7. Insect disease vectors	3.1
8. Sleeping sickness	3.1
9. TB	3.1
10. Typhoid	3.1

Table 3.10: Disease outbreaks related to poor sanitation based on PRA.

Parameter	% of Respondents
1. Water, Sanitation and Hygiene diseases	28.9
2. Food insufficiency and malnutrition	26.7
3. Water pollution and stress	18.5
4. Infrastructure damage	14.8
5. Loss of life	4.4
6. Respiratory and Eye infections	3.7
7. Injuries	2.2
8. Loss of medicinal plants	0.7

Tables 3.10 and 3.11 highlight public health concerns in the water and sanitation, food nutrition and sufficiency and outbreaks of communicable and vector-borne diseases. Malaria, bloody diarrhoea and dysentery, poor hygiene and sanitation (including cholera) accounts for 78.2% of the health issues. Water related disease outbreaks accounts for 47.4%, malnutrition (26.7%) and infrastructure damage (14.8). These PRA findings confirmed reports from the Ministry of Health in section 3.5.2 above.

Besides, severe droughts resulted in frequent dust storms and associated respiratory and eye infections in the lowland ecosystems. In Nakasongola, Lira and Rakai for example, there was an increase in eye infections and persistent respiratory tract infections.

Severe droughts resulted in drying of water sources leading to serious water shortages especially in the lowland ecosystems. This compromised personal hygiene resulting into escalated faecal-oral transmission of diseases. The floodwaters caused silting, pollution of water sources and destruction of gravity flow water supply systems. For example, Kasese district experienced widespread floods in 2003 and 2004, which disrupted the gravity flow water system, contaminated other water sources and resulted into a cholera outbreak where about 200 people were affected and six people died.

(ii) Malaria

There was a general increase of malaria incidences throughout the country, particularly in southwestern Uganda where it reached epidemic proportions. Data from health units in the districts of southwestern Uganda in 1996, 1997 and 1998 reveal an increase in the cases of malaria cases ranging from 23% in Rukungiri to 135.5% in Mbarara district (Ministry of Health, 1998).

Table 3.11: 1998 malaria cases compared with 1996 and 1997 for the month of February

Source: Ministry of Health (1999)

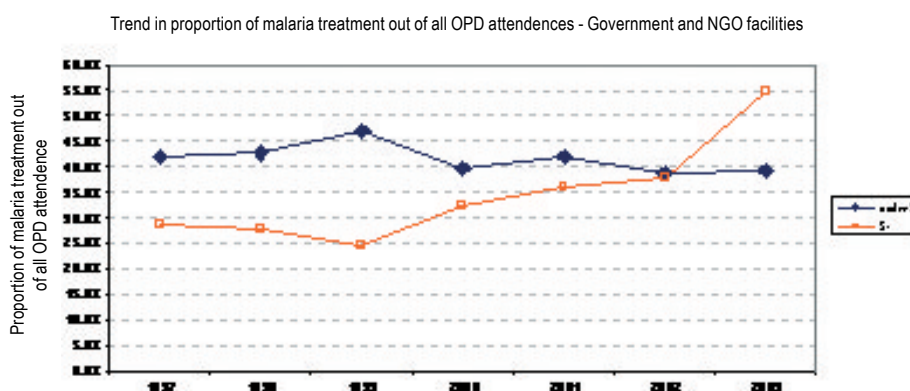
District	% Malaria cases as proportion of all diseases registered in health units			% Increase
	1996	1997	1998	
Bushenyi		25.5	33.3	30.5
Kabale	20.1	22.7	34.4	51.5
Kisoro	18.0	19.0	25.0	31.0
Mbarara	31.6	29.3	69.0	135.5
Ntungamo	31.7	32.2	46.0	43.0
Rukungiri	33.0	39.0	48.0	23.0

Figure 3.10 shows a trend in malaria cases for children five and above years of age and a decline in under-five years, while figure 3.11 shows a sharp trend in both cases. Indeed, malaria has been identified as the most serious killer disease. According to the Malaria Control Programme (2002) malaria causes more illness and death in Uganda than any other single disease. It is responsible for more than 15% of life years lost due to premature death. It accounts for about 15-40% of outpatient's attendances at health care facilities and about 9-14% of deaths of inpatients. Epidemics of varying severity and extent occurred in these areas in 1992, 1994, 1997/98 and 2000/2001.

Fig. 3.10

Malaria treatment compared to total out patiente in government and NGO facilities.

Source: Ministry of Health

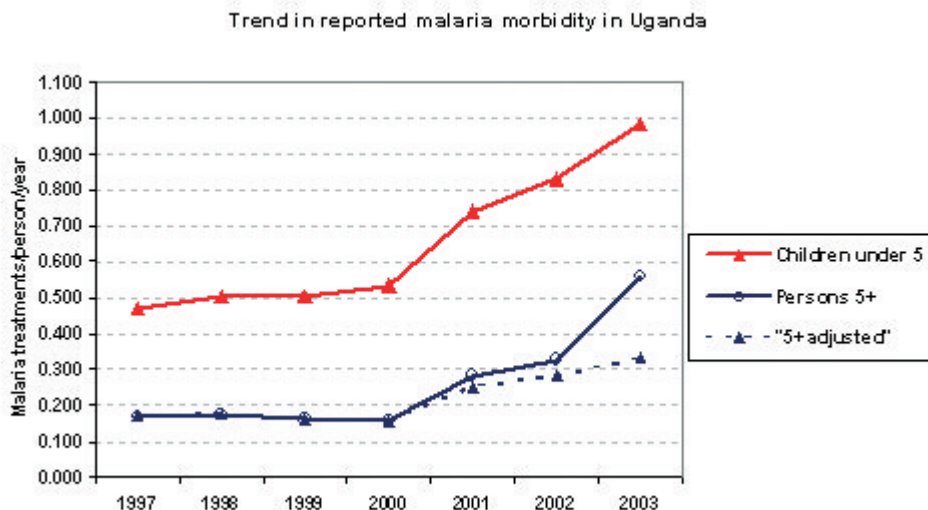


The PRA findings revealed an increase in malaria prevalence in originally malaria-free belts, particularly in the highland ecosystems. The populations in these areas have no protective immunity and this exposes them to high infection rates, morbidity and mortality. In Kabale for example, the rise in temperatures created conditions for the proliferation of mosquito breeding sites.

Fig.3.11

Reported malaria morbidity in Uganda

Source:
Ministry of Health



b) Injuries and loss of lives

Floods are associated with death and injury to human population. Direct loss of lives is particularly high in the highland ecosystem (Table 3.5). At national level, during the 1997/8 El Nino floods and landslides, about 1,000 people died in flood-related accidents, and 150,000 were displaced from their homes. In Mbale and Kapchorwa, for example, 60 people were injured and 33 died in the 1997/98 El Nino floods and landslides. In Rakai the hailstorms of 2005 resulted into three deaths and displacement of 2,800 people. Violent windstorms also claimed many lives when boats capsized on lakes. In one incident, 21 people lost their lives when a boat traveling to Kalangala capsized on Lake Victoria.

c) Health infrastructure

Weather conditions also affected the road network by destroying bridges thus jeopardizing the distribution of drugs and other supplies to the affected areas. Extreme weather and climate events weakened the infrastructure of health services, especially in the highland ecosystems. In Mbale, Kapchorwa, Kabale and Kasese, heavy rains associated with landslides and flooding disrupted transport, leading to difficulties in providing health services. Health facilities, latrines and water sources were washed away. This led to outbreaks of communicable diseases. In Rakai, hailstorms of 2005 destroyed River Bukora Bridge, caused siltation on Lakes Kijanibarora and Kakyera, and polluted water sources.

d) Nutrition

PRA findings indicated that heavy rains, thunderstorms, hailstorms, landslides and floods destroyed food crops leading to food scarcity. In 2004, heavy rains, thunderstorms and lightning, led to severe famine in Kabale especially in the sub counties of Muko, Burambo and Karambo. In 1936, floods and landslides were followed by two years of severe famine in Mbale. Landslides have become more frequent in the highlands. Food scarcity results into nutritional insufficiency with serious health consequences. Overall, food insufficiency and malnutrition accounted for 36% of the reports in the district PRAs. The floods also resulted into the destruction of root crops like cassava, Irish and sweet potatoes, leading to poor nutrition. Severe droughts also led to food and nutritional insecurity because of crop failure, increase in livestock diseases, increase in crop pests like bean aphids, and prevalence of bush fires. The droughts have also become more frequent and intense (Figure 3.1).

3.1.4 Vulnerability of forestry sector

Climate change induced changes are likely to affect forests and wildlife in various ways. The impacts manifest through a number of extrinsic and intrinsic reactions. In wildlife, extrinsic behaviour involves movement to hostile environment in search of food and water. Intrinsic manifestations involve imbalance in physiology leading to phenomena, such as reduced immunity and also hormonal imbalance giving rise to disruption in reproduction.

Extreme weather and climatic events such as windstorms and flooding can destroy and kill trees on a massive scale as observed in Bwindi Impenetrable National Park (BINP). However, trees and forests, on the other hand, are generally resilient and respond to the impacts of climate change very slowly and insidiously. To illustrate this, a genuine climate-induced shift in phenology of leafing, flowering and fruiting of forest trees may not be attributed to climate change since such a phenomenon can easily be fitted into natural cyclical patterns. Watson (2001) stated this dilemma succinctly: climate change may lead to conditions unsuitable for the establishment of key species but the slow and delayed response of long-lived plants hide the importance of the change until the already established individuals die or are killed in a disturbance.

Similarly, unlike the animals, migration of trees and plants to track environmental shifts induced by climate changes, in general, is seriously curtailed. Watson (2001) noted that fossil records indicate that the maximum rate at which most plant species have migrated in the past is about 1 km per year. Known constraints imposed by the dispersal process (e.g. the mean period between germination and the production of seeds, and the mean distance that an individual seed can travel) suggest that, without human intervention, many species would not be able to keep up with the rate of movement of their preferred climatic niche projected for the 21st century, even if there were no barriers to their movement.

