



The Republic of Uganda

THE STATE OF UGANDA POPULATION REPORT 2009

Addressing the Effects of Climate Change on Migration
Patterns and Women





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Foreword

As Uganda commemorates the International Conference on Population and Development – Programme of Action at 15 years (ICPD+15), it is important to note that it created considerable awareness on the intricate interrelationships between population and development. It is significant that a integrated development approach, linking population-related actions to human development, gender equality and women’s empowerment and the needs and rights of individuals, was the same as embedded in Uganda’s revised Population Policy which was launched in 2008. Specifically, there is a better understanding that explicitly integrating population concerns into development strategies will speed up the pace of economic growth, sustained development and poverty reduction and contribute to the achievement of National Population Policy objectives and an improved quality of life of the people. It is for this reason the population issues have also been put at the centre of the Five-Year National Development Plan that is being developed.

This year’s State of Uganda of Population Report has a very relevant theme, “Addressing Effects of Climate Change on Migration patterns and Women”, to current population and development concerns. Climate change and variability are the greatest environmental challenges and increasingly being acknowledged as major threats to the physical and biological sustainability of the environment with long term impacts on the survival, security and livelihood of communities.

Human activities are producing large quantities of greenhouse gases, particularly carbon dioxide. These gases are accumulating in the atmosphere more rapidly than natural processes can remove them. This is accompanied with increasing removal of vegetation cover from the earth’s surface. The increased emission and concentration of these gases into the atmosphere has led to changes in climate; a rise in atmospheric temperatures, disruption in rainfall patterns, droughts and the rising ocean levels among others. Though clearly an environmental issue, climate change is also integral to growth and development, as climate systems form the basis for health, agriculture and energy. It has far reaching implications for food security and gender equality at household level as well as for poverty reduction and economic development at national level. It also has a bearing on international political economy and sustainable development at a global level.

The report provides a comprehensive review of the interplay between climate change, migration, women’s livelihood and selected strategic development sectors on one hand and population. The report also makes far-reaching recommendation critical to future development agenda.

I therefore wish to recommend this report to all policy and decision makers, programme managers, the media, researchers, local government leaders, community leaders, development partners, the academia and all those involved in contributing to the improvement of the quality of life of Ugandans.

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List of Abbreviations and Acronyms

ADB	-	Africa Development Bank
A.S.L	-	Above Seal Level
CDM	-	Clean Development Mechanism
CHOGM	-	Commonwealth Heads of State and Governments
CO ₂	-	Carbon-dioxide
DANIDA	-	Danish International Development Agency
DFID	-	Department For International Development
EAC	-	East African Community
FACE	-	Forestry Absorbing Carbon Dioxide Emission
FAO	-	Food and Agricultural Organization
GDP	-	Gross Domestic Product
GECAFS	-	Global Environmental Change and Food Systems
GHG	-	Green House Gases
GOU	-	Government of Uganda
IDPs	-	Internally Displaced Persons
IFAD	-	International Fund for Agricultural Development
IFCC	-	Intergovernmental Forum on Climate Change
IPCC	-	Intergovernmental Panel on Climate Change
LDC	-	Least developed Country
LULUCF	-	Land use, Land use Change and Forestry
LVEMP	-	Lake Victoria Environmental Management Programme
MAAIF	-	Ministry of Agriculture, Animal Industry and Fisheries
MDGs	-	Millennium Development Goals
MWE	-	Ministry of Water and Environment
NAPA	-	National Adaptation Programme of Action
NBI	-	Nile Basin Initiative
NFA	-	National Forestry Authority
NASA	-	National Space Administration
NDP	-	National Development Plan
NEMA	-	National Environment Management Authority
NURP	-	Northern Uganda Reconstruction Programme
NUSAF	-	Northern Uganda Social Action Fund
OCHA	-	Office of the Commissioner for Humanitarian Assistance
PEAP	-	Poverty Eradication Action Programme
PfA	-	Prosperity for All
PMA	-	Plan for Modernization of Agriculture

PFCC	-	Parliamentary Forum on Climate Change
PRDP	-	Peace Recovery and Development Programme
SOER	-	State of Environment Report
UBoS	-	Uganda Bureau of Statistics
UNEP	-	United Nations Environment Programme
UNCC	-	United Nations Conventions on Climate Change
UNFCC	-	United Nations Framework Convention on Climate Change
UPE	-	Universal Primary Education
USE	-	Universal Secondary Education
WPF	-	World Food Programme



CHAPTER 1

OVERVIEW OF CLIMATE CHANGE – BROAD PERSPECTIVE

1.0 Introduction

Human activities—industry, transportation, power generation, land use—are producing large quantities of greenhouse gases, particularly carbon dioxide. Those gases are accumulating in the atmosphere more rapidly than natural processes can remove them. The increased emission and concentration of these gases into the atmosphere has led to changes in climate; a rise in atmospheric temperatures, disruption in rainfall patterns, droughts and the rising ocean levels among others. Though clearly an environmental issue, climate change is also integral to growth and development, as climate systems form the basis for health, agriculture and energy. It has far reaching implications for food security and gender equality at household level as well as for poverty reduction and economic development at national level. It also has a bearing on international political economy and sustainable development at a global level.

There is global consensus that developed countries are responsible for the bulk of emissions that have already occurred, with the United States of America being the world's largest emitter of greenhouse gases. However, the devastating effects of climate change resulting from these emissions will and are already being experienced by poorer countries particularly those closer to the equator. According to the World Bank President, the world's poor will bear the brunt of the impact of global climate change, as the planet warms, rainfall patterns shift and extreme events such as droughts, floods and forest fires become more frequent. In Africa, Asia and elsewhere, poor people face prospects of tragic crop failures, reduced agricultural productivity, and increasing hunger and malnutrition and disease.

1.2 Impacts of Climate Change

1.2.1 – Agricultural Productivity and Food security

According to the 2008 report of the Africa Progress Panel, Climate change will affect Africa more severely than other regions of the world, and will have a devastating impact on food production and the livelihoods of the rural poor. The report further states that many of the poorest, particularly in urban areas are already facing the consequences of high food prices a situation that will be worsened by the loss of agricultural productivity. Most countries in the world are likely to experience losses rather than gains in agricultural productivity resulting from climate change. With a projected loss of 15 – 25 %, Uganda is one of those countries that are likely to experience significant losses in Agricultural productivity.

Uganda is among those countries that are highly vulnerable to persistent high food prices, a phenomenon

which though serving as an incentive for some, is bad news for the poor because in the long run, their food security cannot be guaranteed by just increasing production, but needs to be based on higher household incomes to facilitate access to food.

1.2.2 - Health

Other effects of climate change are already more than apparent in Uganda with the Meteorology Department issuing an alert that the country is likely to experience the El Nino phenomenon for up to five months from October 2009 to February 2010. Uganda experienced the El Nino rains in 1997 and in 2007, when many areas especially in the eastern and northern region were hit by severe floods. The 1997 El Nino rains had devastating effects such as loss of lives, destruction of roads and bridges due to floods, massive destruction of food crops and disruption of social life and economic activities. The El Nino torrential rains rendered thousands homeless and also caused a malaria epidemic in parts of the country. The El Nino phenomenon is also associated with a resurgence of waterborne diseases like cholera and dysentery especially in crowded urban areas where most of the rural poor are housed. The effects on health of these severe rains whenever they occur cannot be understated as the disruption of agriculture has led to famine, resulting in severe hunger and malnutrition among the population in the affected areas.

1.2.3 Gender

Although not much research has been directly targeted at examining how the effects of Climate Change impact on Gender and Gender relations, experience shows that certain groups of people are / will be disproportionately affected by the effects of climate change. It has already been established that poor people in the poorer countries of the world will be more adversely affected than the rest. As women constitute the greatest percentage of the world's poorest people, they are most affected by the effects of climate change. Even where there is a lack of hard evidence, it is commonly recognised that climate change exacerbates existing inequalities in the key dimensions that are not only the building blocks of livelihoods, but are also crucial for coping with change, including: wealth; access to and understanding of technologies; education; access to information; and access to resources.

Coupled with an increase in population, inefficient exploitation and the resultant depletion of natural resources, one of the most profound effects of climate change has been migration. The movement of the predominantly male household bread winners to find more productive land on which to cultivate and shift their families has led to a disruption in the social fibre that held families together. This has inevitably led to changes in responsibilities between men and women at household level. Also, by virtue of their traditional role as protectors of the family, men have been at the heart of migration related conflict between the original inhabitants and new comers in certain areas. In addition to furthering research on how Climate Change affects gender and gender relations, it is also important to examine how gender inequalities are affecting climate change adaptation and mitigation efforts at all levels.

1.2.4 - Socio-Economic Development

Uganda's economy is largely agricultural based. Over 80% of the population lives in the rural areas and 90% of this population is engaged in agriculture as a means of livelihood. Agriculture also contributes to 29.4% of the country's Gross Domestic Product. Given that the country's agricultural system is highly dependent on rainfall, any extreme changes in rainfall patterns are likely to further adversely affect agricultural production thereby seriously threatening people's livelihoods. The effects of excessive floods, prolonged droughts and erratic changes in rainfall patterns are evident. Some parts of the country especially in the North and North East are already experiencing significant increases in hunger and malnutrition. If the situation is not checked, the country is likely to see more people slumping back into poverty and an increase in malnutrition related maternal, infant and child mortality. This situation doubtlessly compromises the country's ability to meet its own development objectives as well as the Millennium Development Goals.

1.3 Climate Change Policy

It is worth noting that although the developed countries are responsible for the bulk of current emissions, it is expected that future emissions will be generated in developing countries. In view of the fact that countries can only directly control their domestic emissions, managing the stock of greenhouse gases calls for sustained cooperation and genuine commitment by all major emitting nations, as well as developing countries which not only bear the brunt of the burden resulting from accumulation of these gases in the atmosphere, but are also going to be major emitters if they pursue the same path of economic growth and developed as that of the developed nations. As the World Bank President puts it, “Climate change cannot be solved without countries cooperating on a global scale to improve energy efficiencies, develop and deploy clean technologies and expand natural sinks to grow green by absorbing gases. We need to protect human life and ecological resources.

Despite the urgency of the problem, Climate change policy has proved complicated because as already noted above, it requires action on the part of every nation, yet nations at different stages of development can only commit themselves within certain limits as they seek the balance between economic development and combating climate change. Restrictions on what technologies to use in generating energy for example cannot be uniformly imposed on all countries, as developing countries may not be ready to incur significant costs to reduce emissions unless such costs are borne by developed countries.

Combating climate change is also a long term investment whose benefits may accrue more to future rather than current generations. Although developed nations have a responsibility to contribute the most to this cause because they not only have the resources but are also largely responsible for the past and current emissions, the report of the Africa progress panel 2008 states that even if industrialized countries halted all carbon emissions immediately, business- as-usual practices in the developing world would continue to cause global warming. As such, climate change must be addressed by focusing on reducing emissions everywhere – countries must work together and help each other to reduce emissions rather than apportioning blame.

Although it poses major challenges, climate change also presents an opportunity for research and acquisition of new technologies, innovation in financing mechanisms in the aid environment, improved cooperation among countries and increased investment in afforestation and re-afforestation all of which are desirable to accelerate growth and development. Since dealing with the effects of climate change is dependent on community management, it is imperative that the concept be explained to ordinary citizens in every country for them to understand what individual actions exacerbate the problem and what they can do differently to make a contribution to adapt to and or mitigate the effects of climate change. Greater emphasis should also be placed on including women in education and key decision making because although rural men and women play complementary roles in guaranteeing food security, women tend to play a greater role in natural resource management and ensuring nutrition. It is time for individual countries to devise strategies on how to meaningfully engage women in the discourse as well as practices to mitigate the effects of climate change.

1.4 Policy Recommendations/ Broad Strategies

Countries like Uganda can also adopt the following broad strategies to improve the global environment and protect their citizens:

Box 1: Broad Strategies to Improve Global Environment

- Renewable energy, such as solar, wind and geothermal, is very viable in Africa - every effort must be made to exploit these opportunities and minimize use of energy sources that further compound the adverse effects of climate change. Almost all sub Saharan African countries, it is reported, have sufficient renewable resources, exploitable with current technologies to satisfy many times their current energy demands. Countries need to exploit this potential by investing in technology for production of solar energy.
- Farmers should be assisted to adapt to the changing climate. Governments should issue accurate information and early warning alerts on weather patterns to enable farmers to plan for the planting season, avail them with drought resistant seeds, train them in technologies that foster agricultural production, promote irrigation mechanisms and encourage diversification- different crops should be cultivated in different seasons depending on their resilience in the face of the forecasted weather patterns. In addition, they should;
- Promote the efficient use of water resources
- Encourage the preservation of green corridors that would allow plant and animal species to migrate as their habitat changed;
- Facilitate the relocation of people living in low-lying areas that are prone to increased flooding;
- Improve health care and pest control;
- Encourage the development and use of drought-resistant crops.

In addition, the Government of Uganda should do the following;

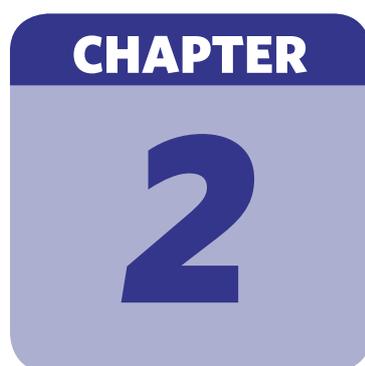
- Expedite the development of a National Food Security Policy and Emergency Preparedness Action Plan.
- Refocus economic empowerment programs to create increased household earnings as a strategy to mitigate effects of crop failure and widen options for food accessibility.
- Put in place a migration policy to address both planned and unplanned urbanization.
- Explore opportunities under the clean development approaches and voluntary carbon markets.
- Increase awareness and education about climate change among the general population.
- Mainstream climate change adaptation in all policies, plans and programmes.
- Implement the National Adaptation Program for Action.

1.5 Conclusion

The reality of our times is that the Earth's climate is changing, the change is being caused by human activities and its effects will worsen if no action is taken. In a globalized world, what happens in one part of the world inevitably affects the other parts of the world. Complacency is not an option on any nation's part. As Robert Zoellick puts it; we need action on climate issues before it is too late. If we act now, act together and act differently, there are real opportunities to shape our climate future for a safe, inclusive and sustainable globalization.

References:

1. Africa's Development: Promises and Prospects; Report of the Africa Progress Panel 2008
2. An Agenda for Progress at a Time of Global Crisis: A Call for African Leadership; Annual Report of the Africa Progress Panel 2009.
3. Broody Alyson et al, (2008) Gender and Climate Change: mapping the linkages; A Scoping study on knowledge and gaps.
4. NEMA, (2008) State of Environment Report for Uganda.
5. Orszag R. Peter, (2007) Issues in Climate Change; Presentation for the Congressional Budget Office Director's Conference on Climate Change.
6. Racheal Nampinga, (2008) Gender Perspectives on Climate Change; Written Statement submitted to the Commission on the Status of Women Fifty-second session.
7. The New Vision Newspaper, September 21, 2009.
8. The New Vision Newspaper, September 22, 2009.



CHAPTER 2

TREND ANALYSIS OF CLIMATE CHANGE IN UGANDA

2.1 Introduction

Climate change and variability are the greatest environmental challenges and increasingly being acknowledged as major threats to the physical and biological sustainability of the environment with long term impacts on the survival, security and livelihood of communities worldwide [IPCC, 2007; FAO, 2007]. Governments, individually and collectively, have an obligation to set effective targets for reducing greenhouse gas [GHG] emissions, and to craft policy frameworks in which those targets can be achieved. Until now, responses to climate change have been inconsistent and inadequate, with many governments refusing to responsibly address the problem. Action simply cannot wait until governments find the political will to do so. Every individual and every institution, within their spheres of influence must act to combat climate change.

Life on Earth as we know it today is made possible by relatively warm temperatures. Without gases like water vapor, carbon dioxide (CO₂), and methane in the atmosphere, the Earth would be much colder than it is now – averaging 0°F instead of about 59°F – and most of the water on the planet would be frozen. At certain levels, these “greenhouse gases” make the planet livable for humans and many other kinds of plants and animals by trapping some of the heat radiating outward from the Earth, much like the walls of a greenhouse trap heated air. This process of limiting heat loss through the atmosphere is called the “greenhouse effect.” Through everyday activities such as burning fossil fuels, agricultural practices, and clearing forests, humans have released large amounts of heat trapping GHGs into the atmosphere in a short period of time. Since about 1750 this rapid and large release of greenhouse gases has caused important changes in the composition of the Earth’s atmosphere and, consequently, in our global climate. Even if GHGs were entirely halted, global temperatures would still be expected to rise over at least the next 50 years. This would happen because of the time lag between emissions and the atmosphere’s response, and existing GHG concentrations have already reached a significant level [DFID, 2004].

How warm the world will get, and how that warming will affect the world’s human communities and ecosystems, is being studied intensively. The most comprehensive assessment of these questions, released in a report by the IPCC every five years, projects that global average temperature will increase by 3.2 to 7°F by 2100 [the “best estimate” range] relative to the average temperature for the 1980-1999 period [IPCC 2007]. It is important to note that these are projections, not predictions

2.2 Defining Climate Change and Climate Variability

2.2.1 Climate Change

Climate change is the result of a great many factors including the dynamic processes of the earth itself, external forces including variations in sunlight intensity, and more recently by human activities. External factors that can shape climate are often called climate forcings and include such processes as variations in solar radiation, deviations in the Earth's orbit, and the level of greenhouse gas concentrations. Climate change is understood as any long-term change in the patterns of average weather of a specific region or the earth as a whole. Climate change reflects abnormal variations to the earth's climate and subsequent effects on other parts of the earth, such as in the ice caps over durations ranging from decades to millions of years.

In recent usage, the term climate change refers to an overall shift of mean climate conditions in a given region whether due to natural variability or because of human activity [IPCC, 2001]. The warming trend associated with anthropogenic emissions of greenhouse gases and the enhanced greenhouse effect of the atmosphere can and should be regarded as a "climate change" when viewed on the time scale of decades or a few centuries.

2.2.2 Climate Variability

In the most general sense, the National Snow and Ice Data Centre [http://nsidc.org/arcticmet/glossary/climate_variability.html] considers the term "climate variability" to denote the inherent characteristic of climate which manifests itself in changes of climate with time. The degree of climate variability can be described by the differences between long-term statistics of meteorological elements calculated for different periods. (In this sense, the measure of climate variability is the same as the measure of climate change). The term "climate variability" is often used to denote deviations of climate statistics over a given period of time (such as a specific month, season or year) from the long-term climate statistics relating to the corresponding calendar period. It refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all temporal and spatial scales beyond that of individual weather events. Variability may result from natural internal processes within the climate system (internal variability) or to variations in natural or anthropogenic external forcing (external variability) (IPCC, 2001). In this sense, climate variability is measured by those deviations, which are usually termed as anomalies.

2.2.3 Climate Change and Variability in Uganda

Uganda's climate is affected in a major way by the La Nina and El Nino phenomena [changing temperatures in the Pacific Ocean]. The La Nina years tend to bring significant drying and El Nino years a soaking. Climate change impacts of these processes are not well understood to be able to make any predictions with confidence, although there is some evidence that warming will increase the intensity or frequency of these phenomena. Across much of Uganda the climate is bimodal, with two rainy seasons, the long rains starting in March and lasting through until June and the short rains running from around October/November until December/January. Generally, these two seasons have been relatively stable and predictable, to the benefit of the economy. The relative importance of the two seasons for crops varies around the country. Rainfall in the arid and semi-arid areas has always been unpredictable and has varied considerably over space and time, with occasional severe droughts.

Uganda's climate is naturally variable and susceptible to flood and drought events which have had negative socio-economic impacts in the past. Human induced climate change is likely to increase average temperatures in Uganda by up to 1.5 °C in the next 20 years and by up to 4.3 °C by the 2080s. Such rates of increase are unprecedented. Changes in rainfall patterns and total annual rainfall amounts are also expected but these are less certain than changes in temperature. The climate of Uganda may become wetter on average and the increase in rainfall may be unevenly distributed and occur as more extreme or more frequent periods of intense rainfall. Regardless of changes in rainfall, changes in temperature are likely to have significant implications for water resources, food security, natural resource management, human health, settlements and infrastructure.

In Uganda, as for the rest of the world, there are likely to be changes in the frequency or severity of extreme climate events, such as heat waves, droughts, floods and storms [Hepworth and Goulden, 2008].