The heavy cutting and burning of the forest cover contributed to land and soil degradation. This practice over the years has created fertile grounds for susceptibility to climate change the fragile ecosystems (cattle corridor) and highlands. In such fragile ecosystems, deforesting and/or degrading forests predispose poor communities to climate change disasters (e.g. landslides), exacerbate the severity of some disasters (e.g. floods and windstorm) and trigger a downward spiral of food insecurity and its consequences.

The disappearance of medicinal plant species was consistently reported. This is serious because a large proportion of the rural population depends on direct herbal medicine to treat a wide range of ailments. The disappearance is mainly related to changes in the ecosystems, land degradation and unsustainable use. The loss of herbal plants was most prominent in highland ecosystems (Table 3.5).

3.1.5 Vulnerabilities of wildlife sector

Droughts, heavy rainfall and high temperatures are the most significant disasters affecting wildlife (Table 3.12). The vulnerabilities of the wildlife are presented based on disasters.

Table 3.12: Disasters in national parks and wildlife reserve based on PRA

Disaster	%
Drought	28
Heavy rain	27
High temperature	27
Wind storm	9
Lightening	9

a) Impacts of drought on wildlife

Various forms of drought-induced vulnerabilities were identified depending on geographical locality. Generally, protected areas in the lowland dry up as a result of drought. This loss of water triggers many types of vulnerabilities for example migration of people and animals, outbreaks of bush fires and soil erosion (strong winds).

(i) Incursions

Various forms of incursion into the Protected Areas (PAs) are experienced because of drought. Pastoralists drive their cattle into the PAs in search of pasture and water. In Lake Mburo National Park (LMNP), over 300,000 cattle entered the park to access water from river Rwihizi, thus degrading over 100sq km of park (Adonia, Personal communication). Refugees from Nakivaale and Oruchinga Valley and the neighbouring communities enter the park to harvest wood and herbal medicine as well as poaching on the wildlife. In Toro-Semiliki Wildlife Reserve (TSWR), the pastoralists are refugees from DR Congo and neighbouring communities. Although the PA-degrading incursions by Congolese refugees are a menace to wildlife, they are sometimes a source of security-related information. In Bwindi Impenetrable National Park (BINP), people from neighbouring communities encroach into PA leading to disease transmission, namely, game to livestock and vice-versa (e.g. tick borne diseases in LMNP and TSWR) and people to gorilla and vice-versa (e.g. influenza in BINP). Wild animals invading *shambas* (fields) cause community-PA conflicts. In such situations, if the conflicts are not properly resolved, animals may be killed.

(ii) Wild fires

Protected Areas experience drought-induced wild fires set by, poachers (Lake Mburo National Park (LMNP) and Toro-Semiliki Wildlife Reserve (TSWR)) and refugees from Congo (TSWR) and Oruchinga and Nakivaale in LMNP. Wild fires are highly destructive to wildlife, both fauna and flora, below- and above-ground; although plants, which regenerate after the fires provide luxuriant, pasture for grazers and browsers. Poachers often take advantage of the wildlife's love for luxuriantly regenerating post-fire pasture. Another strategy is to set fire outside the park or reserve to lure wildlife for poaching, for example in TSWR.

(iii) Migration of animals

Many wild animals in LMNP migrate to Tanzania and those in Toro-Semiliki Wildlife Reserve (TSWR) to DR Congo. Migration is a coping strategy although the wildlife may encounter hostility in the new environment such as poachers. Migration may be localized to swamps, as is the case in LMNP, where game animals invade swamps to find more hospitable environment. However, in the process some animals such as zebras often get stuck in mud. This makes PA staff pre-occupied with rescue activities. Very often, the drought-induced movement contributes to increased tendency of wild animals to hide, thus making the affected PA less attractive to tourists. This undermines the campaign for increased tourism as a source of foreign exchange for Uganda.

(iv) Drop in water level

River courses through PAs experience drop in water level. At the time of this study, River Rwizi in LMNP was reported to have dropped 4 metres below previous level (Abaho, Personal communication). Drop in water level causes disruption in wildlife ecotone activities associated with riverbanks, as animals have to struggle to move down to the new water level.

(v) Disruption of biological Clock

Disruption of biological clock was identified as one of the drought-induced vulnerabilities in LMNP associated with poor feeding. This phenomenon affects the reproductive cycle in both wild and domestic animals by interrupting hormonal balance.

b) Impacts of heavy rain on wildlife

(i) Destruction of infrastructure

Destruction of infrastructure takes place in different forms depending on the geographical location. It is experienced in many PAs; for example, in BINP roads and footpaths are obstructed by fallen trees, while in TSWR roads and houses are destroyed. Sometimes the destruction of infrastructure (roads) is compounded by increased incidences of landslides in BINP.

(ii) Loss of life

The Mountain Gorilla, of which half of the world's population is found in Uganda, is also under threat from climate change (www.peopleandplanet.net/doc.php?id=1036). In the present study, park managers reported that three infant gorillas born in the BINP during the 1997/8 El Nino died. Another three infant gorillas were reported dead in Buhoma during the heavy rains of April 2005. Loss of life during heavy rain was recorded also among people in TSWR.

(iii) Destruction of flora

During heavy rains many trees fall down by wind in BINP. This opens the canopy, which in turn encourages natural regeneration of vegetation, some of which are preferred food plants for gorillas.

(iv) Lightning

Climate change will lead to increase frequency of extreme weather and climate events, including heavy falls. In connection with increased incidences of heavy rain, incidences of lightning were reported to be on the increase in BINP. In the same park, lightning disrupts the functioning of the Repeater Communication System. Occasionally, human life is threatened by lightning, an example being one that occurred there in 2005.

c) Impacts of high temperatures on wild life

The distribution of plants and animals is determined by temperature and moisture patterns. The distribution may change as a result of geographical shifts, changes in species composition or extinction. According to Hopkin's bioclimatic law, for every three degrees Celsius rise in temperature, there is a northward shift (in vegetation) of 250km. It is predicted that climate change could alter the range of African antelope species generally in the 21st Century. More than 90 per cent of the world's 80 antelope species are found in Africa. The loss of sensitive species limits biological diversity, but the loss of key species, which play a role in the support of others may lead to a chain of extinctions.

The reported recession of glaciers on the Rwenzori Mountains has potential repercussions for wildlife specialized to living in the mountain or alpine habitats as well as for those living down below the mountains but depend on the mountains as a vital water source.

New aspects of vulnerabilities in highland ecosystems were noted during the PRA. Infrastructures, namely mountain bridges in RNP, have been destroyed by snow melting owing to temperature increase. The melting of snow brought about increased complication in walking on mountain rocks, because RMS members and wildlife staff were previously walking and life saving on snow rather than rock surface. The emergence of complication in walking on rock brought about necessity to train in rock-climbing and walking by RMS staff.

Furthermore, snow melting has reduced the number of ice caps from six (Speke, Stanley, etc) to two (Margareta and Alexandra). Nostalgia, the socio-cultural anxiety, for the legacies associated with the sight of snow and its seasonality is a constant bother in the minds of many communities

adjacent to RNP. The importance of this is that the communities are strongly committed to the protection of the Rwenzori Mountains. Another source of nostalgia identified among RMS community is reduction of snow. Some fauna, namely butterflies (at Nyakalengiko) and mushrooms are now rare in RNP as a result of temperature increase. The upward expansion of ecological zone is likely to bring an increase in socio-economic conflict as the human population seeks new cultivatable land at higher altitude. The excess heat caused by warming causes discomfort among PA staff, making attention to wildlife more cumbersome.

3.1.5 Conclusion

Climate change negatively impacts on the main ecosystems (section 2.2) in various ways depending on disaster (Table 3.13). Drought is the single most important and widespread disaster in Uganda. It is increasing in frequency and severity, particularly in the semi-arid areas (Cattle Corridor). It impacts on a wide range of ecosystems, sectors and key social and economic programmes. The rural poor, whose livelihoods are dependent on natural resources, are directly most affected. Storms, heavy rains and floods are the second most important cluster of disasters. This cluster of disasters negatively impacts on key sectors such as water resources, health, soils, wildlife and infrastructure. Loss of lives and physical injuries are associated with this cluster of disasters. The impacts of this cluster of disasters are most pronounced in the highland ecosystems.

Table 3.13 Summary of key disasters and their impacts

Disasters	Impacts	Comments
Droughts (frequent and prolonged)	Famine, malnutrition, pasture insufficiency, lack and disappearance of pastures, water stress, drop in water level in our water bodies, low production and productivity of crops and animals, poor health, poverty	The most dominant and widespread disaster more pronounced and severe in the semi-arid drylands areas. It negatively impacts on ecosystems and social and economic development.
Storms, floods, heavy rains, landslides	Epidemics of pests and diseases, water pollution, direct loss of lives, soil erosion and land degradation, destruction of infrastructure	The second most important cluster of disasters, which also negatively impacts on key sectors.
High temperatures	Wild fires and burning leading to destruction of natural vegetation, destruction of biodiversity	Impact of high temperatures on agricultural production needs to be investigated
Pests and disease epidemics	Outbreaks of epidemics of pests and diseases, poor health, low production and productivity of crops and animals	This disaster poses serious health problems and can significantly affect social and economic programmes

4.1 Introduction

Climate has varied and negatively affected communities in the past. Communities have responded and developed coping mechanisms to climate variability. These mechanisms were localized and therefore not accessible by other communities facing similar problems. The coping mechanisms have not been documented but passed from generation to generation. This chapter presents coping options and strategies derived from the PRA and literature review.

4.2 Coping strategies

PRA findings revealed that rural communities in Uganda had several options at their disposal for coping with climate change disasters/challenges. These, among others, should be considered when planning interventions. Resource constrained communities manipulate the options described below to develop coping strategies to avoid catastrophes from the adverse effects of climate change related disasters. However, some of the coping strategies have negative effects on the environment, e.g. bush burning resulting in biodiversity loss and soil degradation. It is against this background that the coping strategies were categorized into A and B as in sections 4.2.1 and 4.2.2.