Uganda is highly vulnerable to climate change and variability. Its economy and the wellbeing of its people are tightly bound to climate. Human induced climate change in the coming century has the potential to halt or reverse the country's development path. In particular, climate change is likely to mean increased food insecurity; shifts in the spread of diseases like malaria; soil erosion and land degradation; flood damage to infrastructure and settlements and shifts in the productivity of agricultural and natural resources. It will be the poor and vulnerable who feel these impacts the hardest; though climate change has serious implications for the nation's economy, with for example, a shift in the viability of coffee growing areas potentially wiping out US \$ 265.8 million or 40% of export revenue. Exacerbating poverty and triggering migration as well as heightened competition over strategic water resources, climate change could lead to regional insecurity [Hepworth and Goulden, 2008].

Different studies and climate models generally give variable results for future rainfall trends but there is more certainty in the picture they provide of future temperature. A review by Goulden (2006) of modelling outputs for East Africa under a range of plausible CO₂ emission scenarios created by the IPCC reveals that there is consensus around:

1. An increase in mean annual temperature of between 0.7 °C and 1.5 °C by the 2020's and of between 1.3 °C and 4.3 °C by the 2080's. If global greenhouse gas emissions remain high then we are more likely to see temperatures in the top end of this range.
2. A significant increase in mean annual rainfall beyond 2060 with the highest percentage increase in December, January and February. For a medium high emissions scenario and taking the average (median) of different model results, annual rainfall increases have been estimated as up to 7% by 2080 with December to February rainfall increases of 13% by 2080.
3. Changes in the severity and frequency of extreme events (floods, droughts, heatwaves, storms), although little is known about the nature of these changes (some models suggested that we would see a 20-30% increase in extreme wet seasons at a medium CO₂ emission scenario).

It can therefore be said with certainty that annual mean temperatures will rise at a rate which has been unprecedented over the last 10,000 years. In summary, temperatures are likely to increase in Uganda by up to 1.5 °C in the next 20 years and by up to 4.3 °C by the 2080s. Changes in rainfall patterns and total annual rainfall amounts are also expected but these are less certain than changes in temperature [Hepworth and Goulden, 2008]. An exercise mapping vulnerability to climate across Africa by the International Livestock Research Institute, finds Uganda to be highly vulnerable [Thornton et al, 2006 in Hepworth and Goulden, 2008]. This is compounded by the country's dependence on primary production and natural resources, weak institutional capacity, limited infrastructure, limited capacity and equipment for disaster management, limited financial resources and low income per capita and heavy reliance on rain fed agriculture (MWE 2002).

The early morning fog is now a fact of history; rainy seasons can longer be traditionally predicted. When such rains come, they are adjunct with devastating floods and their causative links like displacements and diseases. What exactly has happened? Are these symptoms of climate change and subsequent global warming or inefficient policy regimes and deficiency in implementation, monitoring and evaluation of existing environmental policies?

[Rwakabamba, 2009]

According to Oxfam [2008] and drawing from climate models used by the Inter-Governmental Panel on Climate Change (IPCC) it seems that for Uganda:

- There will likely be a big increase in the frequency of heavy rainfall during October to December, with the number of significantly wetter years rising considerably as a result. Indeed, a wetter climate is likely for the whole country, including the arid and semi-arid regions. Farmers believe rainfall is already becoming more intense, and particularly the heavy rains of late 2007 across northern and central Uganda may be a foretaste of this future climate regime.
- For the long rains from March to June the modelled effects of human-induced climate change are much weaker and less predictable. Future generations may therefore see a switch away from Uganda's current pattern of two rainy seasons across much of the country towards a new pattern, of a much more pronounced rainy season (with heavier rains) later in the year, with the rest of the year hotter and drier than at present.
- If Uganda becomes wetter, floods will become more likely, a product not only of higher rainfall and run-off but also of land use changes such as the draining of swamps, and blocked drains in urban areas.
- Changes in rainfall patterns may begin to become noticeable within about 12 years from now but could become particularly big from mid-century.
- Temperatures will increase and this will become particularly noticeable within the next 10 years. All seasons are likely to become warm to extremely warm.

2.2.4 Rainfall variations

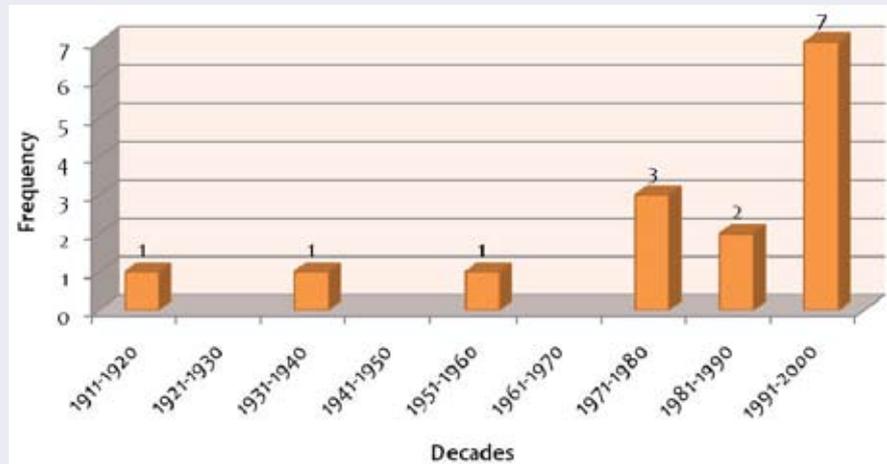
The year-to-year variation of rainfall over different zones expressed in terms of normalised rainfall anomaly. This analysis of rainfall variability does not show any significant trends in rainfall. Although the western, central and northern parts of Uganda experienced good rainfall seasons in 1997, the eastern region experienced drought in 1997. The country then experienced above normal rainfall in 1998 (El Nino year), as depicted in figure 1 resulting in floods. The floods had serious negative impacts on several sectors, particularly the health and transport sectors. The flooding of 1998 was followed by severe drought in western region with Mbarara district being the most affected.

There is also clear evidence of an increased frequency of droughts in the later years. According to the climate analysis in the Ugandan Government's National Adaptation Programmes of Action (NAPA), the wet areas of Uganda, around the Lake Victoria basin and in the east and northwest, are tending to become wetter. Government meteorologists state that the droughts that periodically affect the western, northern and northeastern districts are becoming more frequent. They logged seven droughts [Figure 2.1] between 1991 and 2000, with a particularly long and severe drought in 1999/2000 [Hepworth and Goulden, 2008]. The records show increasing variability in most regions of Uganda other than the central region [Republic of Uganda, 2007].

2.2.5 Temperature variations

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



2.3 Impacts of Climate Change in Uganda

A variable/changing climate due to increasing anthropogenic emissions of greenhouse gases has affected and will continue to affect various sectors of the Ugandan economy. The major climate factors contributing to these responses include increasing atmospheric carbon dioxide, rising temperature, and increasing extreme events, especially droughts and floods. These factors in turn will affect water resources for agriculture, grazing lands, livestock, and associated agricultural pests. Effects will vary, depending on the degree of change in temperature and precipitation and on the particular management system and its location [IPCC, 2007].



Table 1 and 2 below summarizes the effects of climate change on livelihoods and selected sectors of the economy. A representation of primary hazards in selected regions in Uganda is shown in Table 1 and several studies have suggested that recent warming trends in Uganda may have already had discernible effects in the country as shown in the tables.

Table 1: Primary climate change hazards and effects in selected regions in Uganda

Region	Primary hazards Climate Change Hazards:
North Uganda and Teso:	Drought and floods. The 2007 floods followed heaviest rain in 35 years. Hundreds of thousands of people were affected, crops destroyed, and water-borne diseases increased.
Rwenzori regions:	Reduced rainy season hitting yields of basic food crops like beans. Mountain icecaps receded by 40% of their 1955 cover. May ultimately reduce year-round water flows in Semliki River.
Karamoja regions:	Seven droughts experience between 1991 and 2000 have increased food insecurity and animal losses. Increased conflict over water; tick-borne diseases; dust storms, chest and eye infections; and tsetse fly belt expanded.
Elgon region:	Landslides and floods. Increases in deforestation have been reported as farmers are forced to move to higher altitudes. May be one of the few areas still able to grow coffee if temperatures rise by two [2] degrees.
South-West:	Is the fastest warming region at 0.30C per decade with more frequent and severe droughts. The region is becoming unsuitable for coffee and dairy production is falling due to heat stress. Malaria is at epidemic proportions with Mbarara reporting a 135% increase in malaria cases.
Kampala:	More intense rain, inadequate waste disposal, drainage problems and encroachment on wetlands, increased risk of floods, urban disruption, cholera, diarrhea and dysentery.
Lake Victoria:	Hotter temperatures likely to lead to lower outflows, hitting hydropower generation. Drought, loss of lakeside tree cover and over-extraction have affected the rainfall cycle and reduced lake levels to lowest for 60 years.

Oxfam, 2008

Table 2: Summary of impacts of climate change on selected sectors in Uganda

Sector	Impact of Climate Change
Water	Change in river flow regimes Higher temperatures and melting of Rwenzori glaciers temporarily increasing and then reducing flows in the Semliki river downstream.
	Water scarcity Stress, higher demands for water, conflict and biodiversity loss.
	Flooding Risks of loss of life and property; Damage to infrastructure Extension of malaria into higher altitude or once cooler areas due to temperature increase.
Health	Water borne diseases Increase prevalence of diarrheal disease including cholera epidemics particularly where sanitation is poor in slum areas.
	Respiratory diseases Associated with prolonged dry spells.
	Malnutrition and famine Lower food production and insecurity.
	Seasonal rainfall change Crop failure or lower yields of staple; reduction in traditional varieties and more crop diseases; additional agricultural workloads particularly for women
Agriculture & food security	Crop damage and soil erosion, increases in conflicts and reduction in milk production; loss of spawning areas for fish.
Environment	Land degradation and deforestation Collapse of livelihood assets; increased salination and soil erosion, extinction of species.
Infrastructure	Damage to bridges, roads, telecommunication and buildings, higher energy costs and energy poverty with knock on implications for charcoal use, deforestation and land degradation.
Economy	Too much rain reduces flowering of robusta coffee, which reduces production and also affects drying of beans. Diseases, pests and mould hit both production and quality.
	Increase due to pressure on internal and international production capacity
	Affects the tourism potentially due to a degradation of environment and infrastructure.

[Hepworth and Goulden, 2008]

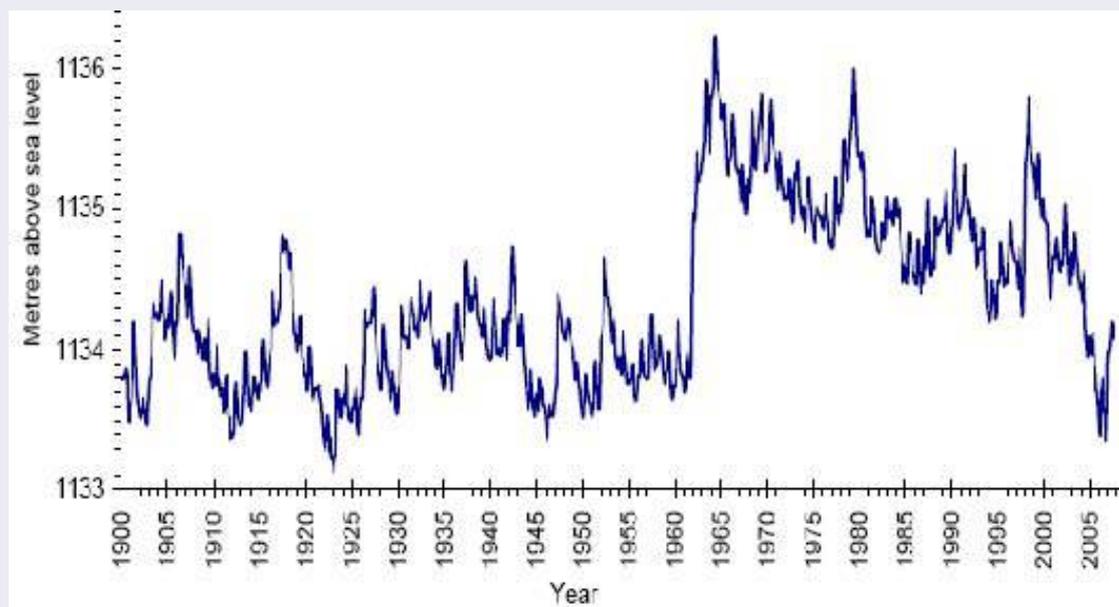
2.3.1 Climate Change and Water Resources

The encroachment, drying up and depletion of River Rwizi in Mbarara, River Nyamwamba in Kasese, Lake Kyoga and Lake Victoria, are glaring manifestations of a severe environmental breakdown. They also indicate inadequate and non-functionality of policy regimes as well as a major cause of economic mayhem; poverty, conflicts, disease, drought and famine. Recently, and perhaps most threatening, Lake Victoria water level has been receding at an alarming rate. Figures 2.2 to 2.4 show the variations in selected water bodies and catchments in the country. Lake Victoria does not get water from a broad land region; most of its water comes from rain that falls directly over the huge lake. For this reason, the lake is very sensitive to rainfall, and its water levels depend on how much rain falls in a particular year.

Since Lake Victoria receives 80% of its refill through direct rainfall and only 20% from the basin discharge, climatic contributions cannot be ignored. Studies have linked the causes of fluctuations in level of Lake Victoria, in particular the large increases in level in 1961 and again in late 1997 and early 1998 to oscillations in sea surface temperatures and ocean circulation patterns in the Pacific (El Niño), Indian and Atlantic Oceans. Other lakes in the region show similar patterns of historical variability in their levels; for example, Lake Wamala, one of Uganda's inland lakes declined by 50% between 1987 and 1995 (NEMA, 2009).

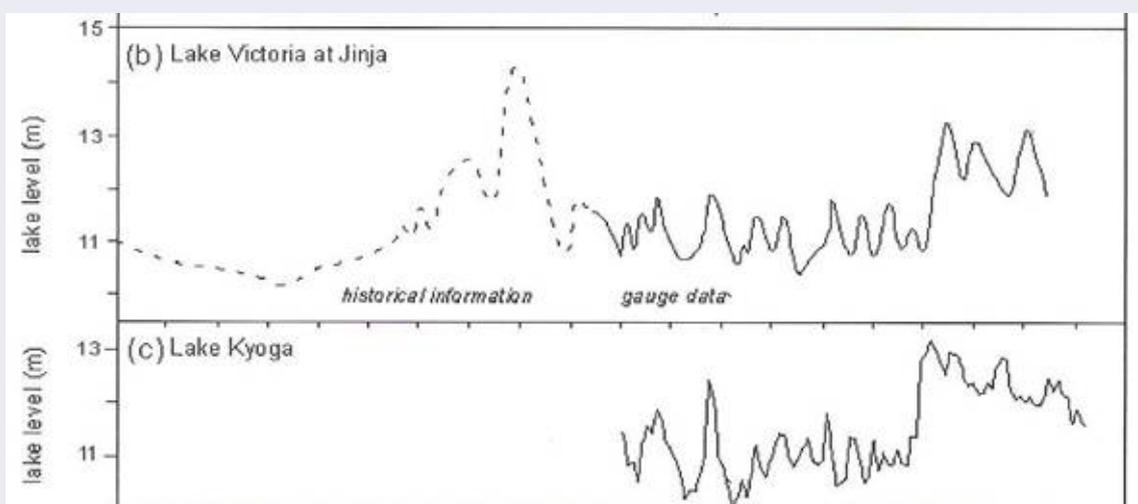
Thirteen years of measurements taken by satellite radar altimeters combined with historical ground measurements reveal Lake Victoria's volatile past. In the 105-year history of accurate measurements on the lake, water levels have fluctuated widely. In 1961 and 1962, for example, heavy rain drove water levels up by an astounding 2 metres. Since that time, levels above the gauge in Jinja, Uganda, stayed above 11.9 meters (about 1,134 meters above sea level) until December 2005. From that point, water levels dropped to alarmingly low levels and were not expected to stop dropping until the April rains arrived. In the 105-year history of accurate measurements on the lake, water levels have fluctuated widely. In 1961 and 1962, for example, heavy rain drove water levels up by an astounding 2 metres [NASA 2006].

Figure 2.2: Water levels of Lake Victoria at Jinja 1900 - 2007



Source: Gouliden 2006, Updated 2007 by Department of Water Resources Management 2007

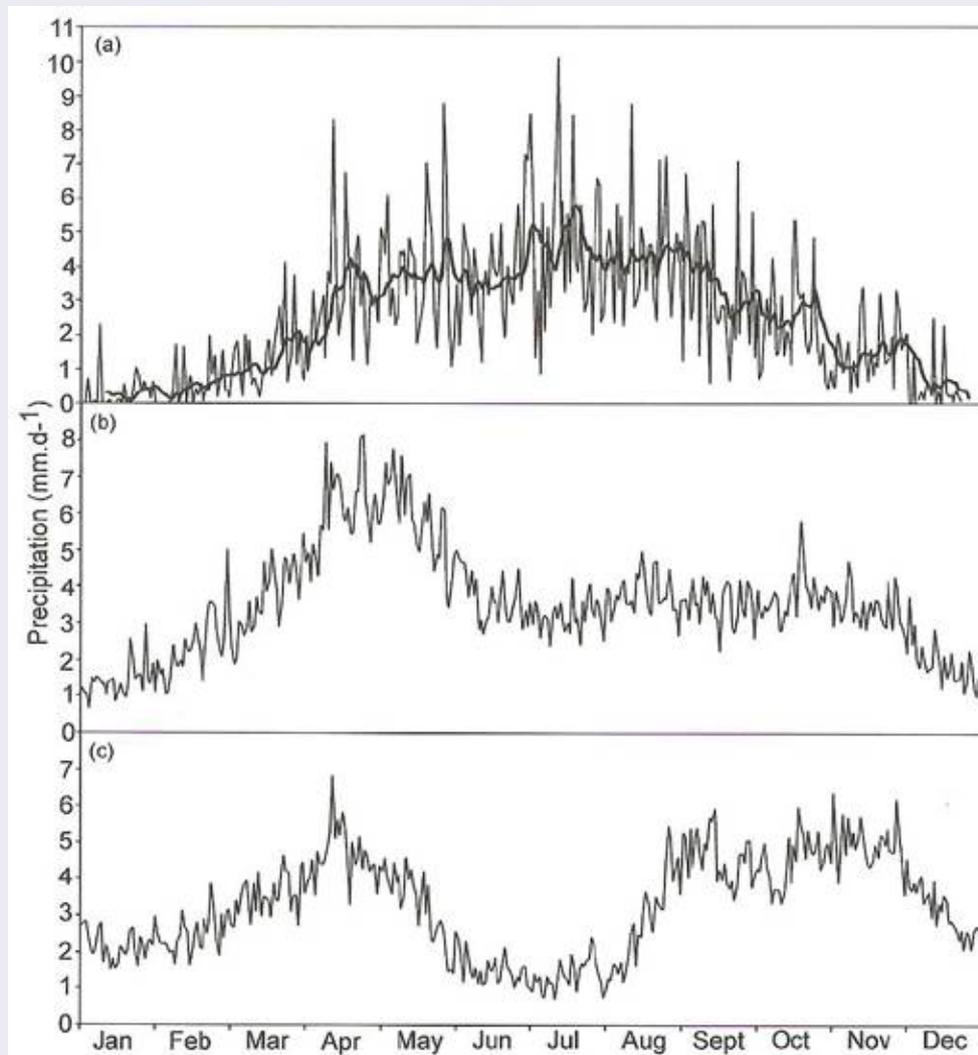
Figure 2.3: Lake Levels of Lake Victoria 1900 - 1990



Inferred from historical information to 1980 and 1890 and gauge data [Nicholson, 1999] and Lake Kyoga [1899 – 1999] – Mileham, [2008].

Based on field surveys and analyses of optical space borne images (LandSat5, LandSat7) report recent decline in the areal extent of glaciers in the Rwenzori Mountains of East Africa from $2.01 \pm 0.56 \text{ km}^2$ in 1987 to $0.96 \pm 0.34 \text{ km}^2$ in 2003. The spatially uniform loss of glacial cover at lower elevations together with meteorological trends indicates that increased air temperature is the main driver. Clear trends towards increased air temperatures over the last four decades of 0.5°C per decade exist without significant changes in annual precipitation. Extrapolation of trends in glacial recession since 1906 suggests that glaciers in the Rwenzori Mountains will disappear within the next two decades [Taylor et al., 2006]. The melting of ice on Mt. Rwenzori due to global warming has increased water flow in the Semliki River, eroding its banks and silting Lake Albert [NEMA, 2009]. A comparison of satellite images from 1987 and 2005 shows a decrease in the extent of glaciers on Speke, Stanley, and Baker peaks [Figure 2.5]. The glaciers declined by 50 per cent between 1987 and 2003. A century ago the glaciers of the Rwenzori Mountains covered nearly 6.5 km^2 . If the glaciers continue to recede as they have since 1906 – researchers estimate they will be gone in the next 20 years [<http://www2.geog.ucl.ac.uk/~rtaylor/rwenzori.htm> - accessed 24th June 2009].

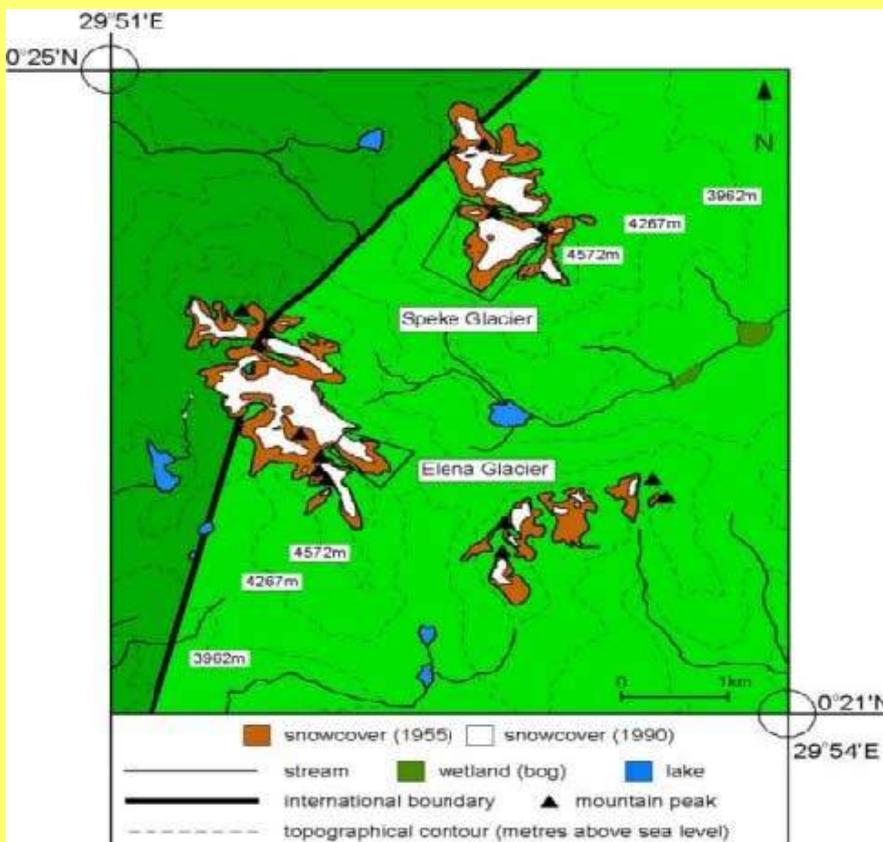
Figure 2.4: Latitudinal precipitation gradient in Uganda, [a] Daily precipitation at Agora station, Northern Uganda



(30.1 0E, 3.80N), thick line is the 10 day moving average [b] Mean daily precipitation for 19 rainfall stations in the Mpologoma catchment, Central Uganda (330E, 1.20N) and [c] mean daily precipitation for 22 precipitation stations within and surrounding the River Mitano catchment in South-western Uganda (300E, 0.80S) for complete years of precipitation for the period 1943 to 1998

Local livelihoods depend heavily on fishing, and the processing and trading of fish. Therefore any negative impacts of climate change on the Lake Victoria fishery will also have an impact on local livelihoods and will exacerbate poverty. People will have varying resilience to these impacts due to differences in their abilities to adapt. Evidence from a study of people's responses to climate variability suggests that any variability or declines in fish catches due to climate change are likely to prompt people to diversify their livelihoods away from fishing or to increase their mobility and migrate to other lakes (Goulden 2006).

Figure 2.5: The Central Rwenzori Massif showing alpine lakes, wetlands, streams & the extent of glacial snow cover in 1995 and 1990

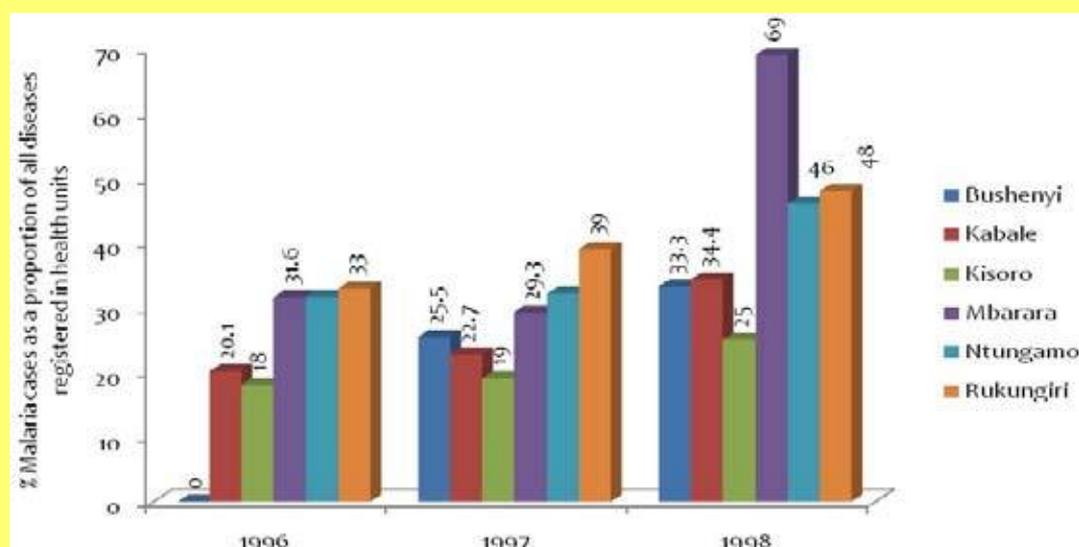


2.3.2 Climate change and health

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. 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 [Republic of Uganda, 2007].

Rising temperatures, for example, has extended the habitats of mosquitoes that carry the malaria parasite, shifting the boundaries of latitude and altitude for malaria transmission - for example, many highland areas in Uganda that have historically been classed as malaria-free are now experiencing epidemics; for example the South western districts of Kabale, Kisoro and Rukungiri. Data from health units in the districts of South western Uganda in 1996, 1997 and 1998 (see figure 2.6) reveal an increase in the cases of malaria ranging from 23% in Rukungiri to 135.5% in Mbarara district (Ministry of Health, 1998 in Republic of Uganda, 2007). Children and pregnant women are particularly at risk. Drought, too, has increased the incidence of malaria in sub-Saharan Africa. There is evidence that rising temperatures help mosquitoes to breed more, bite more and live longer [Oxfam, 2008]. The resurgence of malaria has increased, with the average monthly incidence increasing from about an average of 17 cases per 1,000 (1992–96) to 24 cases per 1,000 (1997–98). These increases, considered alongside evidence of a global increase in the average surface temperature of 0.6 °C this century, have fuelled speculation that temperature-related increases in transmission of *Plasmodium falciparum* are already manifest [Simon, et al., 2002].

Figure 2.6: Malaria cases in selected districts in Uganda [Data from Republic of Uganda, 2007]



Ministry of Health, - Republic of Uganda, 2007

2.3.3 Climate change and agricultural production

Increased intensity and frequency of storms, drought and flooding, altered hydrological cycles and precipitation variance have implications for future agricultural production although the potential impacts on rainfed agriculture vis-à-vis irrigated systems are still not well understood. Table 3 shows the possible direction of changes from negative to positive for most regions when assuming adaptation. Concerning the adaptation scenario, Tol et al, 2002, comment that former studies often assumed “limited capacities of farmers to adapt to changing circumstances” [Tol 2002]. Perfect adaptation is less realistic as inadequate information, limited access to technology and institutional weaknesses reduce the extent and effectiveness of adaptation. FAO [2007] reports that developing countries would face a decrease in GDP from agriculture due to climate change, and Africa would be negatively affected.

Table 3: Global impacts on agriculture* for a 2.5 Degree Celsius increase in global mean temperature

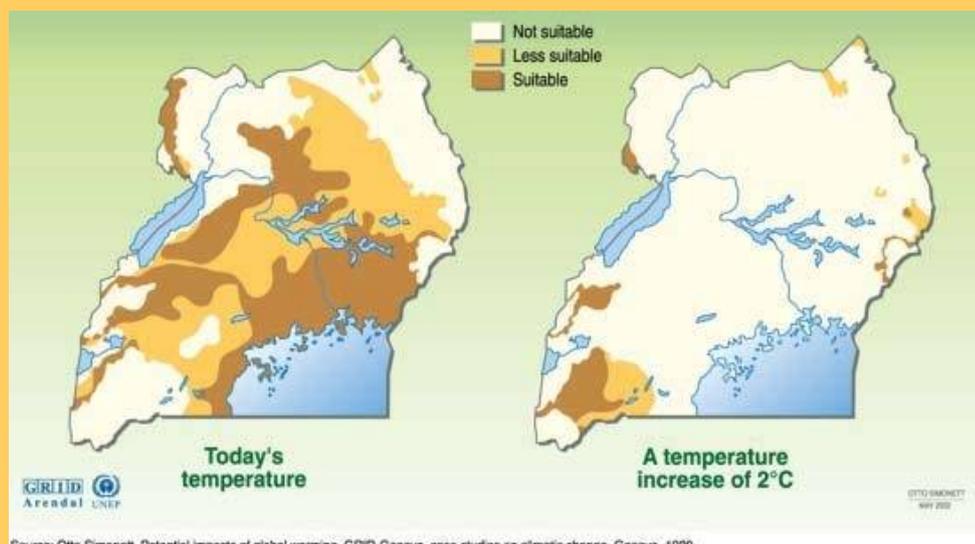
Regions	Without adaptation		With adaptation		Mean
	Bad guess	SD	Best guess	SD	
Latin America	-0.8	0.	0.6	0.7	-0.1
South and South East Asia	0.7	0.3	0.6	0.3	0.0
Middle East	-0.4	0.4	0.6	0.5	0.1
Africa	-0.2	0.2	0.5	0.3	0.1
OECD-P	-0.2	1.6	0.8	1.6	0.3
OECD-A	-0.3	1.3	1.0	1.3	0.4
OECD-E	0.6	1.0	2.1	1.1	1.3
Eastern Europe and Formr SU	0.9	1.2	2.7	1.1	1.8
Centrally planned Asia	1.7	1.0	3.1	1.0	2.4

Expressed in percentage change from reference projection of GDP [Tol, 2002]

The vulnerability of the agricultural sector to both climate change and variability is not well established in Uganda. The general consensus is that changes in temperature and precipitation will result in changes in land and water regimes that will subsequently affect agricultural productivity. Research has also shown that more specifically for coffee production, impacts on productivity are expected to be particularly harmful [Figure 2.7]. Yield losses of up to 78% of maize crop production have also been reported in Masindi in 1998 [Byabakama, 1998 in Komutunga and Musiitwa, 2001].

Food insecurity vulnerability patterns will be modified by climate change. Small-scale rain fed farming systems, pastoralist systems, fishing communities, and forest-based systems are particularly vulnerable to climate change. Moreover, the urban poor, particularly in cities and floodplain settlements face increasing risks. Generally, impacts of climate change on smallholder and subsistence farmers, pastoralists, artisanal fisher folk and forest dwellers including indigenous people are complex and highly localized. Vulnerability also varies within communities, dependent on factors such as land ownership, gender, age and health.

Figure 2.7: The impact of a 2°C temperature rise on Robusta coffee in Uganda



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

Source: [<http://maps.grida.no/go/graphic/impact-of-temperature-rise-on-robusta-coffee-in-uganda>]

In Uganda, the cattle corridor; a fragile ecosystem, depends on rainwater for human consumption and production. By 2002, there were 6 million heads of cattle (about 6,328,000); 6 million goats (6,852,000) and 1 million (1,141,000) sheep in Uganda largely concentrated in the cattle corridor, accounting for about 90% of the national cattle herd and 17% of the agricultural gross domestic product in the country. Long and frequent droughts cause severe water shortage lead to loss of animals, low production of milk, food insecurity, increased food prices and generally have negative effect on the economy [Ikasita, 2009].

Climate variations will continue to exert a strong influence on 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 have also been reported across districts in both livestock and crops as major causes of low productivity. In Katakwi district, grasshopper epidemics in 2005 destroyed all cereals, the main source of food security in Usuk 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 was reported in the cold mountainous

ecosystems. 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 [Republic of Uganda, 2007].

2.4 Responding to Climate Change

2.4.1 Why Uganda can't wait to reduce and prepare for climate change impacts

For reasons provided below, Uganda cannot wait for taking steps to reduce and prepare for climate change impacts.

1. An increasing amount of physical evidence points to the fact that climate change is already in motion particularly since the 1950s. In fact, many of the changes projected throughout the middle of the 21st century will be driven by present-day activities. Therefore, the impacts of present day activities will limit the severity of long term future impacts, but it will do little to alter the near-term changes already set in motion.
2. Significant reduction of greenhouse gas emissions is possible, but it is unlikely that greenhouse gas emissions will be stabilized or reversed in the near term. Approximately 75 percent of CO₂ emissions to the atmosphere over the past 20 years are due to fossil fuel burning (IPCC, 2001). If the world's nations move quickly and collectively work towards a global clean energy economy, prospects for reducing global human greenhouse gas emissions are good. However, avoiding the worst climate change impacts will require reducing greenhouse gas emissions to the point where atmospheric concentrations stabilize and then decline. Given the dependence of Uganda's economy increasingly on fossil fuels and the time required for new technologies that reduce or replace fossil fuels to integrate into the economy, any significant reduction in CO₂ emissions is unlikely to occur soon enough to avoid many of the projected climate impacts.
3. Climate change is expected to continue long after greenhouse gases are stabilized. Greenhouse gases remain in the atmosphere for tens to thousands of years before breaking down. Until this happens, greenhouse gas molecules will continue to trap energy, causing continued warming. Additionally, even after atmospheric concentrations of greenhouse gases are stabilized, it will take hundreds of years for global temperature and ocean levels to reach a new equilibrium due to the physical size and characteristics of the Earth's oceans and atmosphere [IPCC, 2001; IPCC, 2007]. Together, these facts mean that atmospheric greenhouse gas concentrations and global temperature are expected to increase well into; and in all likelihood beyond the 21st century.
4. Climate change will likely lead to irreversible losses in some areas. If no action is taken, climate change will likely lead to irreversible losses in nature, including extinction of species and permanent loss of habitat and special historical and cultural places. If the global average temperature increases by only an additional 2.7 to 4.5°F over pre-industrial levels, an estimated 20 to 30 percent of the plant and animal species known in the world are likely to be at higher risk of extinction (Parry et al. 2007). Avoiding these losses, if possible, will require actively managing ecosystems and human choices.
5. Climate change will have largely negative economic consequences, but may also create economic opportunities. Climate change will affect a wide array of economic sectors, including: agriculture, forestry, water supply, fisheries, health, energy, transportation, and tourism. Non-economic resources such as biodiversity, air, and water quality will also be affected. Planning for climate change and its specific effects may help reduce the economic costs to these sectors while also creating opportunities to capitalize on its beneficial impacts.

6. Preparing for climate change is an indicator of good governance. Governments share a common goal of ensuring the safety, health and welfare of their communities now and into the future. Meeting this goal and maintaining the integrity of essential public services requires that the Ugandan governments anticipate trends and changes that could affect their environment, economy, and community wellbeing. Since climate change will affect a broad range of community assets and government services, operations and policy areas, preparing for climate change is thus a matter of good governance and risk management.

2.4.2 National responses and National Climate Policy in Uganda

A useful measure of the priority afforded climate change and the adequacy of the Government response is provided by the track record of the Department of Meteorology within the Ministry of Water and Environment. The Department coordinates climate change activity for the MWE in its capacity as the National Focal Point for Climate Change under the UNFCCC. Uganda's National Adaptation Programmes of Action (NAPA) and the First National Communication.

Responsibility for coordinating an effective response to climate induced disasters such as droughts and floods lies with the Ministry of Relief, Disaster Preparedness and Refugees under the Office of the Prime Minister. Their efficacy and reach, certainly in terms of disaster risk reduction and preparedness is limited as demonstrated by the devastation wrought by the 2007 floods in north-eastern Uganda. Another initiative within the agricultural sector is the Plan for Modernisation of Agriculture which receives support from donors through Agricultural Sector Programme Support II [2004-2009). The PMA focuses on enhancement of agricultural production, increasing land and labour productivity, competitiveness and private sector participation.

Regional sectoral support programmes like the Nile Basin Initiative (NBI) (funded by DFID, World Bank and other donors) and the Lake Victoria Environmental Management Programme (LVEMP) (World Bank support) currently have no specific focus on climate change, although the need to address climate change has recently been raised within working groups of the NBI and several of the NBI programmes. The Lake Victoria Basin Commission, established in 2005 as an institution of the East African Community (comprised of Kenya, Tanzania, Uganda, Burundi and Rwanda) and implementer of the planned second phase of LVEMP, propose to have a sub-programme on climate change, although initial proposals lack any details (EAC 2007)

A Parliamentary Forum on Climate Change (PFCC) was created in late 2008 to respond to the pressing issues – environmental, social and economic – presented by rising global temperatures due to the phenomena known as Climate Change. The Forum has established a timeline of priorities and expected outcomes, to be adopted by and implemented by its members. These priorities include streamlining climate change issues into the national budget, creating a communications strategy, implementing a training program for all members so that in the long run the trickle down effect is to the constituencies that each member serves.

2.4.3 International responses and Climate Policy

Developing countries must be included in any emissions reduction regime to achieve the stabilisation of atmospheric carbon at a safe level, thereby tempering climate change impacts in the long term. Securing developing country participation in a global emissions reduction regime implies that agreement will be necessary on a framework for resource transfers that provide incentives for the transition away from carbon-intensive economies, the provision of support for the integration of climate risks in development activities, and the necessary investment in the international political process.

Uganda has signed and ratified the Kyoto Protocol. As a non-Annex I Party to the Protocol, Uganda is not bound by specific targets for greenhouse gas emissions. Uganda has actively participated in international fora on climate change, including as Vice President of the Bureau and as a member of the Clean Development Mechanism [CDM] Executive Board. Negotiations are led by the Department of Meteorology where technical

understanding is strong but workload exceeds resource allocation. There is a need for support to strengthen the voices of Uganda and other developing countries.

2.5 Mitigation Mechanisms

2.5.1 The Clean Development Mechanism

The Clean Development Mechanism [CDM] was established by the Kyoto Protocol with the double objective of assisting developing countries in achieving sustainable development, and assisting industrialised countries to meet emission reduction commitments. Under CDM, projects that reduce greenhouse gas emissions and contribute to sustainable development can generate Certified Emission Reductions (CERs), a tradable commodity in international carbon markets. To date, Uganda has not benefited from CDM on any meaningful scale. The Designated National Authority for coordinating CDM under the UNFCCC is the Ministry of Environment and Water, supported by a steering committee and a one person secretariat. Activity has been limited by a lack of funds to operate, competing commitments of officers and insufficient staff to discharge the functions required. In part reflecting this, only one project has been established under CDM, the West Nile Nyagak Mini Hydropower project, which attracted about US\$4 M. Other projects are under development with donor support such as the Kakira Cogeneration Project and landfill gas recovery initiatives under development within nine municipalities with planned extension into a further nine shortly.

Although the potential to benefit from CDM is significant in Uganda, climate change mitigation through the Clean Development Mechanism and Voluntary Carbon Markets has had a limited impact in Uganda. High transaction costs limit investment in CDM in Uganda and that the overly bureaucratic process of registration is not only difficult and expensive for project developers, but also requires skills (for baseline surveys, production of a Project Idea Note and Project Design Document) which are quite cumbersome. There is agreement that generating the capacity and expertise within Uganda to conduct this type of work and the appointment of local verifiers will reduce the costs and facilitate greater uptake.

2.5.2 Voluntary Carbon Markets

Besides CDM, voluntary carbon markets are relevant to countries like Uganda. This is especially true for Land-use, Land-use Change and Forestry (LULUCF) projects where voluntary carbon market methodologies are less demanding. The volumes transacted in the voluntary markets tripled between 2006 and 2007 with the total value of the voluntary carbon markets in 2007 at US\$ 331 million. Uganda has a more extensive track record with the Voluntary Carbon Market than with the CDM, with reforestation projects associated with carbon offsets operating as early as the mid 1990's, through the work of the Forests Absorbing Carbon Dioxide Emissions [FACE] Foundation. Examples of successful entry into international carbon markets is evident through schemes like Plan Vivo however, quantification of actual or potential benefits for Uganda has not been carried out recently.