4.2.1 Category A copying strategies

Coping strategies in this category generally have positive environmental impacts and tend to be innovative. These coping strategies should be encouraged.

a) Exploitation of aquatic resources

Communities adjacent to water bodies consider these resources as a common good. The intensification of the frequency of droughts and famine compounds the exploitation of these resources. Once disaster strikes, fishing activities intensify as an alternative livelihood option particularly where arable land is scarce. In some districts like Soroti and Lira, consumption of aquatic plants such as the water lily (corms) by humans increases. Promotion of aquaculture is a distinct technology, which should be strengthened for coping with drought.

b) Food preservation

This is a time-honoured technology and coping strategy practiced by many communities to ensure food security. Different techniques are used, for example sun drying, use of herbal plants and ashes to store food, use of honey to preserve meat and smoking. This indigenous knowledge (IK) is under-utilised and not documented. Therefore, there is a strong need to promote these strategies.

c) Herbal medicines

This is a time-honoured coping strategy practiced by many communities to treat common ailments e.g. malaria, diarrhea, wounds, worms, skin diseases, eye infections and coughs. There are increasing reports of malaria parasites showing resistance to malaria therapy. The increasing costs of malaria drugs, particularly new drugs, coupled with resistance to malaria drugs has increased and spread the use of herbal medicine to cope with malaria epidemics. Although some herbs have

been domesticated, the majority is in the wild and endangered by unsustainable use. There is need to develop guidelines on their use.

d) Alternative livelihood systems

These remain options in the event of failure by conventional crop and livestock farming. Charcoal burning, brick making, craft making, *bodaboda* cycling and hawking are among the alternative employment options which were identified. There is need to mainstream these activities into community development. However, the present charcoal burning, brick and craft making methods have serious negative environmental effects because the methods are not sustainable.. Alternative and sustainable approaches should be explored.

e) Under-utilized & non-conventional foodstuffs

Many of these foodstuffs are available in the traditional farming systems and in the wild. In times of food scarcity, households exploit these resources. Examples include wild yams (*modo, endagu*), *mulondo, matungulu*, honey and wild fruits. The eating of banana and sorghum varieties meant for brewing beer, cassava and jackfruit as a meal is another coping strategy. These foodstuffs and plants have either been neglected or are unknown to the detriment of their contribution to present and future generations. There is a strong need to promote these under-utilised food resources.

f) Water harvesting

This is a commonly practiced coping strategy. With the frequent droughts and water scarcity, communities have been harvesting water from various sources, e.g. ground, rooftop and stem runoffs. Various approaches are used to harvest and clean the water e.g. the use of Moringa seeds in Nyabushozi and communal dams. The harvested water is used for household use, livestock, crops, construction and brick making. In agriculture, stem runoff is used in drip irrigation of crop plants notably vanilla, bananas and vegetables. Water harvested from the ground run-off is stored in open and underground reservoirs (Fig 4.1) and used in various ways including soil conservation.

Fig 4.1

Construction of underground water reservoir.



g) Soil conservation

Coping strategies for soil erosion, landslides and soil degradation is through construction of infiltration ditches around homes, planting grass cover, terrace farming, digging trenches to divert runoff, mulching and tree planting,

h) Change in husbandry practices

Farmers have adopted different strategies for coping with severe effects of climatic extremes. During droughts, grazing and watering are manipulated to cope with feed and water scarcity and the high temperatures. To encourage the intake of poor quality roughage, animals are watered early in the day to cope with the high temperatures, so that by nightfall animals are sufficiently hungry to feed on the dew-moistened standing hay. Erratic seasons have led to shifting farming and staggering cropping calendars. This stresses farmers and lowers productivity. There is a need to strengthen meteorological services in order to provide timely weather and climate information early warning systems. The situation could be further improved if stress-resistant species are developed and promoted. The existing indigenous knowledge (e.g. phenology, husbandry, ethno-medicine, and weather forecasting) should be studied and integrated into the farming systems.

i) Self-help initiatives

This is a strategy where people come together in times of distress to help each other. They may function through formation of self-help community emergency groups and /or extended family network.

j) Traditional vector control

In times of increased mosquito populations especially during floods, communities use cow dung smoke to keep away mosquitoes from the homesteads.

k) Indigenous approaches to rainmaking and thunderstorm prevention

In some communities, special plants such as the *Mutete* and *Lwanyi* in Mbarara are believed to prevent thunderstorms, and are planted near homesteads. Similarly, not eating animals killed by lightning is believed to prevent recurrence of thunderstorms. It is, however, doubtful whether these coping strategies are not based on superstition. It is crucial that working closely with the practice owners may help to unravel the socio-cultural dimensions of these strategies.

l) Increased law enforcement

During droughts law enforcement is intensified in protected areas to counteract the intensified poaching and hunting activities.

m) Hygiene and sanitation strategies

During floods, communities are exposed to a number of hygiene and sanitation diseases. Communities intensify observing hygiene practices including water boiling, hand washing and awareness campaigns. There is a need to strengthen adherence to good hygienic and sanitation practices.

n) District disaster management committee

In response to increased disaster frequencies, districts have put in place district standing or rapid response committees to deal with disasters.

o) Renting land

Where floods displace people, for example in Lira, people have to resort to renting land for agriculture through a barter system using the produce and/or livestock.

p) Bush burning

Bush burning is done by pastoralists to improve pastures and by hunters to trap wildlife. Although controlled bush burning may improve pasture quality, it is associated with immense loss of biodiversity and emission of green house gases. However, controlled bush burning is a useful tool in forestry and park management. An economic analysis of this strategy is essential. Options for pasture supply need to be explored to reduce pressure on the rangelands. Communities need to be made aware on the best practices for bush and rangeland management.

4.2.2 Category B coping strategies

Coping strategies under this category have either negative environmental impact (bush burning and migration into wetlands) or distressful physiological effects. Unplanned coping strategies should be discouraged.

a) Shifting cultivation

Arable land for agriculture is the first resource for every rural household. However, with increasing populations, this land is fragmented and decreasing per household, leading to encroachment on natural forests, grazing land, wetlands and rangelands. Land degradation and renting arable land are on the increase. With arable land per household decreasing at a rate of 2.5%, there is need to promote intensive agriculture and productivity.

b) Incursions

Incursions occur in situations where pastures, water and other resources are scarce or degraded. Pastures are an important resource for livestock keepers and wildlife. Lack of water and pastures due to droughts is a major cause of incursions. This is particularly prominent in areas where pastoralism is a major form of livelihood.

c) Migrations

If affected communities have no option for coping with climate-induced stress, especially in drought-prone areas then, victims migrate to urban areas or resource-endowed neighbourhoods. In the lakeside communities e.g. Nakasongola, migration includes settling on suds (floating islands). This strategy causes social and economic conflicts, which may lead to instability, family disintegration and related conflicts. The movement of livestock and wildlife often ensures their survival. However, it is one of the biggest modes of disease spread. Migrating animals also suffer physical injuries and death. In the protected areas such as the national parks and game reserves, these negative aspects of the strategy are more pronounced. In the pastoral communities where livestock is the major source of food, migration of the men (family leaders) with the livestock herds in search of water and pasture often leaves the family behind more vulnerable to famine.

d) Sale of assets and use of starter stock

It is normal in subsistence agriculture to reserve starter seeds and herds for future production. However in times of food scarcity these reserves are eaten or sold. Also land that is a primary asset for production is often sold at such times. The practice of ensuring food reserves should be revived, strengthened and enforced.

e) Encroachment on wetlands

This is normally during droughts when rain-fed agriculture has failed. This destroys the wetlands thus changing the microclimate. Availability of water for agriculture on arable land is therefore a preferred solution to this practice. Small-scale irrigation schemes should be explored.

f) Exploitation of forest and wildlife resources

These are sources of diverse products (e.g. wood, craft materials, medicine and foods) and services (microclimate moderation, sanitation, and water catchments). With increasing stress, exploitation of these resources is increasing. There is therefore an urgent need to promote sustainable use of these resources. This could be enhanced by a land use policy.

g) Famine marriage

In times of food crisis, some parents distressfully marry off their daughters to secure dowry for survival. In some cases women and men elope to avoid famine and poverty. Some rich men are often ready to take young women. This fuels early marriages, drop out of schools and exposure to sexually transmitted infections and related reproductive complications.

h) Change in eating behaviour

Where the victims have no option, they resign to fate. The only options to prolong life and avert death include reducing number of meals per day, food rationing and eating wild foods (animals, fruits and tubers).

i) Hunting of wild birds and animals

Hunting of wild birds and animals in both gazetted and non-gazetted areas is practiced in many districts where traditional agriculture has failed e.g. Pallisa, Lira and Soroti .

j) Idling

Idling is due to lack of three factors: food, livelihood and economic activities. Idleness is often associated with social problems like drug abuse (alcohol, marijuana, *mayirungi*), stealing, robbing and other social crimes. This problem is dominant among the youths and is an area that needs to be addressed, e.g. by providing alternative livelihood options.

4.3 PRA Recommendations and interventions

The communities made a number of recommendations. These were analyzed and categorized into major themes and issues as in Table 4.1. The percentage represents the proportion of a given recommendation by the respondents. However, it is important to note that there are recommendations unique to individual ecosystems, districts and sectors, which are addressed in the next section.