2.6 Conclusions

The analysis of the climatic parameters clearly indicates that all parts of the country have been affected by climate change 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 [Republic of Uganda, 2007].

Increased frequency, intensity and widespread climate variability and climate change pose serious threat to agriculture; the mainstay of the economy thereby retarding social and economic development pathways. However, despite the eminent threat, an 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 [Republic of Uganda, 2007].

Increasing the response-capability of developing countries will also require information on seasonal forecasts to enable preparedness to climate variability, as well as longer-term climate prediction data to ensure that strategies to reduce vulnerability also reflect the underlying longer-term climate trends.

References

1. Awange, Joseph L Ogalo, Laban Bae, Kwang-Ho Were, Paul Falling Lake Victoria water levels: Is climate a contributing factor? Climatic Change 2008 Vol. 89(No.3-4)
2. DFID [2004], Impact of Climate Change on Poverty
3. East African Community [2007], Lake Victoria Basin Commission – Operational Strategy 2007- 2010. Final Report, Cardno Agrisystems Africa Ltd. July 2007
4. FAO, [2007] Adaptation to climate change in agriculture, forestry and fisheries: Perspective, framework and priorities, Interdepartmental Working Group on Climate Change, Rome Italy
5. Goulden, M., [2008], Building resilience to climate change in lake fisheries and lake-shore populations in Uganda, Policy briefing note, Tyndall Centre for Climate Change Research, University of East Anglia, UK
6. Hepworth, N. and Goulden, M., [2008], Climate Change in Uganda: Understanding the implications and appraising the response, LTS International, Edinburgh
7. IPCC, (2001). Climate Change 2001: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change. IPCC/ WMO/UNEP.
8. Jones, P.D., Mann, M.E. 2004. Climate over past Millennium. Reviews of Geophysics, 42, RG2002
9. Komutunga-Tumwesigye, E., and Musiitwa, F. [2001], Characterising drought patterns for appropriate development and transfer of drought resistant maize cultivars in Uganda. Paper presented at the Seventh Eastern and Southern Africa Regional Maize Conference 11-15 February 2001. Pp. 260-262
10. Mileham Lucinda, [2008], Impact of climate change on the terrestrial hydrology of a humid equatorial catchment in Uganda. Doctoral Thesis Department of Geography University College London
11. Ministry of Water and Environment, [2007], National Adaptation Programme of Actions, Department of Meteorology, Government of Uganda
12. Mubiru, P [2006], Causes of the Decline of Lake Victoria Levels During 2004 to 2005
13. NEMA [2009], Uganda Atlas for Our Changing Environment. National Environment Management Authority Kampala Uganda
14. Orindi, V.A., and Murray, L. A., [2005], Adapting to Climate Change in East Africa: A strategic approach, Gatekeeper series 117, International Institute for Environment and Development, UK
15. Orindi, V. O and Laurel A.Murray, L. A., [2005], Adapting to Climate Change In East Africa: A Strategic Approach 117 International Institute for Environment and Development

16. Orindi, V.A., and Eriksen, S., [2005], Mainstreaming adaptation to climate change in the development process in Uganda, African Centre for Technology Studies (ACTS) Ecopolicy Series No. 15
17. Oxfam, [2008], Another inconvenient truth: how biofuel policy is deepening poverty and accelerating climate change, Oxfam Briefing Paper 114, June 2008
18. Oxfam, [2008], Turning Up the Heat: Climate Change and Poverty in Uganda, July 2008, Oxfam GB
19. Patz, J. P and Sarah H. Olson [2006], Malaria risk and temperature: Influences from global climate change and local land use practices Proc Natl Acad Sci U S A. 2006 April 11; 103(15): 5635–5636. Published online 2006 April 4. doi: 10.1073/pnas.0601493103 The National Academy of Sciences of the USA
20. Republic of Uganda [2007], Climate Change: Uganda National Adaptation Programmes Of Action In association with Environmental Alert, GEF and UNEP]
21. Rwakakamba, M. [2009] Uganda at brink of water crisis [<http://www.independent.co.ug/index.php/column/guest-column/68-guest-column/1043-uganda-at-brink-of-water-crisis>] Tuesday, 09 June 23:23
22. Simon I. Hay, Jonathan Cox, David J. Rogers, Sarah E. Randolph, David I. Stern, G. Dennis Shanks, Monica F. Myers & Robert W. Snow [2002], Climate change and the resurgence of malaria in the East African highlands Nature 415, 905-909 (21 February 2002) | doi:10.1038/415905a; Received 12 October 2001; Accepted 7 December 2001
23. Snover, A.K., L. Whitely Binder, J. Lopez, E. Willmott, J. Kay, D. Howell, and J. Simmonds. [2007], Preparing for Climate Change: A Guidebook for Local, Regional, and State Governments. In association with and published by ICLEI – Local Governments for Sustainability, Oakland, CA.
24. Taylor, R.G. and Mileham, L. and Tindimugaya, L. and Majugu, C. and Muwanga, A. and Nakileza, B. [2006], Recent glacial recession in the Rwenzori Mountains of East Africa due to rising air temperature. Geophysical Research Letters, 33 (10). L10402. ISSN 00948276
25. Tol, R.S.J. (2002), 'New Estimates of the Damage Costs of Climate Change, Part I: Benchmark Estimates', Environmental and Resource Economics, 21 (1), 47-73.
26. Trumper, K., Bertzky, M., Dickson, B., van der Heijden, G., Jenkins, M., Manning, P. June
27. 2009. The Natural Fix? The role of ecosystems in climate mitigation. A UNEP rapid response assessment. United Nations Environment Programme, UNEPWCMC, Cambridge, UK
28. Twinomugisha, B. [2007], Climate Change And Human Health Uganda Country Report: Case of Malaria, Kabale District Final Report DENIVA
29. UN Habitat [2009], Assessment of Cities and Climate Change in Kampala and Uganda Draft
30. Report Urban Environment & Planning Branch Sud-Net Cities In Climate Change Initiative (CCCI) United Nations Human Settlements Programme Unhabitat
31. Water Resources Management Department [2006], The Year Book of the Water Resources Management Department 2004-2006 Entebbe Uganda



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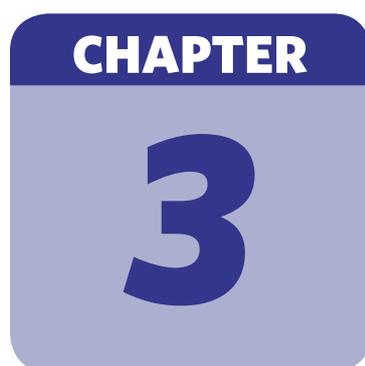
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CLIMATE CHANGE: IMPLICATION TO SOCIO-ECONOMIC DEVELOPMENT IN UGANDA

3.1 Introduction

Since 1997, the Government of Uganda developed the Poverty Eradication Action Programme (PEAP) as a three year rolling overall policy framework for poverty reduction. Within the PEAP the country developed a number of programmes for promoting social economic development. These include Plan for Modernization of Agriculture (PMA), the Prosperity for All (PfA), Universal Primary Education (UPE) Universal Secondary Education (USE), improved access to Primary Health Care, Roads Safety Network, Water and Sanitation, women emancipation and children rights. In addition there are a number of disaster response programmes such as Northern Uganda Reconstruction Programme, (NURP I&II), Northern Uganda Social Action Fund (NUSAF) and Peace Recovery and Development Programme (PRDP) for the war affected region in the north.

The country Uganda has made tremendous progress towards achieving some major social economic targets that are set in the PEAP. Over the 20 years the country has achieved sustainable growth and significant reduction in income poverty, the economy has grown on an average of 5.6 per year, while income poverty reduction headcount has declined from 56 percent in 1992 to 31 percent in 2005/06.

Other achievements include increased school enrollment from 2 million children to over 7 million by the year 2006, reduction in HIV prevalence from 18% to 6.4% in 2006. Other achievements include increased road transport network, and rural safe water coverage estimated at 62%, reduced infant mortality rate and significant increase in agricultural yields.

However, the above achievements are vulnerable to the effects of the current global warming and therefore the sustainability of the above social economic variables is greatly dependent on sustainable environmental management of which climate/weather is one of them.

Climate change is a change of 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 a comparable time (UNFCCC). Human activities such as industrialization, transport and power generation, clearing of bushes for agriculture, deforestation result in emissions of GHGs into the atmosphere. These

emissions in the last 50 years have significantly increased the concentrations of the GHGs in the atmosphere resulting in offsetting the natural equilibrium hence warming of the earth's surface resulting in global climate change.

3.2 Implications on Socio-Economic Development

Climate is one of the most valuable natural resource which constitutes the primary source of livelihoods for all Ugandans and the entire global village. It is the driver for secondary resources such as health, agriculture, education, water resources, transport and tourism, constituting the base of the economy are climate sensitive and dependent making highly vulnerable to impacts of climate change.

The impacts of climate change are continuing to be experienced in every corner of the world among both the poor and rich, making it difficult to meet development set targets and goals especially identified under PEAP as well as the Millennium Development Goals (MDGs). Although Uganda is generally known to have a good climate, events in the last 30 years have shown increased climate variability and signs of severe climate change. In the last ten years alone, seven droughts have been recorded and droughts have almost become a yearly event/occurrence. There has also been an increase in intensity of these droughts.

Table 4 gives some evidence of selected occurrences of weather/climate changes where as the in the next section of this report we discuss in detail the effects of climate change especially draught and floods on socio-economic development in Uganda.

Table 4: Climate Change and related Disasters in Uganda

Year	Description	Affected Areas
1992-1993	Extreme drought conditions causing hunger/famine	Eastern and North Eastern parts of the country
1994-1995	Extreme drought conditions	Widespread countrywide. Over 1.8 million people were affected due to lack of food, water and inadequate pasture for animals.
1997-1998	Extreme floods causing loss of crops, death to livestock, land slides, water-related diseases and submergence of homes due to the el-nino occurrence	Most parts of the country. Land slides killed 53 people in total and over 2,000 people were displaced. Roads, bridges, houses, crops, and property worth more than US\$ 20m were destroyed.
1998-1999	Extreme drought conditions resulting in loss of crops, animals and drying up of water sources	South Western districts. Over 3.5 million people in 28 districts were affected by lack of food and large numbers of live stock suffered from inadequate pasture and water.
2000	Extreme drought conditions resulting in loss of crops, animals and drying up of water sources	Northern, North-Eastern, South-Western and parts of Central Uganda.
2007	Extreme floods causing loss of crops, death to livestock, land slides, water-related diseases and submergence of homes	Mostly in Eastern and North Eastern parts of the country.

Source: Ministry of Water and Environment and PEAP 2004

3.2.1 Soil degradation

Land is a main natural resource for sustainable agricultural production in Uganda. Land degradation therefore remains a major threat to Uganda's land resource and to agricultural production in particular (SOER-2008).

With increased global warming, soil moisture is affected as a result of prolonged dry season making it vulnerable to soil erosion because of the bare soils.

During the period of 1998/99 and 2008/09 the country experienced severe droughts and this has resulted in massive crop failure in many parts of the country as evidenced in figure 3.I below. There are a number of reported cases where animals died due to lack of pasture especially in Mpigi, Rakai, Masaka and Sembabule districts, Teso sub-region and entire so called cattle corridor which is predominantly a pastoral area, hence the wide spread famine. Loss of soil fertility due to prolonged drought has caused inter district migrations in search for animal pasture and water and this has led to conflict in many parts of the country leading to breakdown of traditional property rights to land and ultimately of law and order.

Figure 3.1: An Old Woman in a Severely Degraded Environment



Normally droughts are followed by heavy rain falls which has always washed away the top soils which are more fertile to low land areas though there is no empirical statistical data to quantify the amount of soil that is washed away to low land areas. This has consequently forced people to migrate to low land areas in search for fertile land for cultivation thereby leading to rampant wetlands degradation and destruction of ecosystem. It should be noted that soil degradation is responsible for the poor crop yields and therefore threaten the food security especially among the rural women and children who are more vulnerable.

3.2.2. Agricultural Productivity

Agricultural productivity is the other area affected by climate variability. Uganda heavily depends on rain fed agriculture practiced at small scale subsistence level by the majority of its rural population. The main activities include crop cultivation; animal keeping, bird keeping and these types of activities are sensitive to climate change. It should be noted that productivity growth in Ugandan agriculture has resulted primarily from expansions and not from intensification of production resulting from high yields. The area under cultivation is largest and has increased from 84,000 km² to 99,000 km² between 1990 and 2005 (SOER-2008).

According to Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), in the recent years, there have

been significant yields in maize (1.8 metric tones per hectare), banana (6 metric tones per hectare, and not less than 1 metric ton per hectare for most pulses. Live stock production has grown to more that 4 percent annually in the past 10 years. Despite the impressive growth rate of the industry and service sectors (Table 5), agriculture remains an important factor in the socio-economic development of Uganda, particularly in the poverty eradication.

Recent trends indicate that the contribution of agriculture to total GDP has decreased from 45.7 percent in 1995/96 to 29.4 percent in 2008/09. Currently, agriculture is the main contributor to total employment and it has increased from 66% in 2002/03 to 73% in 2005/06 (UBoS 2008).

Table 5: Trend of the Agricultural Contribution to Growth in Uganda

Sector	Growth Rate	Employment in %	Comments
Industry	10.5	8	Impressive growth rate
Service	7.5	23	Impressive growth rate
Agriculture	3.8	73	Slow growth rate but remains an importance source of employment.

Source PEAP-2004

The decline in agricultural contribution to the GDP and the profitability of agriculture enterprises are constrained by a number of broader development challenges like the occurrence of extreme weather events such as droughts, floods, land slides, hailstorms not disregarding limited market information, research and technology, high transport costs and value chains among others. For example, the decline in agricultural contribution to the growth in 2008/09 is partly explained by the long drought, hailstone and flooding of farm land as illustrated by the dried maize plantation in figure 3.2 and banana plantation in figure 3.3. The climate change related disasters contribute well over 70 percent of the natural disasters and destroy an average of 800,000 hectares of crops making economic losses.

The increase in intensity and frequency of the climate change disasters has escalated farmers' risks and losses and is now the major reason for low crop and livestock productivity and sector growth. In Mbarara for example hailstorm greatly affected the production of banana in the region causing food shortages and significant increase in food prices and other consumer commodities all over the country. This increased inflation to 9 percent and consequently it has had impacts on the macro economic stability in real terms as it discourages foreign investment, promote poverty, increased child mortality and consequently resulting to poor health and decreased standard of living.

Figure 3.2: Shows the Impact of Drought on a Maize Crop in Nakasongola district



Figure 3.3: Banana plantation destroyed by hailstone in Mubende District.



Source: New Vision

Furthermore, the Daily Monitor of July 2009 revealed the effects of prolonged droughts in Nakasongola district on crop production as illustrated in figure 3.2. Statistics shows that most parts of the district received rainfall within the near normal to below normal range throughout the first half of this year (2009) a proof that global warming is real. For example the entire maize garden dried up as narrated in Box 2.

Box 2: A farmer in Nakasongola District lamenting over the long dry season

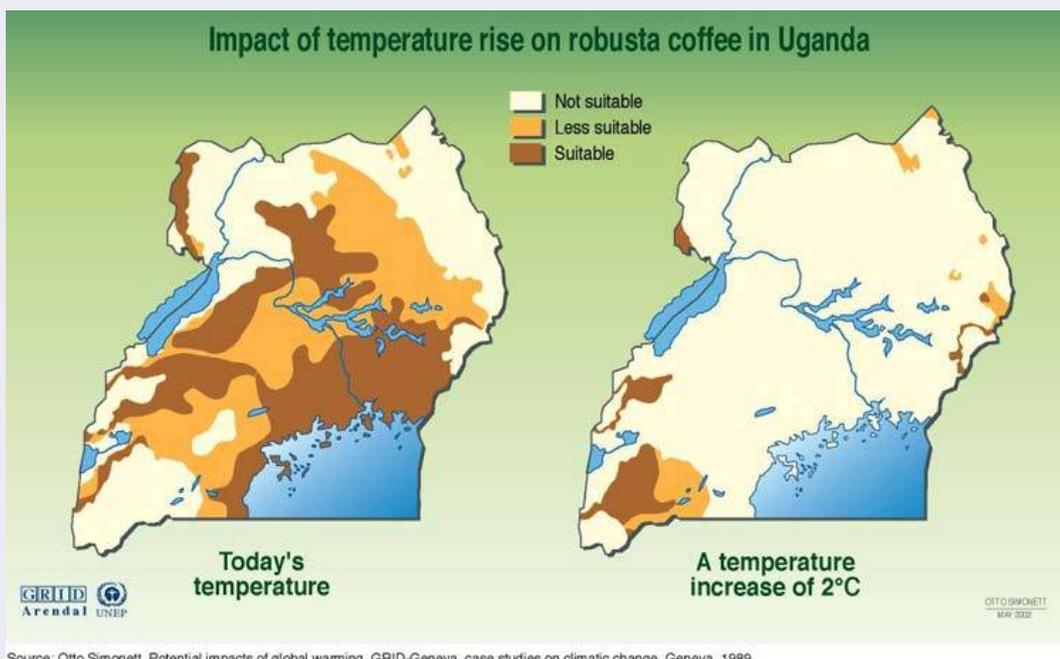
At times I am forced to buy water at Shilling 200 per 20 litre Jerican to irrigate because I cannot sit and look on when my garden, the only source of income is drying up. We have harvested nothing in this year's first season (2009) due to poor rains, says Mr. Ssenku who has lived on farming for the last 30 years. This season alone I have slashed two maize plantations, one of seven acres and another one of 10 acres after they dried up, narrates Salongo Sseku.

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Further studies reveal that, current temperatures and rainfall are conducive for the growing of coffee in most parts of Uganda. However, an increase in temperature of 2 degrees centigrade can have significant impact on coffee growing areas as clearly illustrated by figure 3.4. Warm temperatures led to the emergence of new coffee pests. The two maps of Uganda illustrate the potential impacts of increased temperatures on the coffee industry in Uganda.

All in all droughts have resulted in sharp reductions in agricultural output, related to productive activity and employment. This in turn has led to lower agricultural export earnings and other losses associated with decline in rural income, reduced consumption and investment and destocking and many have had additional multiple effects on the monetized economy. Observations on major rainfall deficient years and major macro variables show a significant relationship between rainfall amount and GDP. The World Bank Study on the East African Members states revealed that a 10 percent increase in temperature results in a decrease in GDP of 8.7 percent, 18 percent and 14 in Kenya, Uganda and Tanzania respectively.

Figure 3. 4: Potential Impacts of Temperature Rise on Coffee Growing Areas in Uganda



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

Figure 3.5: Dry borehole in Masaka district:



Source: Ministry of Water and Environment

Reduction in availability of water resources is another area affected by climate change. 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 by water bodies, 80% of which is accounted for by the Lake Victoria. Uganda has good mean annual rainfall ranging from 700 mm in the drier areas to about 1500 mm in humid areas. The rainfall in good years, therefore offsets the water distribution problem particularly during the rainy season.

A large proportion of the population depends on streams as a source of domestic water use, crop irrigation and animal consumption and when the streams dry up during droughts it causes serious water stress for large proportion of the rural communities leading to increased poverty levels. Prolonged and severe droughts has reduced water table making clean water scarce in most parts of the country as illustrated in figure 3.5. For example a number of cases of non-functional water sources including valley dams/tanks for water for production have been registered during the period of 2008/2009 almost throughout the country. It should be noted that the rural poor depend on streams and swamps. Therefore drying up of water sources during droughts impacts more on children and women who travel long distances to fetch water leading to disruption of school time and the end result has been poor performance of children. This has had serious consequences on the achievements of the Universal Primary Education (UPE) as well as the Universal Secondary Education (USE). On the other hand women fail to do other more productive activities thus increasing poverty in the families.

Climate Change has exacerbated water scarcity problems, particularly in the cattle corridor. The prolonged and severe droughts of 1999/2000 and 2004/05 respectively caused severe water shortage leading to death of animals, low production of milk, food insecurity and increased food prices. The scarcity of water in these areas has resulted in migrations into neighboring districts in search for pasture and water causing animal diseases, grabbing of land and stealing of animals especially in the Kotido, Moroto and part of Teso region. In addition, these movements have frequently led to ethnic conflicts and disruption of agricultural production leading to persistent poverty among communities especially the women.