Table 4.1: PRA recommendation categories for coping with climate change

Category	% of Respondents
1. IK documentation and awareness creation	20
2. Farm forestry	18
3. Water resources	16
4. Weather and climate information	11
5. Policy, legislation and planning	11
6. Land and soil management	9
7. Disaster preparedness	7
8. Alternative livelihoods	4
9. Health	2
10. Infrastructure	2

4.3.1 Area-specific recommendations

Protected areas (PA) are typically characterized by frequent incursions of people and livestock in search of specific resources. To alleviate this problem the UWA recommended:

- Provision of permanent water sources to communities outside PA;
- Creation of migration corridors on one side of the PA;
- Reviewing of carrying capacity of land outside PA for cattle keepers;
- Growing trees for fuel wood outside PA;
- Protection of RNP bogs (swamps) by constructing wooden walk ways;
- Degazetting of part of the wildlife reserve to secure Toro Semliki; and
- Marking park boundaries by planting trees.

4.3.2 Recommended tree products

During the PRA, respondents were asked to specify the tree species they would prefer to grow for various products. The tree products demanded in the target ecosystems were as summarized in Table 4.2. It is obvious from the summary that the demand for tree products varied with ecosystem. Nevertheless, the demand trend was persistent: fruit, firewood, timber and poles were in great demand except in the aquatic ecosystem where fruit trees are not important in rural livelihoods (Table 4.2). The high demand for fruit trees in highland, semi-arid and Lake Basin ecosystems (Table 4.2) seems to be a response to the ready fruit markets in urban centres. Fruit trees are the best entry points for the introduction of farm forestry (John Okorio, personal communication) as demanded by many communities (Table 4.1).

Table 4.2: Demand (% score) for tree products in various ecosystems

Product	Ecosystem				
	Highland	Lowland	Semi-arid	Lake Basin	Aquatic
Firewood	22	21	16	0	50
Timber	22	37	24	19	10
Pole	11	25	12	25	0
Fruit	41	11	36	37	20
Medicine	0	5	8	13	10
Shade	4	0	4	6	10

Chapter 5.

Prioritized Interventions and Implementation Framework

5.1 Introduction

Climate variability and its impacts have led communities to develop coping strategies to climate-related disasters such as droughts, floods and storms. However, frequency of these events was low and therefore coping mechanisms have not been documented, developed or popularized but have been passed from generation to generation through traditional and cultural practices. The literature review and the participatory rural appraisal (PRA) informed and guided the preparation of the Ugandan NAPA.

The criteria developed and described in Chapter Two were used to rank the identified intervention areas and key activities. The outputs of the ranking are summarized in Tables 5.1, 5.2 and 5.3. Table 5.1 summarizes the prioritization of the PRA intervention areas by the community and technical officers using the first tier. The first three columns of Table 5.1 show the preference of the respondents, and the remaining columns of the Table show the scores and ranking obtained by applying the first tier. Examination of the Table reveals that the prioritization by the communities has been improved by taking into account the relevant importance of the intervention areas to the national development goals. For instance, the health sector was rated lowest (2%) and yet it is viewed as a critical sector to achieving poverty eradication. It is now rated 4 while research and awareness creation is downscaled from 1 to 6. Farm forestry and water resources remain unchanged, indicating their relative importance in the overall development of Uganda.

Table 5.1 Prioritized interventions issues (areas)

Intervention area	PRA Rating		First Tier Rating				
	Proportion (%)	Rank	PEAP	MEAs	Equity	Scores	Rank
IK documentation and awareness creation	20	1	3	2	1	6	6
Farm forestry	18	2	4	3	3	10	2
Water resources	16	3	3	3	3	9	3
Weather and climate information	11	4	3	3	1	7	5
Policy and legislation	11	4	2	2	1	5	7
Land and land use	9	5	4	4	3	11	1
Health	2	6	4	2	2	8	4
Infrastructure	2	6	2	1	1	4	8
Total	100					60	

The second tier (community/ecosystem level) was used to obtain the scores, which were weighted to reflect the relevance of these strategies in the national development goal, and the first 17 key intervention strategies are presented in Table 5.2. A total of 53 intervention strategies were derived from the community coping strategies.

Table 5.2 Prioritized (top 17) intervention strategies

Sector	Key intervention strategy	Score	Weighted score	Rank
Agriculture	Promote community best practices of collaborative natural resource management	20	3.67	1
Forestry	Promote tree growing in farmland	20	3.33	2
Forestry	Promote the cultivation of forest medicinal and edible plant (e.g. Malewa) species outside PAs	18	3.00	3
Water resources	Promote community best practices of collaborative water resource management	20	3.00	3
Wildlife	Promote use of trees in demarcation of PAs	18	3.00	3
Wildlife	Enhance water supply to communities adjacent to PAs	20	3.00	3
Water resources	Scaling-up of water and sanitation using appropriate technologies	18	2.70	4
Water resources	Expand access to safe water	18	2.70	4
Water resources	Promote appropriate and sustainable water harvesting, storage and utilization technologies	18	2.70	4
	Community sensitization and advocacy	23	2.30	5
Health	Improvement and expansion of health infrastructure	16	2.13	6
	Study and promote traditional food preservation technologies	20	2.00	7
Weather and climate information	Expansion of weather observing network	17	1.98	8
	Promote use of IK as coping mechanism	19	1.90	9
	Develop and promote drought-tolerant and early maturing plant varieties and animal breeds	19	1.90	9
	Promotion of multimedia approach to dissemination of weather and climate information	19	1.90	9
Forestry	Integrate climate change issues into the sectoral planning and implementation	22	1.83	10

The strategies in Table 5.2 were ranked using the third tier criteria, which focused on NAPA objectives of immediacy, urgency and magnitude of the problem. The final list of prioritized and ranked intervention strategies is presented in Table 5.3.

Table 5.3 Final list of prioritized intervention strategies

Sector	Intervention strategy	Urgency	Immediacy	Magnitude	Total score	Rank
Forestry	Promote tree-growing in farmland	4	4	4	12	1
	Strengthen Community sensitization and advocacy on climate change-related issues	4	4	4	12	1
Weather/climate information	Expansion of weather observing infrastructure (networks)	4	4	4	12	1
	Promotion of multimedia approach to dissemination of weather and climate information	4	4	4	12	1
Water resources	Scaling-up of safe water supply and sanitation using appropriate technologies	4	4	3	11	2
Water resources	Promote community best practices of collaborative water resource management	3	3	3	9	3
	Develop and promote drought-tolerant and early maturing plant varieties and animal breeds	3	3	3	9	3
Forestry	Integrate climate change issues into the sectoral planning and implementation	3	3	3	9	3
Water resources	Promote appropriate and sustainable water harvesting, storage and utilization technologies	3	3	3	9	3
Agriculture	Promote community best practices of collaborative natural resource management	3	2	4	9	3
Wildlife	Promote use of trees in demarcation of PAs	2	2	4	8	4
Wildlife	Enhance water supply to communities adjacent to PAs	3	1	3	7	5
Health	Improvement and expansion of health infrastructure	2	2	3	7	5
Forestry	Promote the cultivation of forest medicinal and edible plant species outside PAs	2	2	3	7	5
	Promote the cultivation of forest medicinal and edible plant (e.g. Malewa) species outside PAs	2	1	3	6	6
	Promote use of IK as coping mechanism	2	1	2	5	7
	Study and promote traditional food preservation technologies	1	1	1	3	8

The first five intervention areas resulting from use of the first tier in Table 5.1 were selected for analysis of the consistency of the three criteria. The results of the analysis are presented in Table 5.4. It is quite clear that the results of applying the three criteria are consistent, particularly in the first four sectors.

Table 5.4 Analysis of the results of application of the tiers

Sector	Position		
	1 st tier	2 nd Tier	3 rd Tier
Forestry	2	2	1
Agriculture	1	1	3
Water Resources	3	3	2
Health	4	4	2
Weather and Climate Information	5	8	1

5.2 Implementation framework and institutional arrangement

The Ministry of Water, Lands and Environment, the focal institution for the UNFCCC and its Kyoto Protocol, coordinated the preparation of the NAPA. The Ministry of Water, Lands and Environment, recognizing the crosscutting nature of climate change and the need for broad participation, has established an institutional framework to coordinate the implementation of the UNFCCC and Kyoto Protocol. The institutional framework comprising of a multi-sectoral and multi-disciplinary National Climate Change Steering Committee and a Secretariat advises the Minister of Water, Lands and Environment on approval of CDM projects and climate change policy issues. The National Climate Change Steering Committee will provide an overall oversight for the implementation of the NAPA. The National Climate Change Steering Committee Secretariat, under the guidance of the National Climate Change Steering Committee, will coordinate the implementation of the NAPA and liaise with the UNFCCC Secretariat. It will also report to the Conference of the Parties on the implementation of the NAPA. The National Climate Change Steering Committee Secretariat, to the extent possible, will also assist with identification of sources of additional funds.

NAPAs were designed to address specific urgent and immediate problems faced by communities. Therefore the NAPA projects will be executed at field level and directly supervised by line institutions at the district. Supervising line institutions will report on progress of project implementation to the Ministry of Water, Lands and Environment. The Ministry of Water, Lands and Environment will be the recipient of NAPA funds although line institutions will be responsible to the Ministry for accountability and submission of audited reports as per guidelines of the Auditor General.

5.2.1 Plan of implementation

The list in Table 5.3 was re-organized to remove duplicates and developed into project matrix. A total of nine projects, based on recommendations and findings of PRA, including Table 4.1 and coping strategies, and technical knowledge, were identified. The matrix was used to develop the project profiles. The project profiles, based on the prioritized and ranked intervention strategies, are in the order of priority. This is consistent with the objectives and guidelines of NAPA.

The project profiles are generic and not area specific. However, priority intervention areas can be deduced from the results of the PRA. For instance the “Community Tree Growing Project”, which aims to reduce deforestation and land degradation is most needed in the densely populated and deforested highlands (prone to land slides) and the semi-arid dry lands areas. Although the “Strengthening of Meteorological Services” is national in nature priority will be given to semi-arid areas, which have sparse climate observing stations and yet rainfall in these areas is marginal. Weather and climate information is most needed in the marginal rainfall areas.

Notwithstanding the urgent need to implement the Ugandan NAPA, there are a number of barriers that hinder effective implementation of the identified and prioritized interventions. To the extent possible some of the above issues should be factored into the projects. The barriers include:

- Inadequate understanding of climate change and its impacts, thus creating a barrier to resource allocation;
- Inadequate technical capacity;
- Inadequate financial resources; and
- Weak institutional and coordinating mechanisms.

The preparation of NAPAs has not only raised awareness particularly at district and community level, but also hope and expectations. Implementation of the prioritized NAPA projects is therefore urgent. The cost of adaptation is high. Even the cost of the nine NAPA projects is relatively high. This therefore calls for concerted effort by the Government of Uganda, the climate change process and development partners. It is hoped that the funding of NAPA projects will stimulate interest among the key stakeholders and also lead to changes in planning approaches resulting into integration of climate change issues into development planning.

The climate change process view NAPAs as a success story and indeed, a learning-by-doing activity from, which other developing countries could learn. However, the success of NAPAs will depend on the actions taken to meet the expectations of the vulnerable communities to whom NAPAs have raised a ray of hope. Table 5.5 gives the estimated cost of implementing the nine NAPA projects. The total cost is US\$39.8m. However, it was recognized that financial resources may be limited and therefore the activities may only be implemented in limited but very high-risk areas. The total cost drops down to US\$23.3m, starting with the high priority because it will have far reaching impacts. The first project will also aim at demonstrating the social and economic benefits of adaptation to climate change in the overall development process.

Table 5.5: Estimated cost of NAPA projects

No	Project Title	Immediate and Urgent Interventions Across Ecosystems	
		Limited Area Interventions	Country Wide Interventions
1	Community Tree Growing Project	3.2	5.5
2	Land Degradation Management Project	2.5	4.7
3	Strengthening Meteorological Services	4.2	6.5
4	Community Water and Sanitation Project	2.8	4.7
5	Water for Production Project	4.0	5.0
6	Drought Adaptation Project	2.0	3.0
7	Vectors, Pests and Disease Control Project	3.5	8.0
8	Indigenous Knowledge (IK) and Natural Resources Management Project	0.6	1.2
9	Climate Change and Development Planning Project	0.5	1.2
Total		23.3	39.8

5.2.2 Project Profiles

The project profiles are presented below in the order of priority.

PROJECT 1

Title: Community Tree Growing Project

Justification:

In Uganda, forestry contributes substantially to economic development and well being of her citizens. The contribution comes either in direct or indirect forms. Unfortunately, the contribution of forestry is not fully recognized in the national accounting system. And yet as implied above, there are many opportunities for exploiting forestry for poverty alleviation, economic development and environmental improvement.

Conservative estimate indicates that the contribution of forestry to the nation's GDP is 6%. Mountain gorilla tourism, a forest-based enterprise earns the country Ushs 2.7 billion yearly. The value of non-timber products derived from forests is also

significant. Similarly, the biodiversity value within forest ecosystems contributes to the economy of Uganda. Values of regulating services are difficult to quantify, although they are integral to agricultural productivity, climate regulation, soil and water conservation and nutrient recycling.

The rural population of Uganda depends on forest resources for basic subsistence needs. For example, over 99% of the national energy demand is met from wood fuels. Large volumes of poles and timber are also used for construction, furniture making and other manufactures. Similarly, forest sector creates significant employment probably the equivalent of one million jobs. Of these, perhaps 100,000 are in the formal sector and the majority in the fuel wood and charcoal production.

Characteristically, the productivity of Uganda's natural forests is low and has all along been known to be unable to satisfy demand of the population. Hence, a deliberate policy of tree planting was promulgated way back in the 1940s. The implementation of this policy was disrupted during the political upheavals that the country went through. This interruption has created a gap of about 30 years in the national tree-growing programme. This period coincided with onset of the ever-increasing national demand for forest products, thus weakening the inherent low productivity of the natural forests and woodlands. The combined consequence of the two scenarios is two fold: severe scarcity of forest products and widespread environmental degradation. During data and information collection and the subsequent stakeholder consultations, participants overwhelmingly identified the problem of land and forest degradation as a principal factor causing rural poverty. This project is a response to this environmental complex problem and aims at empowering the vulnerable communities to produce planting materials of tree species of their choice and grow them to meet demands for forest products and services.

Objective and activities

The objective of this project is to increase tree cover in vulnerable and resource-constrained communities. To achieve this objective the following activities will be conducted:

- Stakeholder analysis,
- Baseline surveys to identify constraints to tree growing in target communities,
- Develop and promote growing of suitable high value trees,
- Promote community involvement in planning, monitoring and evaluation,
- Promote best practices in land use management,
- Identify and promote synergies,
- Develop seedling production systems,
- Develop and enforce byelaws for tree growing and,
- Enhance and promote energy-saving technologies and alternative energy sources.

Inputs

To implement the project a number of inputs are required. Tentatively the following inputs are envisaged: human resource of various professions, equipment and supplies, and vehicles.

Outputs

The following short-term outputs are expected to accrue from the project:

- Stakeholder preferences for tree products
- Constraints to tree growing and ways and means of solving them at community level identified
- Pamphlets on growing of suitable tree species available and distributed to communities
- Community-based nurseries and multiplication centers run by trained community-based extension workers
- Wood lots
- Byelaws made at community level
- Incentive-based enforcement of byelaws at community level and
- Trained and equipped community-based technicians in land use management

Two long-term outputs accruing from the project will be: (i) increased availability of tree products and services in the communities and (ii) increased employment opportunities in the forest industry.

Implementation

The lead institution for implementing the project will be Forestry Resource Research Institute (FORRI) of the National Agricultural Research Organization (NARO). Collaborators for implementing the project will be drawn from NFA, MWLE, MAAIF, ENR/SWG, NAADS and Department of Information in the President's Office.

Risks and Barriers

Possible risks and barriers to the implementation of this project:

- Limited knowledge of tree growing
- Natural hazards and pests
- Insufficient funding, and
- Civil conflicts

Monitoring and evaluation

This important stage of project implementation will be a joint activity, involving the target communities. To facilitate the process a logical framework approach for the project will be designed in which milestones of achievements and their objectively verifiable indicators will be clearly specified.

Financial Resources

NAPA implementation will require financial resources from the Government of Uganda, Bi-laterals, Multilaterals, NGOs and CBOs. Financial Requirements will include but not be limited to: costs of training of communities, construction works, technology development, facilitation of project component personnel, production of manuals, stationeries, computers and other office accessories. Estimated total project cost is 5.5 million US\$.

PROJECT 2

Title: Land Degradation Management Project

Justification:

The economic and social development of Uganda depends on exploitation of its natural resources, including land. The rapid human population growth and demand for food, energy and other social services has necessitated the expansion of land under rain-fed crop and animal agriculture. Although land degradation is caused by poor land use, increasing climate variability and climate change that have been experienced in Uganda recently have gravely compounded this problem. Presently, soil erosion alone accounts for over 80% of the annual cost of environmental degradation representing 4-10% of GNP and estimated at about US\$ 625 million per annum.

The backlash of these actions is degraded soils, quest for more bush clearing, encroachment into forest reserves, reduced production of food and livestock, desertification, migration to towns to look for employment, loss of biodiversity and erosion of gene pools in agro-ecosystems. Therefore, integrated land use management to address the impact of climate change in the NAPA is crucial.

Objectives

To halt and reverse land degradation in climate change vulnerable and resource constrained communities in Uganda

Activities

The key activities of the intervention include:

- Sensitize and strengthen the enforcement of laws and byelaws
- Promote agricultural and land use best practices, and
- Scale up information management and communication system

Inputs

The inputs of this project include human resources, equipment (meteorological instruments, communication equipment, logistics to enable installation and maintenance of field equipment), technical assistance and financial resources.

Short-term outputs

- A number of byelaws made at community level
- Pamphlets on agricultural and land use best practices available and distributed to communities
- A number of community-based resource persons trained on agricultural and land use best practices

Potential long-term outputs

- Communities practicing land and water conservation
- Increased crop and animal production and productivity

Implementation

The Ministry of Water, Lands and Environment (Department of Meteorology) will be the official recipient and will delegate to the appropriate institutions to implement the project in close collaboration with key stakeholders such as local governments and civil society

Risks and barriers

- Civil conflicts
- Natural hazards and disasters
- Limited knowledge of tree growing
- Insufficient funding

Evaluation and Monitoring

The project will be evaluated every two years by a tripartite constituted by the Government of Uganda and relevant development partners. The project management will produce regular reports in accordance with the laid down monitoring plan of the project.

Financial Resources

NAPA implementation will require financial resources from the Government of Uganda, Bi-laterals, Multilaterals, NGOs and CBOs. Financial Requirements will include but not be limited to: costs of training of communities, construction works, technology development, facilitation of project component personnel, production of manuals, stationeries, computers and other office accessories. Estimated total project cost is 4.7 million US\$.

PROJECT 3:

Title: Strengthening Meteorological Services

Justification

Climate is Uganda's most valuable natural resource. It is not a mere natural resource, but a key determinant of the status of other natural resources such as water, land, plants and animals, on which the economic and social development of Uganda depends. Therefore, changes in Uganda's climate are translated directly to its economic and social performance.

In the past, communities knew their local climate well and it was predictable. Annual seasonal variations, particularly the onset

and cessation of rains were minimal. Therefore, weather and seasonal forecast did not make any difference and indeed climate prediction could be based on relatively few climate-observing stations. Today, under climate change, the situation is radically different because there is increased climate variability, and frequency and intensity of weather and climate events. Therefore, strengthening meteorological services to provide weather and climate information to the vulnerable communities is crucial.

Objectives

The main objectives of the intervention are to improve:

- Data collection and strengthen technical capacity; and
- Availability, accuracy and timeliness of weather and climate information and its use by the vulnerable communities.