3.2.3 Climate Change and Energy adequacy

According to the Water and Sanitation Sector Performance Report 2008, there is a relationship between the falling water levels in the lakes throughout the country and reduced precipitation especially around Lake Victoria that occurred between 2003 and 2006. At that time the water levels were 1133.29 m a.s.l, as recorded in July 2006. This consequently affected the electricity generation at the Owen Falls dam leading to power rationing in the domestic and commercial sectors and resulting in interruption of economic activities and decline in manufacturing output.

In Uganda the poor power supply has led to the raising of electricity tariffs making it increasingly and unaffordable to the lower income earners. This has in turn led to people encroaching on forests by cutting down trees for charcoal as an alternative source of energy for cooking hence causing increased deforestation in the country. Similarly the poor rural electrification has significantly contributed to the immigration of the people to urban centers in search for related benefits of electricity such as small scale industries.

3.2.4 Heavy Rains leading to Floods

The heavy rains associated with floods are another outcome of climate change in Uganda. According to the State of Environment Report 2009, the North-Eastern part of Uganda especially the sub-regions of Teso, Lango, Bugisu, Sebei, Tororo including Karamoja in 2006-07, experienced heavy rainfall resulting into massive floods and the destruction of homes, roads, schools, latrines and crops. The floods affected about 22 districts with a total population of nearly 6 million (WFP, 2007). Many people died during the torrential rains as reported by the media reports. The New Vision of 13th September 2007 reported that 9 people died in Teso floods while that of 19th November 2008 reported 47 people to have died in floods of Eastern and Northern Uganda as indicated in table 6 and shown in figure 3.6).

Past experience in Uganda shows that there has been an increase in the intensity and frequency of heavy rains (El Nino) leading to floods in low land areas, landslides in the highland areas and droughts especially in Uganda's cattle corridor where there has been total lack of pasture and water for livestock. A total of 18 districts are covered under this corridor

Other areas experiencing frequent flooding include Kampala City which is mostly due to changed land-use activities. In addition, heavy rains have led to numerous landslides in the mountainous regions in western and eastern Uganda.

Table 6: Case study on the impacts of the 2006/2007 floods in North-Eastern Uganda

District	Extent of Damage
Kapchorwa	<ul style="list-style-type: none"> • 10 homesteads were swept away by floods in Kwoti parish. • 3 homesteads and crops were destroyed by land slides in Kisuro village. • Several schools were destroyed by storms. • 5 bridges were destroyed, roads were damaged and became impassable and massive soil erosion in hilly areas in addition crops were destroyed and domestic animals were killed by floods.
Tororo	<ul style="list-style-type: none"> • 368 households were displaced due to flooding. • 452 pit latrines were destroyed and water sources were contaminated. • Two health centres were destroyed and roads were damaged and became impassable.
Kamuli	<ul style="list-style-type: none"> • 5 roads were destroyed. • A family of 5 people drowned at Kituba swamp. • Cotton crop was destroyed.
Katakwi	<ul style="list-style-type: none"> • 6,000 households were affected. • Schools were destroyed and gardens were destroyed.

Source:: MoWE and Departments of Disaster Preparedness and Refugees 2008 and New Vision 2007

Most of the 2006/2007 floods also affected the war-ravaged northern part of the country. When the floods hit, the victims migrated to the camps for internally displaced people (IDPs). The victims lacked essential services and it would have been almost impossible to cope or adapt with the flood disaster had it not been for the timely intervention of Government and International Organizations like the WFP and World Vision.

Figure 3.6: Flooded Homes in Eastern Uganda

Furthermore, floods have led to water pollution which in turn triggers post-flooding problems such as outbreaks of water borne diseases like cholera, malaria, typhoid and dysentery. These diseases are a result of the increased stagnant water because clean water sources are contaminated by floodwaters and this has increased the incidence of malaria and diarrhea at 30% as reported in OCHA, 2007. Consequently, these high disease incidences have reduced the people's energy to engage in productive activities such as agriculture leading to increased poverty among people. It should be noted women and children are the most susceptible people to the floods and most affected by outbreaks of such diseases. Furthermore, the floods that occurred in April 2003 rendered many people in reclaimed wetland areas homeless and caused extensive damage to property. The El Nino of 1997/8 also inflicted a heavy toll on human health. It was reported that about 525 died and 11,000 people were hospitalized for cholera incidences.

3.2.5 Effects on Construction and Settlement

In Uganda, house construction has invaded wetlands in many parts particularly in the urban centers. Good examples are the houses and buildings that have been constructed in the drained off wetlands of Ndeje-near Zana on Kampala Entebbe road, Kinawataka wetlands and along the Nakivubo channel wetlands. Climate change induces floods whose frequency is projected to increase on account of climate change and has had negative impacts to the settlements leading to considerable discomfort, loss of property, injury and even loss of life due to poor sanitation as already discussed. Furthermore, when the Lake Victoria levels went down in 2003-2005 communities especially around the lake shores extended their settlements into the lake basin which settlements were later reclaimed by the lake when the floods set in.

3.2.6 Transport sector

Transport sector especially roads is the dominant mode of transportation for both the passengers and goods. The growth of the road sector has direct relevance to increasing incomes of the poor because of access to market which stimulates production. In the design of PEAP and PMA development of feeder roads is identified as a priority area. The sector is however vulnerable to climate variability and change. Both floods and prolonged droughts have negative effects on the road sector.

For example the floods of the 1997/8 El-Nino swept bridges and cut off many towns from Kampala, the Capital City and centre of market. Figure 3.7 shows one of the bridges swept away by floods on Hoima Road. This disruption of road access resulted in direct costs (repair of roads and rebuilding of bridges) and indirect costs (loss due to inaccessible markets). The cost of the damage to bridges by 1997/98 is estimated at US \$ 4.0 m. High temperatures prevalent in drought conditions lead to sinking of road surfaces and sometimes creating of folds on road surfaces. Such segments of roads can lead to damage of vehicles and accidents thus putting additional stress on budgets and using up the limited resources that could be used for other socio-economic activities.

Figure 3.7: Bridge Swept away by Floods on Hoima Road



Source: The New Vision

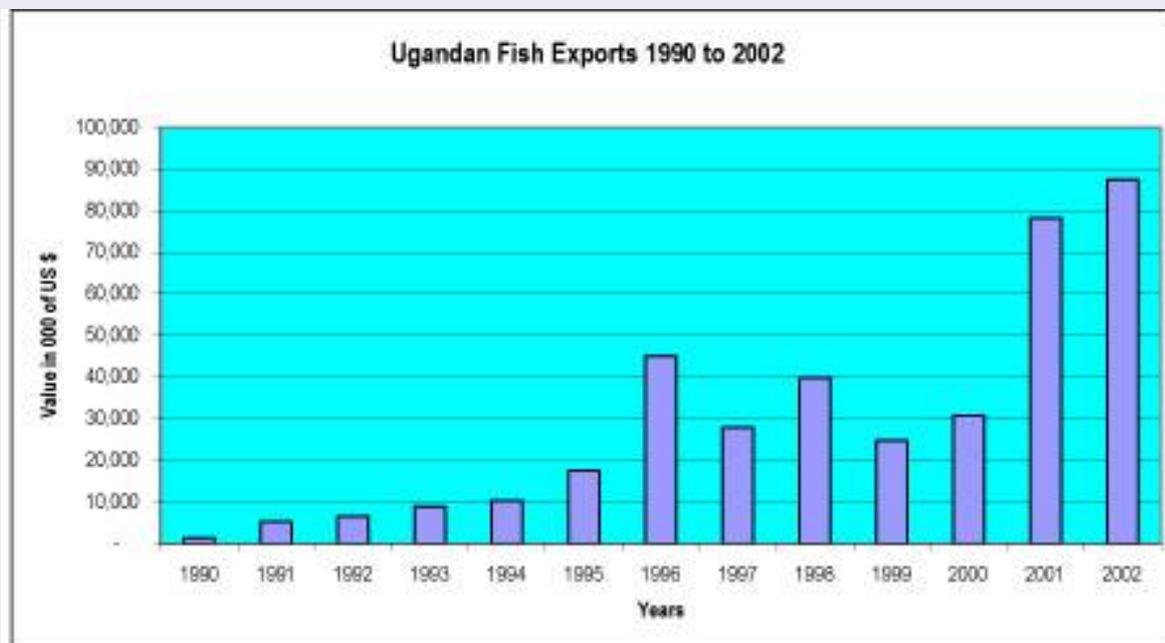
In rural communities markets are very important for a number of reasons such as selling and buying goods, meeting friends and discussing issues including farming activities and also providing some form of recreation. While the Government has committed itself to providing feeder roads to enable farmer access markets in addition to village roads constructed through community efforts, heavy storms and floods have frequently washed away these roads and bridges thus cutting the people off from markets and also making it difficult for vendors to access produce of the rural poor. In the last decade Uganda has experienced erratic and heavy rains leading to washing away of bridges or bursting of riverbanks.

3.2.7 Fisheries Sector

Uganda has abundant water resources comprising of water and swamps giving 43,942 km²., representing 18% of the total area. This large area provides an excellent habitat for fish. Fish is a major source of food and foreign exchange earnings to Uganda. The Ugandan fish is in high demand in the European and Middle Eastern markets.

Fisheries is a key sector in the Ugandan economy. It contributes to food security, increased household income and economic growth. It is estimated that over 200,000 people including the majority of the poor men and women are directly involved in the fishing industry. This number is much larger if people engaged in the added value of the industry such as transport, trading and processing is included. The sector because of its contribution to the GDP has assumed a greater profile with the advent of the Lake Victoria Nile Perch fishery. The fish trade grew from a humble US \$ 1.4 m to US \$ 87 m. The fishing industry has witnessed significant growth since 1990 as illustrated by the figure 3.8 below. It is now estimated that the sector contributes 2.4% (Background to the Budget 2003) to the total GDP.

Figure 3.8: Uganda Fish export from 1990 to 2002, Source: Fisheries Department



The fish industry is however sensitive to climate variability and climate change. Fish population and catch is dependent on key weather and climate parameters such as temperatures and rainfall. There have been increased reported incidences of accidents, which have resulted in loss of lives and property over waters, particularly over Lake Victoria and the Nile River. The levels of these water bodies also depend on the rainfall catchments in the basin and therefore are affected by prolonged droughts and floods.

3.4 Conclusion and Recommendations

Climate change has negatively affected Uganda’s development with serious impact on the women, children and the disabled who are most vulnerable. For instance increased poverty incidence in certain parts of the country has led to early drop out from schools, poor health, wasted time collecting water (walking long distance) and diversion of the women from the productive activities to the non-productive activities.

Use of climate information could reduce the vulnerability of the rural poor because information about the performance of the season can now be known well in advance. The seasonal forecasts serve as an advice to farmers on climate diversity.

The Government should quickly adopt recommendations as stipulated in the National Adaptation Programme of Action (NAPA) on integration of climate change issues in the national development programme such as the National Development Plan (NDP), sectoral strategic plans as well as district and lower development plans and programmes.

There is also a need to promote mitigation and adaptation measures by all actors as a strategy for fighting global warming. Unless Uganda takes steps to adapt to adverse effects of climate change its socio-economic efforts is likely to be frustrated.

References

1. Government of Uganda: APRM Country Review Report No. 7-January 2009
2. Government of Uganda,: State of Environment Report for Uganda 2008
3. Bwango Apuuli, Magezi:, Climate Change, Housing Liveable Cities in Asia and Africa
4. East African Secretariat: Feasibility Study on the Economic Impact of Climate Change in the East African Community (EAC);
6. Government of Uganda: National Adaptation Programme of Action (NAPA, Uganda



CHAPTER 4

CLIMATE CHANGE AND WOMEN'S LIVELIHOODS IN UGANDA

4.1 Introduction

This chapter focuses on climatic change and its impact on women's livelihoods. Uganda like many other parts of the world has experienced climate change. The worst hit areas include; Northern Uganda, Kampala, Teso, Karamoja, Mount Rwenzori and Elgon areas and South western regions. In all areas, women suffer the most because they have low adaptive capacities. This arises from the existing social inequalities that are manifested in differences in property rights, access to information, lack of employment and limited access to resources. Climate change affects resource flows critical for livelihood sustainability

According to Robert Chambers and Gordon Conway, a livelihood comprises of capabilities, assets (including both material and social resources) and activities required for a means of living. Livelihoods are a means through which a household gains an income and meets its basic needs. This includes paid employment and informal employment. However, for the poor especially women, it involves the ability to farm and to exploit common property resources for livestock, fishing, gathering fuel wood and many other things. Access to these resources is fundamental to the livelihoods of the poor. In Uganda, 68% of the households of which 23% of households are female headed depend on subsistence farming for a livelihood. The northern region has the highest proportion depending on subsistence farming. Subsistence farming is the mainstay to about 80% of household heads with either no education or primary education (UBoS,2006).

Women form the majority of the world's population. Indeed in Uganda, 51% of the total population are women. A high proportion especially those in the rural areas engage in agricultural activities and petty trading. Uganda has an estimated population estimated at 31 million (2009) growing annually at 3.2% per annum.

4.2 Gender and Climatic Change

Gender relations are socially determined relations that differentiate male and female situations. Gender relations

refer to the gender dimensions of the social relations structuring the lives of individual men and women, such as the gender division of labour, and the gender division of access to and access over resources (Elson 1995). Biological differences between men and women are obvious and acknowledged by all, however the difference in roles and responsibilities within communities, access to information, economic and social factors have to be analyzed for successful implementation of adaptation and mitigation measures. There is a need to differentiate between men and women as far as the climate change process is concerned because of the different roles the two sexes play currently, which will result in different impacts of the climate change policies.

Behaviour patterns and activities carried out by women and men, young and old, rich and poor differ greatly. Women and men perceive climate change differently and their response to the occurrence differs. This in part leads to a discrepancy in the way climate change affects both groups. The social roles and responsibilities of women and men are different as well as leading to the different degrees at which they depend on natural resources within communities affected by impacts of climate change.

Women are predominately more susceptible to adverse impacts of climate change. This occurrence mainly affects sectors that are associated with women such as agriculture and fishing. This has implications on women's survival. Climate change has a direct impact on women's lives because of their domestic responsibilities. In Uganda, for example, women have primary responsibility for food security, household water supply, and the provision of energy for cooking. Conditions such as drought, deforestation and erratic rainfall have a disproportionate negative affect on their ability to carry out these duties. As climate change causes Ugandan women to work harder to secure these basic resources, they have less time to secure an education or earn an income. Girls are more likely than boys to drop out of school to help their mothers gather fuel wood and water. Therefore, adequate attention to gender perspectives in risk management (including risk assessment) requires a broad focus on gender in relation to natural resource management. To understand the impact of climate change on women and their potential for adaptation and mitigation measures, it is necessary to understand the interactions of women and men with the environment.

Men and women's knowledge with regard to climate change and adaptation, including their contributions and potential to mitigation measures need to be identified and utilized. Since gender perspectives are not always taken adequately into account in environmental management, women are not consulted and involved to the same extent as men in natural disaster management programmes. Women's considerable knowledge of natural resources and their contributions to environmental management are often under-utilized. When women do not receive adequate information on climate change, natural resource use and environmental sustainability to the same extent as men, there is a risk that they can contribute directly and indirectly to environmental vulnerability.

Although there are clear indications of a positive shift from a purely technological response to social interactions with the environment in early warning and information systems, there is still much to be done before the responses adequately incorporate relevant social issues, including gender perspectives. The social context needs more attention if adequate early warning and prevention systems are to be developed and losses and costs to individuals, household and communities are to be reduced.

The millennium development goals (MDGs) recognize the need to promote gender equality and empower women to participate in all aspects of economic and social life with the aim of achieving sustainable development. Climate change poses a significant challenge to achievement of sustainable development for the rural poor, especially women who suffer disproportionately from the impact. In this context both women and men need to have access to timely information and warnings on risks or impending disasters. However, given that women experience gender-specific constraints - lack of decision-making capacity, lack of capital of different forms (financial, physical, human, and social) and socio-cultural norms on mobility, etc - access to

information will not, be sufficient for women to be able to respond adequately. Therefore women may need additional support in order to be able to effectively act upon such warnings.

4.3 The Effects of Climatic Change on Women's Livelihoods

Climate change has far reaching impacts on women's livelihoods. This section discusses the impact of climate change on: the natural resource base; food security and nutrition; women's health and mortality; women's labor and economic empowerment and conflict and gender-based violence.

4.3.1 Natural Resources

Despite the fact that Uganda has numerous policies and laws put in place to conserve the environment, the natural resource base has continued to decrease largely due to climate change. For instance, there has recently been a decline in aquatic biodiversity in most of Uganda's water bodies. It has been attributed to destructive fishing habits, increasing eutrophication as a result of pollution, degradation of riparian watersheds and deforestation.

The fisheries sector is a very important source of livelihoods to both men and women in Uganda. Women are often responsible for the treatment of the catch - smoking, drying and for marketing (Mugambe and Madanda 2000). The sector provides an important source of protein for the population which is a domestic responsibility for women (MAAIF 2004). Given that women's contribution in this sector is invisible in the wider national economy they are regularly excluded from decision-making processes. Therefore, their role in sustainable development, especially by conserving the natural resource base is not recognized (Nampinga 2008). In the same way women are further marginalized with lack of access to land and other natural resources.

4.3.2 Food Security and Nutrition

Climatic change is impacting on Uganda, with more erratic, intense, severe and or destructive rainfall and droughts. Until recently, the bimodal climatic seasons across Uganda have been relatively stable and predictable to the benefit of agriculture. Agriculture provides a livelihood to about 90% of the population. Women in Uganda are primarily responsible for the production of food, mostly through subsistence forms of production, and are highly exposed to the risks that come with drought and uncertain rainfall. Today the seasons are becoming unreliable, with rain being less useful because of its distribution and impact. The rains come early even when it is supposed to be a dry season and stop for long periods. In some instances rains have come with very strong winds and destructive hailstorms, causing floods, landslides and soil erosion.

Women are the custodians of natural and productive resources and instigators of activities that generate agricultural and non-agricultural incomes. In most households (68%), women are the main producers of the staple crops such as maize, beans, sorghum, ground nuts and millet, producing 60 to 80 per cent of the produce and derive their livelihoods from subsistence farming, which contributes 77% of the total employment. Floods, ever-increasing aridity, rising frequencies of disaster, among other factors, erode the quality of natural resources. The massive and unequal impact of climate change in the affected areas impinges directly upon women's livelihoods. As a result, climate change exacerbates existing vulnerabilities and creates new ones, making the fight of poverty difficult (Adger et al 2003).

The rate of infant mortality is approximately 76 per thousand live births while the overall life expectancy is 50.4 years for both sexes: 52.0 for females and 48.8 for males (UBoS 2007). The total fertility rate is 6.7, while maternal mortality is estimated at the rate of 435 per 100,000 live births (UBoS, 2008).

In Uganda, women rely directly on forest resources to meet health, nutritional, economic and cultural needs of their families and communities. Climate changes and deforestation pose a direct threat to women's economic well-being because forests provide a significant source of environmentally-based income generating activities

for women. Given that most of Uganda's agriculture depends on rainfall, climate changes and deforestation make it more vulnerable during drought and flooding. Food scarcity and nutritional shortages are common in many parts of Uganda.

The food crisis in the country threatens to reach alarming levels. About 40% of deaths among children in Uganda are due to malnutrition. The rate of infant mortality is approximately 76 per thousand live births while the overall life expectancy is 50.4 years for both sexes: 52.0 for females and 48.8 for males (UBoS 2007). Given that Uganda's annual population growth rate is 3.2%, while the annual growth rate of food production is only about 1.5%, the food crisis is worsening. This implies that if food production levels do not increase, food scarcity will become more severe in the near future.

Livestock production is another important source of livelihood for many rural farmers. It is concentrated along 'the cattle corridor', which runs southwest to northeast across Uganda. There is no doubt that animal husbandry is a significant source of income. It represents 7.5% of the GDP and 17% of the agricultural GDP. Conversely, water scarcity in the cattle corridor reduces productivity and triggers conflict among herders. The role of women in livestock production systems is significant. In general, women are often responsible for most livestock nurturing activities and play an active role in on-farm livestock duties including feeding, watering, fodder collecting, stable cleaning, milking and milk processing, caring of small and sick animals, poultry raising, wool work, traditional animal health care, mention but a few. While men's tasks are seasonal, most women's tasks are daily (Nassif, 2008).

Given that climate change is likely to further intensify the existing inequalities and affect differently the capacity of women and men to cope with additional stresses, more attention will be needed to ensure that adaptation and mitigations strategies are developed taking into account these differences and the increased needs of women in view of their roles as the most significant suppliers of family labour and efficient managers of household food security (IFAD, 2009).