Activities

The key activities of the intervention include:

- Expand and maintain weather and climate observing network
- Strengthen data collection, processing, analysis and interpretation
- Strengthen human capacity in weather observing, forecasting and information management
- Scale up information management and communication system
- Strengthen early warning system and its coordination mechanism
- Develop and package weather and climate information for vulnerable communities
- Sensitize communities on weather and climate information use
- Disseminate and promote use of weather and climate information
- Develop partnerships and synergies with media and other stakeholders
- Monitor and evaluate utilization of weather and climate

Inputs

The inputs include: human resources, equipment (meteorological instruments, communication equipment, logistics to enable installation and maintenance of field equipment), technical assistance and financial resources.

Short-term outputs

- Effective and adequate climate observing network
- Skilled and effective human capacity in climate management
- Functional and effective early warning system
- Increased use of weather and climate information by communities

Potential long-term outputs

- Accurate and timely provision of weather and climate information
- A community-based climate information distribution and management system

Implementation

The Ministry of Water, Lands and Environment will be the official recipient and the focal point will be Department of Meteorology to implement the project in close collaboration with key stakeholders such as local governments and civil society

Risks and barriers

- Civil conflicts
- Natural hazards and disasters
- Limited knowledge of tree growing
- Insufficient funding

Evaluation and Monitoring

The project will be evaluated every two years by a tripartite constituted by the Government of Uganda and relevant development partners. The project management will produce regular reports in accordance with the laid down monitoring plan of the project.

Financial Resources

NAPA implementation will require financial resources from the Government of Uganda, Bi-laterals, Multilaterals, NGOs and CBOs. Financial Requirements will include but not be limited to: costs of training of communities, construction works, technology development, facilitation of project component personnel, production of manuals, stationeries, computers and other office accessories. Estimated total project cost is 6.5 million US\$.

Time Frame

A period of 3-5 years is planned. Since there is an urgent need for adaptation to climate change, it should commence immediately.

PROJECT 4

Title: Community Water and Sanitation Project

Justification

In Uganda, the last few decades have seen an increase in the frequency and intensity of extreme weather events with serious socio-economic consequences. Increased frequency of heavy rains leading to floods and landslides, compounded by a poor sanitation system, pollution of water sources and damage to sanitation infrastructure has led to increased outbreaks of water borne diseases such as typhoid, cholera, bacillary dysentery and other water related diseases (e.g. malaria, bilharzias). For example, the 1997/98 *El Nino* phenomenon had a significant impact on the health sector. The cholera epidemic, first reported in October 1997 in Lolwe and Sigulu Islands of Bugiri District, hit Kampala City in early December and subsequently affected 39 districts. An estimated 41,857 were hospitalized, of whom 1,682 died. About 1,000 died in flood-related accidents and 150,000 displaced.

Objectives

- To increase access to safe water supply and improved sanitation among vulnerable communities in disaster prone areas.
- To strengthen community awareness on health impacts due to climate change
- To strengthen emergency & disaster preparedness & response programmes

Activities

- Sensitize communities on health impacts due to climate change
- Establish emergency & disaster management plans and enhance strategic planning for disaster preparedness & response.
- Special assistance to vulnerable people,
- Relocate communities to safer areas/districts,
- Scale up poverty alleviation programmes and control population overgrowth through Family planning programmes.
- Formulating appropriate policies and strategies, legislation, standards
- Enforce public health bye – laws including public sensitization on relevant laws in health, environment & agriculture.
- Scale up hygiene & sanitation activities,
- improve on safe water supply through construction of more protected water sources and gravity flow schemes,
- Scale up preventive public health programmes including vector control e.g. mosquito control and management of malaria.
- Constitute food security programmes and plant multi -purpose trees for wind breaking, timber & fruits,
- Re -introduce herbal plants from other areas.
- Household Sanitation Promotion
- Strengthen school Sanitation
- Scaling up Food Safety and Hygiene
- Strengthening Water Quality Surveillance
- Scaling up Capacity Building Initiatives

Inputs

- Funds from both Development Partners and Government of Uganda
- Human Resources
- Relevant logistics and equipment

Short-term outputs

The expected achievements will include:

- National latrine coverage will have increased from 49% to 60%
- The minimum environmental health services package

Potential long-term outputs

- Improved health through reduction of water and sanitation related diseases
- Improved and sustained socio-economic development for Uganda

Implementation

The Ministry of Water, Lands and Environment (Department of Meteorology) will be the official recipient and will delegate to the appropriate institutions to implement the project in close collaboration with key stakeholders such as local governments and civil society

Risks and Barriers

- Inadequate funds
- Natural hazards and disasters
- Civil conflicts
- Limited knowledge
- Some communities have strong cultural resistance to assimilation / adaptation of new water and sanitation technologies

Monitoring and evaluation

This important stage of project implementation will be a joint activity, involving the target communities and financiers. To facilitate the process a logical frame for the project will be constructed in which milestones of achievements and their objectively verifiable indicators will be clearly specified.

Financial Resources

NAPA implementation will require financial resources from the Government of Uganda, Bi-laterals, Multilaterals, NGOs and CBOs. Financial Requirements will include but not be limited to: costs of training of communities, construction works, technology development, facilitation of project component personnel, production of manuals, stationeries, computers and other office accessories. Estimated total project cost is 4.7 million US\$.

Time Frame

A period of 3-5 years is planned. Since there is an urgent need for adaptation to climate change, it should commence immediately.

PROJECT 5

Title: Water for Production Project

Justification

Agriculture is the mainstay of Uganda and is rain-fed. Subsequently, GoU aims at achieving agricultural modernization with high yielding species, varieties and breeds. These high yielding species usually require much more safe water throughout the year. However, increased climate variability and climate change will frustrate this initiative. Thus, providing appropriate water

harvesting and irrigation technologies become pertinent. Therefore, access to improved water supply and sanitation for production by 2015 is crucial.

The IPCC Assessment Reports of 1995/2001 indicate that extreme weather events notably floods and droughts are to increase considerably in intensity and frequency. Floods and droughts have a negative impact on water resources. Floods pose a serious pollution of sources of drinking water with potential danger of outbreaks of water borne diseases. The large population of the rural poor and their livestock is most vulnerable to these effects given the fact that they are faced with inadequate access to water for production.

Therefore, attaining adequate access to and better use of water for crop and animal production is crucial. This is to be achieved in partnership with key stakeholders and community involvement. This also is in line with the national Poverty Eradication Action Plan (PEAP)

Objectives

- To improve utilization of water resources among vulnerable communities for production

Activities

- Stakeholder analysis
- Baseline surveys to identify constraints to water for production access in target communities
- Develop and promote appropriate rainwater harvesting technologies
- Develop and promote simple and low cost irrigation technologies
- Construct, protect and maintain valley dams
- Develop water reservoirs inside protected areas
- Promote community involvement in planning, monitoring and evaluation,
- Promote best practices in water for production use and management
- Identify and promote synergies
- Develop and enforce byelaws for water for production

Inputs

To implement the project a number of inputs are required. Tentatively the following inputs are envisaged: human resource of various professions, equipment and supplies, vehicles and logistical support. Inputs for training of trainers in the use/production of water and sanitation technologies, construction works for safe water sources, drawing of guidelines on safe water use and sanitation and community training in water resources management will be required.

Short-term outputs

- Rain water harvesting demonstration units in strategic places
- Appropriate irrigation demonstration units in strategic places
- Communal valley dams constructed in arid and semi-arid areas
- Increased availability and accessibility to safe water sources to vulnerable communities
- Community with sufficient capacity in water resources management
- Pamphlets on water for production use available and distributed to communities
- Number of community-based production water sources established and managed by trained community-based technicians
- Incentive-based enforcement of bylaws at community level
- A number of community-based technicians trained and equipped in water and sanitation technologies

Long-term outputs

- Increased availability and utilization of rain water for production in vulnerable communities
- Increased crop and animal production and productivity
- Improved animal health through reduction of water and sanitation related diseases

Implementation

The Ministry of Water, Lands and Environment (Department of Meteorology) will be the official recipient and will delegate to the appropriate institutions to implement the project in close collaboration with key stakeholders such as local governments and civil society

Risks and barriers

- Inadequate funds
- Natural hazards and disasters
- Civil conflicts
- Some communities have strong cultural resistance to assimilation / adaptation of new water and sanitation technologies
- Water Resources Management is strange concept to the communities and it could be not well appreciated at community level
- Limited knowledge of water harvesting

Monitoring and evaluation

This important stage of project implementation will be a joint activity, involving the target communities and financiers. To facilitate the process a logical frame for the project will be constructed in which milestones of achievements and their objectively verifiable indicators will be clearly specified.

Financial Resources

NAPA implementation will require financial resources from the Government of Uganda, Bi-laterals, Multilaterals, NGOs and CBOs. Financial Requirements will include but not be limited to: costs of training of communities, construction works, technology development, facilitation of project component personnel, production of manuals, stationeries, computers and other office accessories. Estimated total project cost is 5 million US\$.

Time Frame

A period of 3-5 years is planned. Since there is an urgent need for adaptation to climate change, it should commence immediately.

PROJECT 6

Title: Drought Adaptation Project

Justification

The most climate change prone communities in Uganda are those living in semi arid areas where droughts are most frequent and most prolonged. In the last decade alone, more than 10 severe droughts have occurred indicating a > 50% rise. The population growth rate is also highest in semi arid areas, averaging 9.7% in Kotido and 6% in Moroto and Nakapiripirit. Thus most climate change vulnerable communities have the highest population growth rates. Uniquely, more than 50% is < 18 years. The implication of this population structure is that sooner or later, the demand on natural resources is going to increase significantly, leading to NR degradation.

These harsh environments are fragile and severely resources constrained. Ironically, these semi arid areas also form the cattle corridor, supplying most of Uganda's livestock and meat products. However, the prolonged and frequent droughts in these areas have led to almost perpetual dependency on food aid. A typical example is in the arid areas of Karamoja where the world food program (WFP) supplies virtually all the food. Also, climate change impacts differently on men, women and youth in these drought prone areas. Women have a key role of looking after the households. They spend long hours during drought in search of water, firewood depriving them of productive time for other economic activities.

This project aims to reduce impacts of droughts on vulnerable communities and fragile ecosystems. This is in line with the government PEAP which aims at improving farmers' livelihoods and eradication of poverty.

Objectives

This project aims at enhancing the adaptive capacity of the vulnerable communities in drought prone parts of Uganda, especially those in the arid and semiarid cattle corridor zone, so as to enhance their capacity to cope with the increasingly frequent droughts. This will enable them not only to be prepared for seasons when rains fail, but also to mitigate the effect of droughts in a situation where normatively they wouldn't be able to cope.

Activities

- Baseline surveys to identify suitable intervention packages for target communities
- Develop and promote appropriate rainwater harvesting technologies
- These will include development and promoting drought tolerant perennials and early maturing varieties and breeds of crops which are able to utilize the shortened seasoned rains.
- The project will also carry out documentation on indigenous technologies to preserve food as well as improving them. These will include drying and use of native preservatives.
- Analysis of post harvest losses and promotion of adapted and improved post harvest technologies
- The projects will also identify and promote alternative livelihood options to unsustainable coping mechanisms and promote best practices especially for women and youths. These would replace the present coping mechanisms of seasonal migrations to neighboring areas, reduced food consumption and sale of stocks and heirlooms /assets.
- Promotion of pasture production, harvesting and storage.
- Promotion of nucleus multipurpose trees suitable for improved livestock production and feeding as standing and perennial fodder banks and soil conservation pillars
- Control and prevention of major animal diseases as a base for guaranteeing the major livelihood option in the cattle corridor
- Promotion of a suitable and community led livestock and animal products marketing system
- Promotion of a micro community rainwater harvesting and storage system

Inputs

To implement the project a number of inputs are required. Tentatively the following inputs are envisaged: human resource of various professions, equipment and supplies and vehicles. In puts for training of trainers in the use/production of adaptation technologies, construction works for feed banks and storage sites, water sources, drawing of guidelines on feed banks use, water use and community training in communal resource management and baseline research will be required.

Short-term outputs

These will include producing;

- A list of drought tolerant and early maturing species and varieties of crops. The project will ensure they are well documented and the information passed on to the extension workers.
- The project also aims at producing booklets, brochures and materials on appropriate production methods; for drought tolerant and early maturing species, varieties and breeds for extension workers to distribute to the farmers.
- The other output in the short term will be printed information on improved indigenous food preservation methods available for community consumption.
- In the short term, the project also intends to train community based technicians in indigenous and appropriate food preservation technology.
- The community based technician will also have knowledge in drought tolerant agronomy and production including pasture harvesting and storage techniques.
- Communal feed banks and compost pens systems established
- Nucleus demonstration sites with multipurpose trees growing established in the communities for adoption
- Mass vaccination against major animal diseases carried out and a community based mechanism of vaccination and disease prevention established

- A suitable and community based and community led livestock and animal products marketing system established
- Promotion of a micro community rainwater harvesting and storage system

Potential long-term outputs

- In the long term this project will lead to and restore household food security.
- This will in turn mean more and better quality food consumed, leading to improved nutrition as well as increased food/crops for sale; earning the household income.
- Secondly the project will ensure more livestock and crop productivity, through enhanced pasture production and storage, disease control and marketing

Implementation

The Ministry of Water, Lands and Environment (Department of Meteorology) will be the official recipient and will delegate to the appropriate institutions to implement the project in close collaboration with key stakeholders such as local governments and civil society

Risks and barriers

- Inadequate funds
- Natural hazards and disasters
- Civil conflicts
- Limited knowledge of water harvesting
- Insufficient community mobilization, response and adapting to new innovations may limit activities.
- Community based management is new concept to the communities and it could be not well appreciated at community level

Monitoring and evaluation

This important stage of project implementation will be a joint activity, involving the target communities and financiers. To facilitate the process a logical frame for the project will be constructed in which milestones of achievements and their objectively verifiable indicators will be clearly specified.

Financial Resources

NAPA implementation will require financial resources from the Government of Uganda, Bi-laterals, Multilaterals, NGOs and CBOs. Financial Requirements will include but not be limited to: costs of training of communities, construction works, technology development, facilitation of project component personnel, production of manuals, stationeries, computers and other office accessories. Estimated total project cost is 3 million US\$.

Time Frame

A period of 3-5 years is planned. Since there is an urgent need for adaptation to climate change, it should commence immediately.

PROJECT 7

Title: Vectors, Pests and Disease Control Project

Justification

Climate changes have expanded the geographical distribution of pests, vectors and diseases to new areas and are now prone to epidemic outbreaks. This has complicated the management of vector borne diseases and pests in animals, crops and humans. For example, in semi-arid Karamoja, tick-borne diseases have been reported. The tsetse belt has expanded to cold mountainous ecosystems, resulting into higher morbidity due to nagana and sleeping sickness in animals and humans respectively. Newcastle disease epidemics in poultry rearing districts have escalated due to frequent and prolonged droughts.

Similarly, other water related diseases like Onchocerciasis (River Blindness), Bilharzia and malaria tended to increase. Malaria is now endemic in about 95% of Uganda. The incidence of malaria epidemics has increased in the highland areas in the recent years. Uganda experienced malaria epidemics in 1992, 1994, 1997/8 and in 2000/1. The most affected areas were Mbale, Sironko, Kabale, Rukungiri and Kisoro. The main factor that triggered this rapid increase was the El Nino rains. The rains led to floods; a lot of stagnant water and growth of bushes. All these encouraged the multiplication and spread of mosquitoes. According to the baseline study, morbidity attributed to malaria in children aged less than 5 years presenting to outpatient departments was 44.4% and 41.6% for those children above 5 years of age. It is responsible for more than 15% of life years lost due to premature death. It accounts for about 15 – 40% of OPD attendances at healthcare facilities and about 9 – 14% of inpatient deaths. Malaria stricken family may spend up to 25% of its income on the direct or indirect costs of the disease.

Climate change has also induced escalation of pest and disease epidemics in crops. In Katakwi district, grasshopper epidemics in 2005 destroyed all cereals the main source of food security. Armyworms have become rampant in Wakiso, Tororo and Pallisa districts. In semi – arid areas for example Nakasongola district, persistent termite epidemics have continuously destroyed natural vegetation.

This project aims at understanding the linkages of these outbreaks to climate change for more cost-effective management with special emphasis on vulnerable communities and gender dimensions.

Objectives

- To strengthen the national programmes on prevention, control and effective management of disease vectors and pests.
- To enhance the protection of the vulnerable communities against climate change related diseases and pests outbreaks.
- To strengthen community awareness on health impacts due to climate change
- Identify communities and extent of damage to communities that are vulnerable to climate change related diseases and pests outbreaks
- Investigate the relationships between climate change and, disease vectors, pests, other biodiversity including the use of herbal plants
- To assess the impact of risky occurrences of climate change related diseases and pests outbreaks on the welfare of the victimized farmers
- To enhance the protection of the vulnerable communities against climate change related diseases and pests outbreaks
- To assess the impact of interventions proposed by the project and associated with the control of climate change related diseases and pests outbreaks on reduced health and income risks of the farmers

Activities

- Investigate the relationships between climate change and disease-, vector- and pest-outbreaks (e.g. termites) including biodiversity loss
- Investigate the use of herbal plants in the management of these outbreaks
- Develop and implement strategies for effective control of climate change related vector and pest outbreaks
- Implement effective programs for treatment of diseases
- Conduct monitoring and evaluation of effectiveness of vectors, pests and disease control strategies
- Verify alternative technologies for management of disease pests and vectors

Inputs

The following inputs are envisaged: human resource of various professions, equipment and supplies, vehicles, logistical support and laboratory services.

Short-term outputs

- Knowledge of linkages between climate change and diseases, vectors, pests and other biodiversity for planning & capacity building
- Reduced incidence and prevalence of climate change-related diseases, vectors and pests
- Reports and publications about knowledge of linkages between climate change and diseases, vectors, pests and other

biodiversity for planning & capacity building

- Reduced incidence and prevalence of climate change-related diseases, vectors and pests
- Tools for data collection available for use in related tasks

Potential long-term outputs

- Decreased outbreaks and ecological shifts of vector borne and communicable diseases and pests.
- Enhanced adaptive capacity of communities to climate change-related diseases, vectors and pests
- Improved health (human, crop, animal) through reduction of disease vectors and pests.
- Improved and sustained socio – economic development for Uganda
- Enhanced adaptive capacity of communities to climate change-related diseases, vectors and pests.

Implementation

The Ministry of Water, Lands and Environment (Department of Meteorology) will be the official recipient and will delegate to the appropriate institutions to implement the project in close collaboration with key stakeholders such as local governments and civil society

Risks and barriers

- Inadequate funds
- Natural hazards and disasters
- Civil conflicts
- Insufficient community mobilization, response and adapting to new innovations may limit activities.
- Community based management is new concept to the communities and it could be not well appreciated at community level

Monitoring and evaluation

This important stage of project implementation will be a joint activity, involving the target communities and financiers. To facilitate the process a logical frame for the project will be constructed in which milestones of achievements and their objectively verifiable indicators will be clearly specified.

Financial Resources

NAPA implementation will require financial resources from the Government of Uganda, Bi-laterals, Multilaterals, NGOs and CBOs. Financial Requirements will include but not be limited to: costs of training of communities, construction works, technology development, facilitation of project component personnel, production of manuals, stationeries, computers and other office accessories. Estimated total project cost is 8 million US\$.

Time Frame

A period of 3-5 years is planned. Since there is an urgent need for adaptation to climate change, it should commence immediately.