4.3.3 Women and Health Care

Climate Change brings about an increase in temperature-related diseases and illnesses. In addition, it leads to changes in geographical range of vector borne diseases such as malaria fever because of changes in temperature and rainfall patterns. Anemia- resulting among other factors from malaria also affects women's health and is responsible for maternal mortality (ADB etal 2003).

Degradation of water sources is a usual consequence of drought and natural disasters. Children and pregnant women are particularly at risk and are susceptible to diseases which thrive in such conditions such as cholera and diarrhea as shown in figure 4.1. Uganda has recently been hit by a string of epidemics including: Ebola, meningitis, cholera, bubonic plague in West Nile and yellow fever. A rare strain of cholera ravaged the Eastern districts of Tororo, Butaleja, Mbale and Manafa in June, 2008. A total of 28 people out of 350 who were infected died of the epidemic. Furthermore, women's roles in relation to water supplies and domestic chores are particularly at risk of such disease. Floods just compound on existing problems. Climate change increases the cost needed for emergency health care for affected areas, yet most local governments do not budget for it.

Malaria cases are on the increase in areas where previously the epidemic was low. Recently, there has been an increase in malaria cases of 43 percent in Ntungamo, 51 percent in Kabale and 135 percent in Mbarara. Since women are the primary care givers to all other members of the household, their responsibilities increase as family members suffer from illnesses brought about by exposure to vector borne diseases such as malaria and other water borne diseases.

4.3. Women's Labour Force and Economic Empowerment

In Uganda, both men and women rely directly on forest resources to meet health, nutritional, economic and cultural needs of their families and communities. The massive and unequal impact of climate change in the deforested areas impinges directly upon women's livelihoods. Deforestation poses a direct threat to women's economic well-being because forests provide a significant source of environmentally-based income generating activities for women. For example, forests are a source of firewood, herbal medicines, fruits, wild game, to mention but a few.

The quality of life of the population has remained poor due to persistent gender inequality in decision making. Since men generally earn more than women, they are likely to be the main decision makers at household level (UBoS, 2006). Women remain the food producers and yet men bear the responsibility of marketing and making decisions on proceeds from agriculture. In addition, women have less voice and participation in social, political issues, progress of the last ten years notwithstanding.

Agriculture is the dominant sector of Uganda's economy. Agriculture provides a livelihood to about over 80% of the population. Women in Uganda are primarily responsible for the production of food, mostly through subsistence forms of production, and are highly exposed to the risks that come with drought and uncertain rainfall. In most households (68%) women are the main producers of the staple crops, producing 60 to 80% of the produce and derive their livelihoods from subsistence farming, which contributes 77% of the total employment.

Natural disasters - particularly erosion and other forms of soil degradation, pollution of freshwaters, shore-line erosion, flooding, loss of wetlands, drought and desertification impact directly on women in their roles as providers of food, water and fuel. Climate change also impacts on women's productive roles since the physical impacts of global warming - rising sea levels, flooding in low-lying areas and increased contaminated water can jeopardize sustainable livelihood strategies. Food security and family well-being are threatened when the resource base on which women rely to carry out their critical roles and obtain supplementary incomes is undermined.

Due to drought caused by climate change, people have to collect water from distant locations. Women and children, who are the most vulnerable members of society mainly bear this burden. To make matters worse, frequent droughts have resulted in lowering of the water table, leading to drying of boreholes. The long distances women travel significantly reduce their productive time and ability to engage in other economic activities, either for themselves or their families. Besides, the amount of water that is collected is insufficient to meet drinking, cooking and hygiene needs.

Figure 4.1: Women collecting water from a dirty source



Source:: Africa Science News Service

4.3.4 Conflict and Sexual and Gender-Based Violence

Climate change aggravates conflict which may lead to sexual and gender based violence. Due to shortage of resources, women are inevitably involved in the struggle for resources such as land and water. It should be noted that lack of access to water and sanitation exposes rural women in conflict areas to more disastrous impacts. Women in the North and North Eastern regions where climate change is more widespread are exposed to rape or forced sex. This is because they look for water and other resources far from their homes. They are even abducted by rebels during armed conflicts to go and serve as sex slaves.

Inadequate resources as a result of climate change increase conflicts within the households as women are expected to feed other members of the household as well as provide water required for daily use. In addition, as yields decrease, tensions between women and men in households where the latter controls the family income, increase. Since women are supposed to take care of their children, climate change makes it difficult for them to perform this responsibility. Most rural women are forced to carry their youngest children on their backs as they try to fulfill their other gender roles. As a result, they are often punished by their husbands for moving away from home without their consent. Additionally, women are sometimes battered for leaving their children at home as they to search for water. According to 2006 UDHS, 56% and 52% of women thought that neglecting children and going out without informing their husband were key reasons for wife beating.

Women and girls are targeted because of their subordinate place in society. This arises from unequal power relationships between men and women. It involves numerous human rights violations including sexual abuse and discrimination against women. According to the 2002 Uganda population and housing census areas (Northern and Eastern regions) where climatic change has been more severe in recent years recorded the highest proportion of communities (4%) that reported rape and defilement as rampant. It should be noted that rape and defilement cases are under reported in all regions of the country (UBoS, 2006).

4.4 Role of Women in Mitigating the Effects of Climatic Change

Uganda's ability to adapt to climate change is dependent on resources at its disposal: financial and human. Uganda is more likely to suffer more from the impacts of climate change because of lack of sufficient resources to adapt to change and extreme vulnerability. It's widely acknowledged that the negative impacts of climate change will hit the poorest communities hardest. Since women constitute the majority of the world poor and are often more dependant on natural resources, they are likely to be disproportionately vulnerable to the effect of climate change

Women are not just victims of climate change; they are also powerful agents of change. Women have demonstrated unique knowledge and expertise in leading strategies to combat the effects of climate change, as well as natural disaster management, especially at the grassroots level. Women play a vital leadership role in community revitalization and natural resource management. Overall, however, women tend to be underrepresented in decision-making on sustainable development, including on climate change, and this impedes their ability to contribute their unique and valuable perspectives and expertise on the issue.

According to a report on Climate Change and Poverty prepared by Oxfam in 2008, climate change does not happen in isolation. It interacts with existing problems and challenges; notably deforestation, soil degradation, declining food security and makes them worse. There is a need to scale up efforts to adapt for climate change. Adaptation has to start with adaptation to current climate.

With respect to natural resource management, women and men can make different types of contributions to climate change. In forest resource management, for example, women play key roles in planting, protecting or caring for seedlings and small trees, as well as in planting and maintaining homestead woodlots and plantations on public lands. Women typically gather non-timber forest products for commercial purposes and to improve the living conditions within their households (e.g. medicines, fodder for livestock).

In urban areas, women are capable of implementing energy efficiency programmes at the household level. On the other hand, women in rural areas can be trained to use biomass and biogas in addition to promoting solar energy. Women are beginning to play important roles in tropical forest preservation; women's groups are managing forest resources and development projects through woodlot ownership, tree planting and nursery development. Actions that are being taken to increase women's participation in climate change activities include global and national networks, awareness-raising, advocacy for greater participation of women in the climate change negotiations, and promoting the inclusion of gender perspectives in policy formulation and evaluation. In this regard, the special role of civil society organizations is important.

4.5 Policy Recommendations

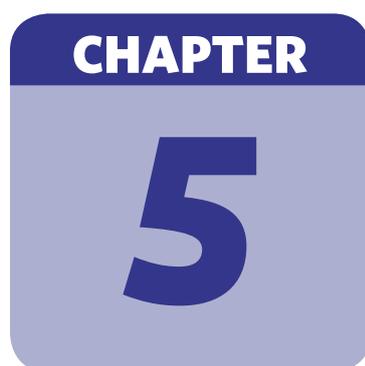
1. Since there are various laws in place to preserve Uganda's environment, the GOU through NEMA and NFA should endeavor to implement regulations geared towards preserving the environment, for instance, people arrested cutting trees without permission should be severely dealt with.
2. Local governments should come up with appropriate bye-laws to protect the environment.
3. Institutions and bodies involved in dealing with climate change mitigation should endeavor to involve women in design, planning and implementation of interventions since they play a significant role in mitigating the impacts of climate change;
4. Water resources should be strengthened, in addition to more water sources such as boreholes should be erected at sub-county level to reduce the distance women and children cover in search for water;
5. Gender mainstreaming is needed in any endeavors geared towards mitigating the impacts of climate change;

6. There is need for capacity building for gender specific programs for adaptive farm practices to prevent food insecurity;
7. Gender disaggregated data on relevant variables is needed to have more information on the levels of vulnerability and coping mechanisms of numerous groups; and
8. There is need for more studies on climate change and gender in Uganda in order to generate more information required on impacts of climate change.

References

1. Rennie, J.K. and N. Singh. Participatory Research for Sustainable Livelihoods. Winnipeg: IISD, 1996.
2. United Nations Framework Convention on Climate Change, 1992.
3. United Nations Commission on Status of Women: emerging issues panel Gender Perspective of Climate Change, Rachael Nampinga
4. Uganda National Water Report (2005), Coping with Water Related Disaster.
5. Republic of Uganda: National Population Policy for Sustainable Development, Ministry Of Finance, Planning and Economic Development, 1995.
6. Republic of Uganda: The state of Environment Report for Uganda 2008. National Environment Authority (NEMA) / UNDP.
7. The World Conservation Union (IUCN): Gender Environment and Climate Change. www.genderandenvironment.org
8. Carney, D. (1998). Sustainable Rural Livelihoods: What Contribution Can We Make? London, Department for International Development
9. DFID (2008), Climate Change in Uganda: Understanding Implications and Appraising Response. DFID, Kampala-Uganda
10. Chambers R. and G. Conway (1992). Sustainable rural livelihoods: practical concepts for the 21st century, Brighton, Institute of Development Studies
11. Republic of Uganda (2006), Housing Characteristics, Uganda Bureau of Statistics(UBoS), Kampala.
12. Republic of Uganda (2006), Population Dynamics, Uganda Bureau of Statistics(UBoS), Kampala.
13. Republic of Uganda (2006), Uganda Demographic and Health Survey, Ministry of Health, Entebbe.
14. Population Secretariat, State of Uganda's Population Report, 2007
15. Population Secretariat, State of Uganda's Population Report, 2008
16. United Nations Development Programme, Uganda Human Development Report, 2007, Kampala.





CHAPTER
5

CLIMATE CHANGE, MIGRATION AND NATURAL RESOURCE MANAGEMENT

5.1 Introduction

Climate change is any long-term change in the statistics of weather over periods of time that range from decades to millions of years (http://en.wikipedia.org/wiki/climate_change). The United Nations Framework Convention on Climate Change (UNFCCC) on the other hand, defines climate change as a change of climate that is attributed directly or indirectly to human activity that alters the composition of global atmosphere and that is in addition to natural climate variability over comparable time periods. Climate change can express itself as a change in the mean weather conditions, the probability of extreme conditions, or in any other part of the statistical distribution of weather. It may occur in a specific region, or across the whole Earth.

Climate change poses a serious threat to development and poverty reduction in the poorest and most vulnerable regions of the world (Post note, 2006). Indeed, it is regarded by some as a weapon of mass destruction because of its ability to cause widespread destruction. Within the next few decades climate change could have devastating effects on human security and threatens to undo decades of development efforts. Consequently, climate change due to Global warming is no longer only an environmental issue but a development and a political issue as well.

It should be noted that all countries are vulnerable to the negative effects of climate change. However, adaptive capacities between countries differ, with the rich countries having a higher adaptation capacity. The vulnerability and the limited coping mechanisms of the poor to the impacts of climate change is one of the factors leading to migration.

Migration is the act of moving from one country, region or place of abode to settle in another. It can be seasonal or long-term, voluntary or involuntary. Involuntary migration is driven by the desire to flee from potential or real life threatening situations such as climate change and it takes different patterns including rural-urban migration, rural-rural migration, migration to adjacent countries and migration from the poor to rich countries. Migration may be seasonal, for example by farmers to wetlands and by pastoralists in search

of water and fresh pasture, or permanent. In Uganda examples of seasonal migrations include the Karimojong and the Bahima pastoralists who migrate in search of water and pasture for their animals.

This Chapter attempts to analyse the critical inter-linkages between climate change, migration and natural resource management. The migration discussed however is that driven by the adverse impacts of climate change.

5.2 Climate change as a driver of Migrations

There are various drivers of migration, including natural disasters such as droughts, floods, landslides, diseases and epidemics. All these are linked to the adverse impacts of climate change on the environment and natural resources on which economies and the livelihoods of the people especially in developing countries are derived.

A study by the Red Cross, revealed that more people are now displaced by environmental disasters than wars. Indeed, climate change may be the single most important factor to determine migration flows in the future. A new report by Columbia University, the United Nations University and Care International (<http://www.clesin.columbia.edu>) warns that unless aggressive measures are taken to halt climate change, the consequences for human migration and displacement could reach a scope and scale that vastly exceed anything that has occurred before. It further adds that all major estimates project the trend to tens of millions of migrants in the coming years.

In 2004 severe flooding in Bangladesh, caused by excessive rains of the annual Asian Summer Monsoon, killed over 600 people and displaced over 20 million (Postnote, 2006). Another study by the United Nations University predicts that by 2010, as many as 50 million people may be driven from their homes by environmental crises. The study cited an estimate from the International Organization for Migration of 200 million migrants from environmental causes by 2050 while other estimates reach as high as 700 million.

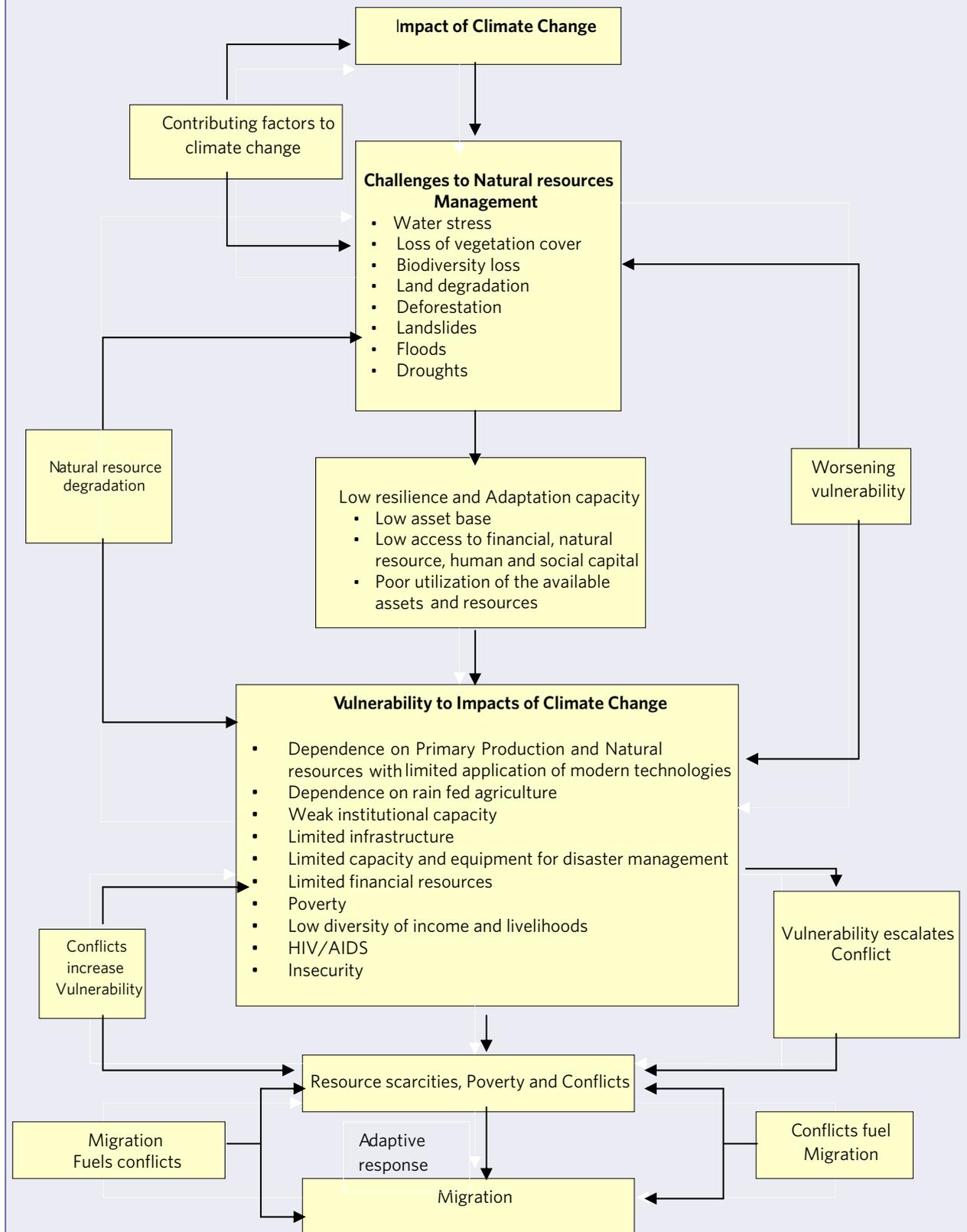
The adverse effects of climate change are more evident and threatening in developing countries like Uganda that are more dependent on natural resources and rain-fed agriculture. The concern here is the increase in the frequency and intensity of climatic extremes, including monthly variations of rainfall amounts and seasonal variability. Most of the natural resource base is prone to the adverse effects of climate change. Environmentally motivated migration is expected to feature more poor people, women, children and the elderly, from more desperate environmental situations that have low coping mechanisms.

5.3 Climate Change, Migrations and Natural Resource Management: The Inter-linkages

The conceptual framework below (Figure 5.1) gives an illustration of the critical inter-linkages between climate change, migration and natural resource management. Climate change poses special challenges to the sustainable management of natural resources on which economies and livelihood security depend.

Climate change diminishes the quality, quantity and productivity of natural resources and undermines capacity to perform their functions and ability to meet the increasing human demands. Climate change and human induced natural resource degradation in turn contribute to and worsen the impacts of climate change.

Figure 5.1: Climate Change, Migration and Natural Resource Management: The Inter-Linkages



The resultant environmental stress and natural resource scarcities fuel conflicts which in turn lead to migrations. On the other hand, the migrants (environmental refugees) also cause conflicts in the new areas of abode.

From the above figure above, it is clear that while climate change leads to migration, it is also true that migration contributes to or worsens the impacts of climate change. The migrants cause environmental stress through encroachment on wetlands, natural forests leading to deforestation and total degradation of the natural resources which in turn contributes to climate change.

5.4 The Impact of Climate Change on Natural Resource Management

Climate change imposes special challenges to the management of the environment and natural resources. It affects the quality and productivity of natural resources and ecosystems, some of which may be irreversibly damaged, and these changes may also decrease biological diversity and compound existing environmental degradation as shown in Box 3). Climate change increases the vulnerability of natural systems and increases the risk of species extinction and damage.

Climate change is changing the disaster risk profiles, environmental and socio-economic vulnerabilities and induces new environmental hazards that further impact on the development processes (Baas and Selvaraju 2007). On an annual basis, for example, developing countries have already absorbed US \$ 35 billion in direct losses from natural disasters (NEMA, 2008). For instance, between 1990 and 1998, about 97% of all natural disaster-related deaths occurred in developing countries and 90% of all natural disasters are climate, weather and water related (Postnote, 2006).

According to the Intergovernmental Panel on Climate Change (IPCC) report on the regional impacts of climate change, Africa has contributed the least to potential climate change because of its low Green House Gas (GHG) emissions about 4% of the total. Yet it is the most vulnerable continent to climate change because widespread poverty that limits its capacity for adaptation.

5.5 Implications of Climate Change on Natural Resource Management in Uganda

Human induced climate change is likely to increase average temperatures in Uganda by up to 1.5 °C in the next 20 years and by up to 4.3 °C by the 2080s (DFID, 2008). Indeed, Uganda like the rest of the world is already experiencing extreme climate events which are already having significant implications and posing challenges on sustaining natural resource integrity, food security, human health, settlements and infrastructure. In particular, there have been shifts in the spread of diseases like malaria, increase in the tsetse fly belt, soil erosion and land degradation, flood damage to infrastructure and shifts in the productivity since the country's economy and the wellbeing of its people are tightly bound to climate (DFID, 2008).