PROJECT 8

Title: Indigenous Knowledge (IK) and Natural Resources Management Project

Justification

Communities have from time immemorial used indigenous knowledge to cope with climate variability and extreme weather and climate events. During the NAPA process many Iks were encountered and they tended to be area, culture- and subject specific. For example, in Rakai, the *Lwanyi*, a local shrub is used as antidote to lightning. In Karamoja, initiation of farming following the first rains is sanctioned by the elders after examining the content of ruminant guts and forecasting based on an apparently “indigenous meteorological system”. Others include food preservation in Kapchorwa using honey, rain making using

a combination of rituals and herbal concoctions, and water purification using *Moringa* seeds. These traditional practices are of considerable cultural value to communities, although the scientific basis of some of them is doubtful.

IK is integral to many community based practices in the areas of agriculture, forestry, water, wildlife, human and animal health management. These time-honored practices (IK) are effective ways of involving communities in sustainable management of natural resources. IK thus provides a suitable entry point for community mobilization and action.

To exploit this potential for adaptation to climate change, there is need to document and understand IK and where possible establish their scientific basis. Despite the need, modern research efforts have largely ignored the integration of IK. This is due to lack of frameworks for conducting research in this important area, coupled with total disregard of IK due to misconception and disrespect of cultural values.

Objectives

The major objective is to enhance sustainable use and management of natural resources by the vulnerable communities.

Specific objectives include:

- Support the maintenance, protection and continuity of use of indigenous knowledge in the management of natural resources
- Create awareness among stakeholders about the importance of use of indigenous knowledge in natural resource management
- Develop and implement strategies based on use of indigenous knowledge that would enhance communities to cope with effects of climate change

Activities

- Document and validate climate related indigenous knowledge (IK) for natural resource management
- Develop and implement community based strategies for effective NR management
- Train communities in integrated NR management
- Promote use of appropriate IK in natural resources management
- Strengthen collaborative management of NRs,
- Identify and promote alternative livelihoods

Inputs

The following inputs are envisaged: human resource of various professions, supplies, vehicles, logistical support, community mobilization and copyright services.

Short-term outputs

- Booklets on IK for natural resource management available and distributed to communities
- Enhanced use of IK in NR management by communities
- Incentive-based enforcement of NR management at community level
- Trained community-based technicians in NR management

Long-term outputs

- Enhanced sustainable use and management of natural resources by the communities
- Better understanding and appreciation of cultural values
- Enhanced adaptive capacity of communities

Risks and barriers

- Inadequate funds
- Civil conflicts
- poor information access and flow
- Insufficient community mobilization

- Undervaluing IK by elites
- Poor packaging of IK
- Competition by western knowledge
- Lack of recognition and copyright protection by relevant authorities

Implementation

The Ministry of Water, Lands and Environment (Department of Meteorology) will be the official recipient and will delegate to the appropriate institutions to implement the project in close collaboration with key stakeholders such as local governments and civil society

Monitoring and evaluation

This important stage of project implementation will be a joint activity, involving the target communities and financiers. To facilitate the process a logical frame for the project will be constructed in which milestones of achievements and their objectively verifiable indicators will be clearly specified.

Financial Resources

NAPA implementation will require financial resources from the Government of Uganda, Bi-laterals, Multilaterals, NGOs and CBOs. Financial Requirements will include but not be limited to: costs of training of communities, construction works, technology development, facilitation of project component personnel, production of manuals, stationeries, computers and other office accessories. Estimated total project cost is 1.2 million US\$.

Time Frame

A period of 3-5 years is planned. Since there is an urgent need for adaptation to climate change, it should commence immediately.

PROJECT 9

Title: Climate Change and Development Planning Project

Justification

The economic and social development of Uganda depends on exploitation of its natural resources, including climate. Climate is a key driver of the natural resources and therefore changes in Uganda's climate will directly and negatively impact on its social and economic development. The importance of climate and its relationship with natural resources and social economic development is not well understood nor are impacts of adverse effects of climate change on development well understood either by planners and policy makers. Therefore climate change issues are not taken into consideration in the development of sectoral and investment plans.

While climate change cannot be stopped, its impacts of adverse effects on social and economic development can be minimized by climate proofing development programmes. The cost of adaptation can therefore be significantly reduced and also spread.

The purpose of this project is therefore to support the development, dissemination and application of mainstreaming guidelines at various levels to climate-proof development activities. Generation of climate change scenarios and their packaging will be required to support dissemination of key messages to improve understanding of climate, its variability and change.

Objective

To integrate climate change issues into development planning and implementation at all levels.

Activities

The key activities are:

- Review existing relevant policies and laws/regulations in relation to climate change
- Develop policy, laws, regulations and byelaws on climate change
- Develop guidelines for mainstreaming including gender issues
- Sensitize and train decision makers, planners and implementers on impacts of climate change
- Undertake monitoring and evaluation

Inputs

The inputs of this project include human resources, technical assistance and financial resources.

Short-term inputs

- Knowledge on gaps and weaknesses of existing legislation with regard to climate change available
- Policy, laws, regulations, ordinances and byelaws on climate change available
- Guidelines for mainstreaming climate change at all levels available
- Pool of trained climate change agents across sectors
- Development plans integrating climate change

Potential long-term outputs

The long-term output of this project is climate change proofed development programmes.

Risks and barriers

- Inadequate funds
- poor information access and flow
- Inadequate sector awareness

Implementation

The Ministry of Water, Lands and Environment (Department of Meteorology) will be the official recipient and will delegate to the appropriate institutions to implement the project in close collaboration with key stakeholders such as local governments and civil society

Monitoring and evaluation

This important stage of project implementation will be a joint activity, involving the target communities and financiers. To facilitate the process a logical frame for the project will be constructed in which milestones of achievements and their objectively verifiable indicators will be clearly specified.

Financial Resources

NAPA implementation will require financial resources from the Government of Uganda, Bi-laterals, Multilaterals, NGOs and CBOs. Financial Requirements will include but not be limited to: costs of stakeholders' sensitization, facilitation of project component personnel, consultancy costs, production of manuals, stationeries, computers and other office accessories. Estimated total project cost is 1.2 million US\$.

Time Frame

A period of 3-5 years is planned. Since there is an urgent need for adaptation to climate change, it should commence immediately.

Selected Bibliography

1. Osmaston, H., Tukahirwa, J., Basalirwa, C. and Nyakana, J (1996). (Eds) *The Rwenzori Mountains National Park, Uganda*. Department of Geography, Makerere University. 395 pp. ISBN 9970-429-01-9, Printed by, D K Printworld (P) Ltd., New Delhi, India.
2. Intergovernmental Panel on Climate Change (IPCC) (2001). *Third Assessment Report of IPCC*, London. Cambridge University Press.
3. Forestry Department (2002). *Forestry Nature Conservation Master Plan*. Publishers: Ministry of Water Lands and Environment, Forestry Department. 304 PP.
4. Karekezi. S., Majoro. L., and Tohnson, T.M. (2003) *Climate Change Mitigation in Urban Transport sector. Priorities for the World Bank*. World Bank. Global Environment Facility (Pub.) Washington, D.C.
5. Katende, A.B; Birnie, A; and Tenywa, S, B. (1995). *Useful Trees and shrubs for Uganda: Identification, propagation and Management for Agricultural and Pastoral Communities*. Regional Soil Conservation Unit, (RSCU) Nairobi. 710 pp.
6. Kayanja, F I. B. and Edroma, E. L. (1986). *African Wildlife Research and Management*. By ICSU Press of the International Council of Scientific Unions on behalf of the African Bioscience Network(ABN).
7. Lamprey.R., Buhanga.E., Omoding.J., Michelmore .F., Olacha.,J.Egungu.F. (1999). *Wildlife Protected Area System Plan for Uganda. Detailed Proposals for Protected Areas, Vol. 4, Draft 2*.
8. National Environment Management Authority NEMA (2004) *Capacity Needs Self Assessment Report*.
9. Moyini.Y. and Onyango .G. 2000/2001. *State of Environmental report for Uganda*. National Environment Management Authority (NEMA).
10. Nakimera, I. (2001). The Impact of Human Activities and Climate on the Vegetation in the Lake Victoria Region and on the Rwenzori Mountain and its Neighbourhood. *Ph.D.Thesis Geology*, Makerere University, Faculty Science.
11. Ogwang, B.H. Aanyu M. and Mutayanjulwa E (2002b) *Localizing Global Environmental Conventions. Volume II: Opportunities for Integrating Multilateral Conventions in planning processes in Uganda*. NEMA.
12. Poverty Eradication Action Plan (PEAP) 2004-2009 (2004). Ministry of Finance, Planning and Economic Development, Uganda.
13. State of Environment Report for Uganda, NEMA (1998).

ANNEX 1. Operational definitions

Adaptation

Adjustment in natural or human systems, in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

Climate

The prevailing or average weather conditions of a place as determined by the temperature and meteorological change over a period of time. Many factors determine climate, but rainfall and temperature are the most prominent.

Climate change

Change in climate attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

Chlorofluorocarbons

Very stable, non-reactive and non-poisonous chemical used as coolants in refrigerators, and in air conditioning; also used as aerosol propellants for filling the spaces in foam used for packaging.

Coping mechanism

Ways and means of minimizing adverse effects of climate change.

Disaster

A destructive climate-induced event of a magnitude requiring external or extra intervention

Ecosystem

A self-regulating community of living things in their physical and chemical environment.

Forest

A large tract of land covered with trees.

Land races

Dominant fauna and flora established in a given location through ecological evolution and are now the most adapted to the prevailing chemical and physical environment.

Mitigation

An intervention to reduce green house gas (GHG) emissions or enhance GHG sinks.

Phenology

A study of natural phenomena that recur periodically.

Pleistocene

The period, in the earth's history, which lasted from about 2,000,000 years ago to about 10,000 years ago during which much of the northern part of the earth may have been covered with ice. It was during the Pleistocene that the earliest humans are thought to have appeared and hence the beginning of anthropogenic (man-induced) activities.

Synergy

A co-operative effort or action that exceeds the sum of individual effort and enhances output.

Vulnerability

The degree to which a system is susceptible to or unable to cope with adverse effects of climate change, climate variability or climate extremes.

Wildlife

Undomesticated plants and animals found in their natural environment.