Box 3. Impacts of Climate Change on Natural Resource Management in Uganda

- **Change in river flow regimes.** The higher temperatures and the melting of Rwenzori mountain glaciers have increased and then reduced flows in the Semliki River downstream. This has led to erosion, siltation and shifting of the course of the river leading to habitat disturbance. The eroded good soils are deposited in the lower valleys of the mountain, leading to reduced productivity upstream, and increased soil productivity downstream. As a consequence, the Bakonzo people have been forced to migrate from the mountain tops downstream “to follow their soil” (NEMA, 2009).
- **Water scarcity.** Higher temperatures, evaporation and recurrent drought leading to water stress, higher demands for water, conflict and loss of biodiversity. The cattle corridor is more vulnerable to water stress and a lot of animals are lost as a result. The decline in the water levels of Lake Victoria in 2004-2005 caused water for consumption in Kampala to be drawn deeper from the lake.
- **Fisheries depletion:** Changes in nutrient cycling and loss of spawning and feeding grounds brought about by temperature and water level change impacts on fish migration routes and reduces productivity. This has negatively impacted on many fish species especially those which breed and nurse their young in the shallow inshore areas and use shoreline wetlands as refuge from predators. Prolonged droughts have serious socio-economic consequences on fisheries and result into a reduction in fish catches.
- **Land degradation and deforestation:** Higher risk of forest and bush fires in dry spells and pressure on forests. Climate change affects the forest composition, health, productivity and geographic range. There is increased salination and soil erosion. The vegetation is degraded.
- **Biodiversity losses and disturbances:** Species reported to be affected include; the Mountain Gorilla, the alpine and sub-alpine species on the Rwenzori e.g. the giant Lobelia, Tree Senecio, the Rwenzori Leopard and the Rwenzori Duiker. The three horned Chameleon and Senecio are reported to have shifted their ranges upwards due to warmer temperatures. Droughts also increase the frequency of bush fires which destroy a lot of biodiversity. The 1998 El Nino floods associated with climate change caused a lot of habitat disturbances and destroyed a lot of flora and fauna.
- **Energy shortages due to a drop in the water levels of Lake Victoria by 1 metre in 2006 following a prolonged drought experienced in 2004/2005.** This reduced the water flows for power generation leading to energy shortages and higher energy costs. These have implications on firewood and charcoal use, resulting into deforestation and land degradation. Meanwhile the diversification to thermal power just added to emissions of Green House Gases (GHG) responsible for climate change.
- **More frequent and extreme flooding:** Higher mean and increased intensity rainfall, coupled with land degradation and encroachment raises risks of loss of life and property and damage to infrastructure. The heavy rains destroyed up to 90% of the crops in some regions and caused many traditional mud-brick homes to collapse. Roads and bridges were destroyed and access to some northern and eastern sections of the country was cut off. By September 18, 2007 the floods had killed at least 10 and affected about 300,000 people in Uganda.
- **Increased occurrence of Malaria:** Extension of malaria carrying mosquitoes into higher once cooler areas where people have a low natural immunity to malaria. This is true of mountainous areas of Kisoro, kabale and Elgon where Malaria has almost reached epidemic levels.
- **Increased threat of water borne diseases such as Cholera arising from the contamination of water sources during floods.** On the other hand, water shortages during droughts are associated with the outbreak of diarrhoeal diseases attributed to improper hygiene.
- **More frequent occurrences of hailstones and lightening that have caused destruction of crops, livestock, property and loss of lives.**

Source:: Adapted with some modifications from DFID Uganda: Climate Change in Uganda: Understanding the Implications, 2008, NEMA, National State of Environment Report; 2006, 2008

5.6 Uganda's Vulnerability to the Impacts of Climate Change

A report by International Alert, 2007 on Vulnerability to conflict and Climate, categorizes Uganda as one of the states facing high risk of potential instability as a knock on consequence of climate change. While a recent international Climate risk report labels Uganda as one of the most unprepared and most vulnerable countries in the World (CIGI 2007).

Vulnerability to climate change in Uganda is high because of the heavy reliance on climate dependant resources and rain-fed agriculture, degraded ecosystems, weak institutional capacity, limited infrastructure, limited capacity and equipment for disaster management, limited financial resources and widespread poverty.

Climate related disasters in Uganda are estimated to contribute to over 70% of natural disasters and destroy an average of 800,000 hectares of crops annually making economic losses in excess of Ushs 120 billion (NEMA, 2008). During the El Niño rains of 1997 landslides killed 48 people in Bududa district and displaced tens of thousand in this area (Kitutu et al., 2004). By 2004 about fifteen thousand people were displaced and landless, giving a rate of 700 internally displaced persons per year. In addition, roads, bridges and homes valued at Shs. 30 billion were destroyed (PEAP, 2004).

While the whole of Uganda is vulnerable to climate change, the impacts are felt more by those that are directly and solely dependent on natural resources with very low technologies such as the pastoralists and subsistence farmers dependent on rain-fed agriculture; the drier districts in the northern and eastern regions of the country, the cattle corridor and those living in abject poverty.

Poor people are highly vulnerable to climatic and environmental hazards because they have limited options to diversify their resources and technology. They have a low coping mechanism to deal with environmental stress and their traditional coping mechanisms have been surpassed by the frequency, severity and scale of the impacts.

Vulnerability to the impacts of climate change can be further seen at the sectoral levels. Unfavourable climatic conditions reduce agricultural productivity, leading to higher food prices, low domestic revenue and the widening of the current account deficit due to lower export earnings (NEMA, 2006).

5.7 Climate Change: a driver of migrations in Uganda

Migrations in Uganda take different forms and patterns, some of which include; rural-rural, rural-urban migration and an increasing phenomenon of regional and international migrations mainly driven by the search for economic opportunities has been noted. Climate change driven migration results in relocation, demographic and spatial changes which are all adaptive responses to the impacts of climate change.

5.7.1 Climate change, Conflicts and Migration: the case of out-migration from Karamoja

The complex links between climate change, conflicts, migration and human security are more visible among the pastoral communities. Growing resource scarcities, high population growth rates, food shortages, environmental degradation and the declining productivity of ecosystems coupled with competing demands for them can potentially create conflict and escalate existing conflicts and generate others. Thus, the impacts of climate change increase vulnerability to conflicts.

A 2007 United Nations Environment Programme (UNEP) report on the conflict in Sudan noted that the competition for natural resources brought about by climate change was considered to be directly related to the conflict in the region. Desertification has added significantly to the stress on the livelihoods of pastoralist societies forcing them to move south to find pasture.

There is a strong correlation between environmental degradation and resource based conflicts and insecurity. Indeed, in the future, environmental pressures and conflicts may become a leading cause of war and civil strife and that land degradation and food shortage may lead to pressures for out migration, which are likely to lead to conflict ((FAO, 2000).

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In Uganda, the linkages between climate change, conflicts and migration are more evident in the cattle corridor and Karamoja region in particular. Moyini and Winyi (2004) documented water and pasture use conflicts as the key causes of insecurity in the Karamoja region in North Eastern Uganda. The persistent climate change driven droughts cause scarcity of water and pasture forcing the Karimojong cattle herders to move long distances into the neighboring districts of Teso, Acholi and Sebei which in turn increases the potential for conflicts.

In regard to this out-migration, the main distress coping mechanism is the departure of young people, in particular girls and young women from Karamoja, to urban areas to seek employment. Begging is a highly visible livelihood strategy among the migrant Karimojong young women combing the streets of Kampala city.

5.7.2 Climate change, Migration and Conflict in Protected Areas: the case of the Basongora Pastoralists in Queen Elizabeth National Park

The impact of climate change makes the management of protected areas such as National parks, Forest reserves and Wetlands difficult. It has increased the conflicts between neighboring communities and protected areas. The invasion of Queen Elizabeth National Park by the Basongora herdsmen in 2007 and the ensuing conflicts between the herdsmen and the management of the National Park is a case in point. Before coming to Queen Elizabeth, the Basongora had just been sent away from Virunga National Park in the DRC. Droughts caused scarcity of water and pastureland forcing the Basongora herdsmen to migrate into the National park which they regard as their traditional grazing land. In the Park, the herdsmen and their livestock suffered attacks from wild animals notably the lions, hyenas and leopards. In response, the herdsmen poisoned the animals and over 80% of the hyenas were killed and all leopards along the Nyamusagani river were poisoned and in only 15 months at least 11 lions were lost (The New Vision, Wednesday, 25th July, 2007). Meanwhile in Lake Mburo National Park, the lions were almost driven to extermination because of the importunate conflict between the herdsmen and wildlife authorities.

5.7.3 The Paradox of the co-occurrence of floods and droughts in the Teso region

It is paradoxical for regions like Teso which suffer from floods to also at the same time suffer from droughts and the resultant famine which recently claimed lives. It should be noted that droughts are a manifestation of scarcity of water, while floods imply excessive supply of water. Therefore the co-occurrence of both floods and droughts in Teso region is an indicator of a gap in access to simple technologies for the optimum utilization of natural resources and particularly the water resource.

5.7.4 Linking water scarcity to conflicts and migrations

Although Uganda is considered as being well endowed with water resources, the country is experiencing water management issues relating to variability in both space and time (seasonality), increasing water demand and deteriorating water quality. The Spatial and seasonal variability of water resources in Uganda raises serious concern in the context of the country's rapid population growth, the increasing need for water for agricultural production, livestock, HEP, industrialization and the impacts of climate change.

Increasing availability and access to water is a critical component of Uganda's adaptation strategy to the impacts of climate change. Indeed as indicated above the scarcity of water triggers conflicts, migrations, displacement and dislocations especially in the cattle corridor. The Pastoralists migrate in search of water and pastureland. Availability of water would solve over 80% of the problems in the cattle corridor.

The promotion of simple technologies like water harvesting, irrigation would go a long way in reducing the effects of climate change such as droughts, migrations, displacements and conflicts.

5.7.5 Impact of Climate change on Uganda's Progress towards the Millennium Development Goals (MDGs)

In Uganda, climate change is undermining efforts to eradicate extreme poverty and hunger and attain environmental sustainability (MDGs 1 and 7 respectively). Indeed it is threatening to reverse the gains made in poverty reduction over the years. Climate change would alter the ecosystem-human interfaces and interactions that may lead to loss of biodiversity and hence erode the basic support systems for the livelihood of many people in Uganda (IPCC, 2007).

Climate change is not only an environmental issue, it is clearly also a development issue affecting poverty reduction, food security, economic growth, health, human rights, governance and equality, it is also an MDG issue. While climate change may not have featured directly in the setting of the MDGs, it is evident that climate change and variability may be an additional impediment to achieving them (IPCC 2007).

5.8 Meeting the Climate Change Challenge

5.8.1 Identifying Existing Gaps

There is a tendency by governments in many developing countries Uganda not being an exception to look at climate change in a long-term, abstract or academic manner and therefore attaching more priority to issues such as poverty reduction, health and conflict resolution. What is not appreciated by these governments is that climate change is linked to all these issues and will indeed worsen them if it is not addressed.

Climate, perhaps Uganda's most valuable environmental resource, is also the most neglected (UNDP, 2005). Indeed it should be noted that climate is not only a natural resource, but a key determinant of the status of other natural resources, such as water, biodiversity, forest, fish, ecotourism, wildlife and agriculture (NEMA, 2008).

5.8.2 Managing Climate Change: Adaptation and Mitigation Approaches

The mitigation approach are the actions that tackle the causes of climate change, such as reducing Green House Gas emissions, while, adaptation involves actions that minimize the consequences of actual and expected changes in the climate. Therefore, tackling climate change requires actions aimed at both adaptation and mitigation.

5.8.3 Climate Change Mitigation Efforts: Implications for Developing Countries

International negotiations on managing climate change have been dominated by the interests of developed countries focusing on mitigation issues such as the Kyoto Protocol and paying less attention to adaptation (Postnote, 2006).

The recent meeting in Italy of the G8 rich industrialized countries that are responsible for over 80% of the global emission that cause climate change agreed to set a goal of cutting greenhouse gas (GHG) emissions by 80% by the year 2050. However, they failed to reach an accord on shorter-term targets. China and India insisted that

the rich developed countries should first cut their emissions sharply by 2020 before asking developing countries to commit to a long term target. The negotiations failed to reach agreement on halving GHG emissions by 2050. This therefore dashed the hopes of a short term global solution to climate change. No wonder, at a recent African Union summit, Uganda's President, Yoweri Museveni, declared climate change an act of aggression by the rich world against the poor ones and demanded compensation (The Economist, 2007).

It is clear from the above that developing countries like Uganda have very little ability to mitigate the impacts of climate change on the one hand, and on other hand, the rich industrialized are not very serious in tackling the real causes of climate change. To the developing countries it means that climate change is there to stay, at least for sometime and that they will continue to suffer from its adverse impacts. Given this reality, developing countries should direct more efforts towards building capacity for adaptation to these impacts.

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5.8.4 Adaptation to the impacts of climate change

Adaptation to climate change is a way of reducing vulnerability, increasing resilience, moderating the risk of climate impacts on lives and livelihoods, and taking advantage of opportunities posed by actual or expected climate change (Postnote, 2006).

It is important that resilience (the ability to cope and recover), which is low in Uganda, is augmented rapidly. The ability to adapt needs to be built up right from the country, community and down to the household levels. Adaptive capacity is related to the assets that one has access to i.e. financial, natural resources, human and social capital and how well they are utilized. Therefore enhancing adaptive capacity necessitates building the asset base of the poor and increasing the accessibility and effective utilization of these assets by the poorest and most vulnerable of the Ugandan society.

5.8.5 Managing Climate Change Disasters: Uganda's Preparedness

The recent climate change related disasters that Uganda has suffered have exposed glaring gaps in the country's disaster management capacity and cast doubt on the country's preparedness. There is lack of skills, equipment and financial resources to manage the increasing threat of disasters. Yet the scale, frequency and severity of climate change disasters requires adequate preparedness and a comprehensive disaster management strategy. Unfortunately, the country has no comprehensive national disaster management plan. Although Uganda has a Ministry for Relief, Disaster Preparedness and Refugees, it is one of the least funded and has very limited capacity to meet the increasing threat from disasters.

In addition, the Disaster Preparedness and Management Strategy in Uganda is more inclined to managing human induced disasters such as resettling war victims than to managing climate change and natural related disasters. Climate change refugees are accorded a lower status than the political refugees. However, the issue of the increasing number of environmental refugees and how best to support them is of critical importance because natural disasters such as droughts, floods, land slides, wind storms and hailstones which are more frequent account for 70% of the disasters (MAAIF). For instance, from 1991-2000, Uganda experienced seven droughts (GOU 2007) as shown in table 7 below. Indeed, a report by a National Adaptation Programme of Action (NAPA) noted that drought is the single most important and widespread disaster in Uganda. It is increasing in frequency and severity, particularly in the semi-arid areas of the cattle corridor. The rural poor, whose livelihoods are dependent on natural resources, are the most affected.

Table 7: Summary of Disasters that have affected Uganda

Type of Disaster	Date	No. of People Affected
Flood	15 - Aug - 2007	718,045
Drought	Mar - 2005	600,000
Drought	June - 2002	655,000
Drought	Aug - 1999	700,000
Drought	Jan - 1998	126,000
Epidemic	26 - Nov - 1997	100,000
Flood	14 - Nov - 1997	153,500
Earthquake	6 - Feb - 1994	50,000
Drought	Dec - 1987	600,000
Drought	1979	500,000

Source: EM-DAT: The OFDA/CRED International Disaster Database, 2007

Drought Risk Reduction and particularly the related aspects of drought preparedness, resilience enhancement, sustainable food security, and livelihood diversification and strengthening have not been accorded the necessary status as key elements in enhancing resilience against drought risk (MAAIF, 2008) see table 8 below.

Uganda is committed to addressing issues of climate change. In 2007, the NAPA was prepared. It specified priority interventions in the following key areas; land and land use, farm, forestry, water resources, health, weather and climate information, indigenous knowledge documentation and awareness creation, policy and legislation infrastructure.

Table 8: Key Policy Issues on National Preparedness

Key policy issues on national preparedness:

1. Available early warning information and actions taken.
2. Lack of operational drought policy and supportive frameworks.
3. Uganda does not have a migration and resettlement policy; there is therefore an urgent need to develop one to address increasing number of migrants and explore the root causes and positive benefits of migration. Lack of national policy, strategies and plans, and inadequate budgetary and other resource allocations for Drought Risk Reduction.
4. Lack of a comprehensive national disaster management plan.
5. Weak coordination of drought management initiatives due to lack of national platform for drought risk reduction.
6. Lack of community awareness and participation in implementation of drought programmes at community level.
7. Lack of insurance coverage for disasters in general and drought in particular.
8. The urgent need for legislation for the disaster/drought risk reduction policy to address the emerging issues related to drought as a disaster.
9. Weak linkages between currently.

5.8.6 Building on Traditional Coping Mechanisms: A New look at Pastoralism

For generations, communities that rely on natural resources have developed methods to cope with environmental change. This is the foundation upon which capacity to adapt to climate change should be built. Adaptation should aim at strengthening traditional coping mechanisms, optimizing current systems while building flexibility to cope with the uncertainties posed by climate change. It should be noted as well that new technologies can only be sustainable where they strengthen and build on traditional approaches and reinforce local knowledge. This is more cost effective.

Pastoralism is one of the most appropriate and positive forms of livelihood in the face of climate change (Oxfam, 2008). Mobile pastoralism which was regarded in the past as backward and primitive is now recognized as a highly efficient and economically productive way of managing dry lands. What is therefore required to modernize pastoralism through investment in improving the quality of livestock and livestock products and creating supportive infrastructure. A deliberate strategy to promote small animals such as goats and sheep will enable the land-poor farmers to own livestock and reduce pressure on dryland ecosystem resources such as water and biomass for pastures.

5.8.7 Migration as an Adaptation Strategy

Migration is not necessarily bad. It is an adaptive response to changes in ecological situations caused by various factors, more recently including the impacts of climate change. Indeed as indicated above, some forms of migration such as mobile pastoralism should be encouraged and strengthened with complementary policies. Fishermen and farmers have also used migration especially seasonal migration to manage their available stocks. There are situations when migration is the only option, it is therefore a viable adaptation strategy and requires to be supported.

Unlike political refugees fleeing their country, many environmental migrants seek a new home in their own country. Climate change migrants can present growth opportunities to otherwise economically challenged locations. The locals benefit through refugee-related employment. The refugees can also be a source of investment capital and a source of labour for production (NEMA, 2008).

Uganda does not have a migration and resettlement policy; there is therefore an urgent need to develop one to address the increasing number of migrants and explore the root causes of migration. One indicator of the lack of a clear policy direction on migration and resettlement is the way the issue of Karimojong migrants roaming on the streets of Kampala has been handled. The authorities have thought it wise to bundle them up and take them back to Karamoja without addressing the roots causes of their migration. This has been ineffective and they have always come back to the streets.

5.8.8 Effective Natural Resource Management: A Viable Adaptation Option for Uganda

If Uganda managed its natural resources properly many of the so called climate change related natural disasters could have been reduced or avoided all together. Unfortunately, most of our interventions deal with symptoms rather than the root causes and our policy makers and implementers very often mistake the impacts resulting from the mismanagement of natural resources for disasters. For example, flooding in Kampala which has caused destruction of property and claimed lives has never reached a disaster level; it is only a manifestation of poor management of drainage channels, the lack of physical planning, rampant encroachment on wetlands and the lack of a clear policy on rural-urban migration.

Reducing natural resource degradation does not require expensive solutions, but only requires discipline, compliance to environmental laws and regulations, effective planning and commitment at all levels of policy and decision making. To achieve this, government would therefore need to rehabilitate and restore the productivity of the natural resource base, and address tensions related to access and tenure.

5.8.9 Sustainable Land Management

Much as climate change contributes to land degradation, land degradation also worsens the impacts of climate change. Reducing soil erosion and the declining soil fertility are therefore important steps in Uganda's adaptation strategy to the impacts of climate change.

5.8.10 Afforestation as an Adaptation Strategy

Uganda's National Adaptation Programme of Action (NAPA) report prioritizes reforestation, climate change awareness raising and use of early warning information in its matrix of adaptation options for agriculture. Carbon-absorbing forests are increasingly becoming important as the most cost-effective ways to combat climate change. However, afforestation programmes should take into account the opportunity cost of keeping land under forest as opposed to other competing land uses. The bottom line is that land should be put to its most productive use in order to effectively contribute to food security, poverty reduction and national development.

5.9 Opportunities presented by Climate Change

Whereas the impacts of climate change are known and clear, the opportunities it presents are less obvious. One of the opportunities presented is the increasing national and international concern for the environment gained in the light of the negative impacts of climate change. For instance, during the Common Wealth Heads of States and Governments (CHOGM) meeting held in Kampala in 2007, climate change was one of the topics on the agenda. Again climate change featured during the recent (2009) G 8 Summit held in Italy. Political attention is therefore shifting towards environmental sustainability hitherto given less attention. In addition there are opportunities to tap into new international finance (carbon funds) under the Clean Development Mechanism (CDM) of the Kyoto Protocol .

Uganda has already benefited from the sale of carbon credits at the Nyagak mini-hydro project (US\$ 4 million) under the CDM (PEAP, 2004). NEMA with support from the World Bank is promoting better management of municipal solid waste (MSW) in urban areas and is working with 9 municipalities/towns (Mukono, Jinja, Soroti, Mbale, Lira, Fort Portal, Kasese, Kabale and Mbarara) to compost municipal solid waste generated in these towns. The composting of solid waste into manure reduces the emission of green house gases like methane and will enable Uganda to benefit from the global carbon trading under the Clean Development Mechanism (CDM) of the Kyoto Protocol.

The potential areas for CDM investments include the renewable energy sources (hydro, solar, thermal, biomass) and waste management (PEAP, 2004). In order to attract CDM investments and to coordinate these efforts, climate change unit was formed in the Ministry of Water and Environment (MWE) with the support of the Danish International Development Agency (DANIDA).

While there is a big potential for Uganda to reap real benefits from the CDM and the Voluntary Carbon markets, it is sad to note that these mechanisms have had very little impact in Uganda. The high transaction costs, the low indigenous capacity and the complexities involved in carbon trading have all combined to limit benefits to Uganda and many other developing countries.

Increased rainfall associated with climate change though it may cause adverse effects it could also be beneficial in enabling high agricultural output which is important for raising household incomes and creating food security. In addition, there are opportunities for employment in climate change management related activities which need to be tapped.

5.10 Conclusions

From the fore-going, it is quite clear that there are strong linkages between the impacts of climate change, natural resource management and migration. Climate is not only a natural resource, but is also a key determinant of the status of other natural resources. Indeed climate change affects the quantity, quality and productivity of natural resources. Thus posing special challenges to the management of natural resources on which the economy and the people of Uganda depend for their livelihoods security

Uganda is highly vulnerable to the impacts of climate change. Therefore, reducing vulnerability should be a national priority. The sustainable management of the environment and natural resources is central to Uganda's adaptation strategy and is the most cost effective way of managing the impacts of climate change.

Managing the real and potential risks posed by climate change should be at the forefront of both decision making and planning processes. There is very little that least developed countries like Uganda can do to mitigate climate change, therefore the country needs to concentrate their efforts on adaptation for the short and medium terms.

5.11 Recommendations

Policies and strategies for the management of the impacts of climate change should conceptualise these critical linkages and take them into account in the design of interventions to meet the challenge of climate change. The following recommendations are proposed:

1. RESOURCE MOBILIZATION

- Managing the impacts of climate change requires building partnerships at various levels including global, regional, national, local and community levels. Through these partnerships assistance can be mobilised to help build adaptive capacity, provide funding, sharing technologies, knowledge and experience and supporting education and awareness programmes. Development partners have a critical role to play in mobilizing the required support.
- There is need to take advantage and exploit opportunities provided by climate change. Local capacity should be created to participate in the carbon trade and where possible partnerships with financial institutions to provide the much needed investment finance. The Uganda Investment Authority (UIA) can play a critical role in mobilizing investments to promote natural resource management programmes such as afforestation, sustainable land management and protection of water catchments.
- While Uganda has developed the NAPA and its implementation strategy, it remains largely unimplemented due to the lack of resources. There is therefore an urgent need to mobilize resources for the implementation of the NAPA in order to climate change proof the country's national economic programmes and investments against the increasingly disastrous effects of climate change

2. CAPACITY BUILDING AND AWARENESS RAISING

- Build capacity to adapt to climate change through improving social, economic and technical resilience and increasing flexibility within systems.
- There is a scarcity of skilled manpower in climate related disciplines. Therefore to ensure a sustainable supply of human resources for the climate change industry and sub-sector competent tertiary institutions should offer training programmes in climate and climate change.
- The real and potential impacts of climate change are not adequately understood and appreciated especially by the local leaders and communities that suffer most from these impacts. More efforts therefore need to

go towards increasing awareness and education about the impacts of climate change.

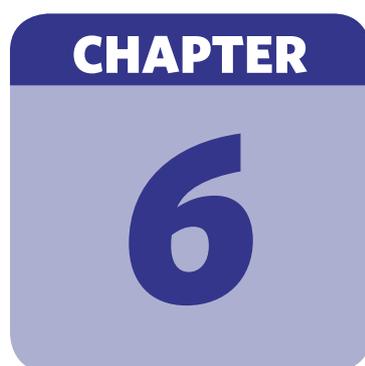
- As indicated natural resource dependent communities such as the pastoralists have for generations developed traditional knowledge and coping mechanisms to environmental changes. Adaptation strategies should therefore build on and as well strengthen the traditional coping mechanisms. Modern technologies can only be sustainable if they strengthen and build on traditional methods and reinforce local knowledge.
- Strengthen research to enhance climate monitoring and effective response in order to provide regular information to support sustainable socio-economic development.
- The sustainable management of Uganda's environment and natural resource base should form the foundation for the country's adaptation strategy to the impacts of climate change. Mainstream adaptation to climate change in all policies, plans and programmes. Climate mainstreaming guidelines are required to support the mainstreaming process. The on-going process of developing a 5 year National Development Plan offers a unique opportunity to prioritise mitigation and adaptations measures to the impacts of climate change in the country's planning process.

References

1. A-AANET (2007). Crisis mitigation in pastoral systems. Livestock situation analysis, n o r t h e a s t Tanzania Volume 1.
2. African Centre for Technology Studies, 2008. Climate Change and Conflict in East and the Horn of Africa.
3. AU (2005). African Ministerial Conference on Disaster Risk Reduction: African Union Commission Conference Centre. African Union, Addis Ababa, Ethiopia; 5th to 7th December 2005.
4. Bwango Apuli, J. Wright et al (2000). Reconciling national and global priorities in adaptation to climate change: with illustration from Uganda.
5. David Pulkol (1991). Resettlement and integration of Pastoralists in the national economy: the case of ranches restructuring in south western Uganda.
6. DFID (2008). Climate change in Uganda: Understanding the implications and appraising the response.
7. Elizabeth Stites, Dyan Mazurana et al (2007). Out migration, return and resettlement in Karamoja, Uganda: the case of Kobulin, Bokora County.
8. Government of Uganda, 2007. Climate change: Uganda National Adaptation Programmes of Action.
9. <http://www.reuters.com/article/environmentNews> (2009). Climate Change could force Millions from homes
10. <http://www.windows.ucar.edu> (2009). Effects of Climate Change
11. <http://www.mg.co.za/article/2009-07-10>. Greenpeace uses G8 summit to highlight climate change
12. <http://www.newvision.co.ug/D/8/12/577946>. Queen Elizabeth Park lions, hyenas poisoned
13. http://en.wikipedia.org/wiki/Climate_change. Wikipedia, the free encyclopedia.
14. Kitutu M, Muwanga A, Poesen J, Deckers J (2004). The Relationship between geology and landslides in Manjiya County, South west of Mount Elgon, Eastern Uganda, Geoscience Africa 2004

- Conference, Abstract volume (1), University of Witwatersrand, Johannesburg, South Africa. Pp. 349-350.
15. MAAIF, (2008). Review and analysis of existing Drought risk reduction policies and programmes in Uganda. National report on drought risk reduction policies and programmes.
 16. NEMA, 2008. National State of Environment Reports;
 17. Oxfam, 2008. Turning up the heat. Climate change and poverty in Uganda.
 18. Postnote (October, 2006 No, 269). Adapting to Climate Change in Developing Countries.
 19. The Economist (12th, May, 2007). International: Drying up and flooding out; Global warming in Africa Vol. 383, Iss. 8528; pg. 59.
 20. Times News (8th July, 2009). G8 Climate Change Deal Stumble Stumbles at First Hurdle (Jenny Booth).
 21. UNDP, 2005. Uganda Human Development Report 2005. Linking Environment to Development: A Deliberate Choice
 22. World Bank, 2005. Disaster Risk Management in a changing Climate.





CLIMATE CHANGE AND MIGRATION: IMPLICATIONS TO FOOD SECURITY

6.1 Introduction

“Climate change” is a phrase used to describe the statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period usually 30 years or longer. The phenomenon is associated with persistent influences of human related activities which cause changes in the composition of the atmosphere and land use. The United Nations Framework Convention on Climate Change (UNFCCC), in Article 1, defines “climate change” as: “a change of climate which is 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”. UNFCCC makes a distinction between “climate change” attributable to human activities, and “climate variability” attributable to natural causes which lead to variations in the mean statistics of the climate on all temporal and spatial scales beyond the individual weather events.

Climate change has been attributed to global warming ; Associated with increased human activity dating to the industrial revolution, and increased burning of fossil fuels (Coal, Oil and Gas) to meet the growing energy needs. At the same time population growth has led to the growing demand for food. Forests and wetlands have been destroyed to make way for more farm land and settlements especially in developing countries.

Since the last century (C20th) there has been evidence that surface air temperatures and sub-surface ocean temperatures have risen, this rise in turn has resulted in the increase of average global sea levels, retreating glaciers, melting snow caps as observed on Mt. Ruwenzori and changes to many physical and biological systems. Global surface temperatures increased by 0.74 ± 0.18 °C (1.33 ± 0.32 °F) during the last century; this rise is attributed to human activity (IPCC 2001), which is responsible for the increased emission of greenhouse gases (water vapor, carbon dioxide, methane, nitrous oxide, and ozone). The human activities associated with greenhouses gases include burning fossil fuels, farming and deforestation. These have increased the concentrations of greenhouse gases contributing to the observed increases in earth’s surface temperatures since the middle of the 20th century . The increased atmospheric concentration of greenhouse gases and aerosols, land cover and solar radiation has altered the energy balance of the climate system as a whole, which is the reason global average temperatures have risen since the mid-20th century .

While most of the human related activities which produce most of the greenhouse gases occur in the developed and industrialized world, it is the least developed countries (LDCs) and the developing countries where

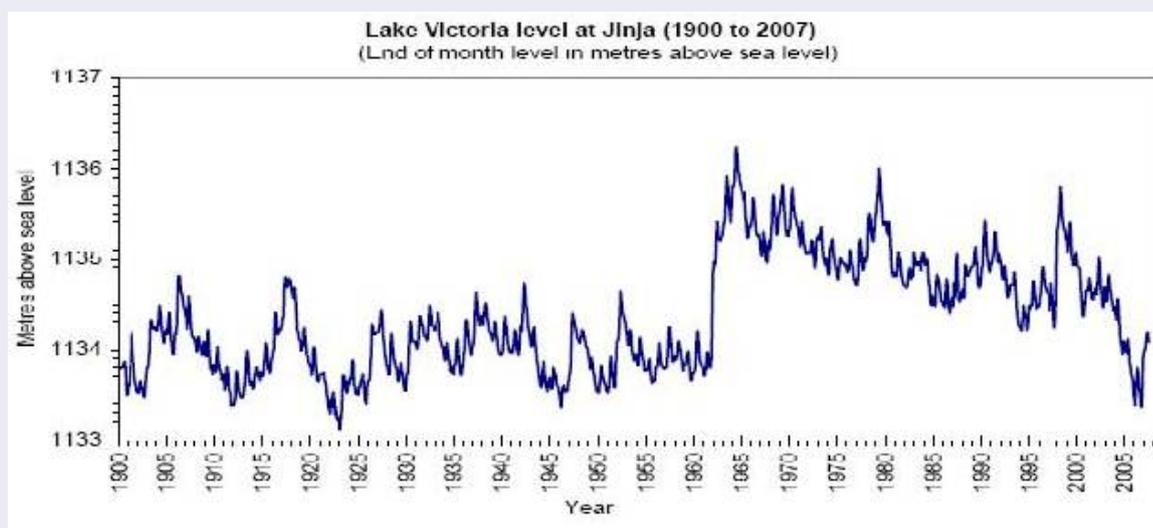
livelihoods still dependent on the climate that will suffer the greater effects of climate change that will be manifested in form of food insecurity, loss of natural resources and inability to provide social services. The consequence of these changes in the local micro-environments if not mitigated will continue to trigger waves of migrations by communities in search of new resources, better social services and food security.

6.2 Climatic Trends in Uganda

Like the rest of East Africa, Uganda experiences wide variability in climate and the country is susceptible to flood and drought events both of which have had a negative socio-economic effect. The country suffered some of the worst floods in parts of the Eastern and Northern regions in 2007; this was followed by prolonged intervals of drought and spatial rains in 2008 and 2009. These events have been hard hitting to Uganda's economy and resulted in increased migration levels among pastoral communities which in turn have caused ethnic tensions in the Eastern, North eastern and Northern parts of the country. The 2007 flooding resulted in widespread lose of livelihood assets, infrastructure damage, and displacements of persons leaving 1.8-2 million people especially women, children and elderly exposed to malnutrition, illness and poverty. It also triggered a wave of migrations by the youth from rural to urban areas in search of petty jobs and the women and elderly into settlement camps with the hope of accessing humanitarian aid.

There has not been sufficient and credible documented data on the of trends Climatic variability in Uganda, however the trends in the water levels of L. Victoria over the last century offers a strong clue of the possible implications of climate change to Uganda and the region. Several studies have showed that both climatic and non-climatic factors have been responsible for the variability in the water levels. The rapid drop of the water level in L. Victoria between 2004 and 2007 has partly been attributed to climatic change factors, while excess release of water at the outflow end for power generation is said to account for 50% of the drop in this period as seen in Figure 6.1 below

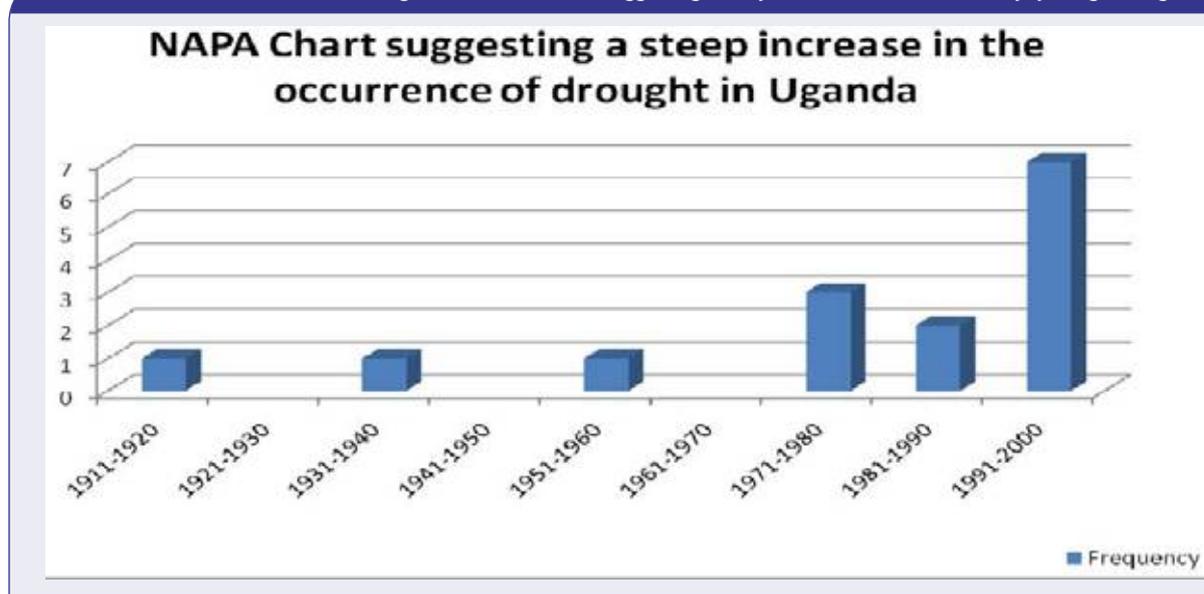
Figure 6.1: Lake Victoria levels at Jinja 1900 to 2007



Source: Goulden 2007, obtained from Directorate of Water Resources Management DWRM.

Experts have a consensus on the rise in the mean annual temperatures in Uganda which are projected to rise by 0.7° C-1.5° C by the 2020s and between 1.3° C and 4.3° C by the 2080s. Some believe that this will severely disrupt the future rainfall patterns. Others suggest a possible increase in floods, heat waves and droughts of up to 30% by 2020s.

Figure 6.2: NAPA Chart suggesting a steep increase in the occurrence of drought in Uganda



Source: Ministry of Water and Environment (MWE) 2007

Figure 6.2 is an extract from (NAPA 2007) reports and shows an increasing trend in rainfall variability and frequency of droughts. Data on this subject is but the uncontested fact is that extreme events resulting from variations in rainfall patterns, have had serious implications for water resources, food security, natural resource management, human health, settlements, energy supply and infrastructure in Uganda, part of these events are responsible for the current migration patterns in the country.

6.3 Implications of Climate Change to Agricultural Production in Uganda

The floods of 2007 and the draught in the first half of 2009 have shown that Uganda is highly vulnerable to climate change, increase in the frequency of heat stress, droughts and floods in each case had severely affected crop and animal production. Two hundred years ago the major determinant of food security in the world was the climate. Since then the industrial revolution and technological advances have increased mans' capacity to control nature in developed countries. Man has been able to create artificial micro-climates suited for crop production such as greenhouse farms, breeding and genetically engineering plants and animals, enhancing soil quality and regulating water flows. Along with these developments advances in food processing, storage technologies and efficient transport systems have created complex food chains that allow long-distance distribution and fast delivery of foods in a highly commercialized and integrated global food chain.

While technology appears to have given man an edge over nature, this success has come at a cost, firstly these and other human activities have interfered with the climatic systems, secondly these advances in food production have been loop-sided; most developing countries still depend on rain fed agriculture rather than man's ingenuity which makes them dependent on climate and remain vulnerable to food insecurity caused by the effects of climate change. The rise in the earth's surface temperatures is expected to result in increased crop and animal production in the cooler and temperate parts of the world; reducing the cost of farming in these regions in a short-run, On the contrary the countries in the tropical regions will suffer a significant fall in crop and animal production creating a cycle of perpetual food insecurity and food related emergencies of enormous proportion that will significantly stretch the existing global food systems.

The effect of climate change on crop and animal production is three fold; First it modifies the environmental risk for fire outbreaks, pest and pathogen outbreak by changing the micro-environmental factors to favor

the emergency of new pests and pathogens or modify the characteristic of the hitherto controlled pests and pathogens making them resurgent leading to high costs of crop and animal production. Secondly the increase in average temperatures, the rise in atmospheric concentrations of CO₂, changes in precipitation levels and the occurrence of extreme events are major determinants of the levels of crop and animal production. The rise in mean annual temperatures will in a short-run to favor an increase in yields for many tropical crops in regions like Kabale which previously had relatively lower mean temperatures and will severely limit production in the majority parts of the country where temperatures are already high. Any further rise in temperatures leads to increased soil evaporation rates, increased frequency of severe droughts and increasingly variable rainfall patterns. Thirdly, the increased frequency of severe events like floods and winds will disrupt infrastructure by sweeping bridges and destroying installations. They will also lead to increased levels of surface soil erosion, crop destruction and cut off farm supply systems resulting in declining farm productivity and possibly total crop and animal output. Generally the potential effects of climatic change are difficult to forecast, but there is universal agreement that Climate change will have major effect on food availability, food accessibility, food systems and food utilization and all these are closely fused with production as the major component of the food chain.

In Uganda 73.3% of jobs in industry and services sector derive from agriculture (UBoS, 2009). Anything that will affect agricultural production should have serious implications to the economy. It is however difficult to assess the real effects of climatic change to the economy due to lack of credible statistics on agricultural production, similarly the lack of reliable data on crop production in Uganda makes it impossible to assess the severity of the effects of climatic change on crop and animal production. Nevertheless anecdotal evidence from all parts of the country show a general decline in farm productivity; statistics showing increased levels of crop and animal production do not show the trends in unit costs of production, the increase in total output can be attributable to increased acreage amidst declining productivity per acre.

Staple crops like crops like bananas, cassava, sorghum, beans and maize have come under increasing pressure from pests and diseases, floods have ravaged crop fields and destroyed animals and property in parts of eastern and Northern Uganda notably in 2007. This floods have been punctuated by intervals of drought and spatial rains which have ushered in waves of famine in the North, Eastern and North-eastern parts of the country over the last two decades most of it attributable to crop loss. These pointers show the vulnerability of rain fed agriculture and an inevitable fact that Uganda will succumb to the effects of climatic change. There is urgent need to improve Uganda's ability to measure and forecast climatic trends if appropriate mitigation strategies are to be designed to deal with future food emergencies resulting from declining agricultural production in the face of a population growth rate of 3.2%. The Ministry of Relief, Disaster Preparedness and Refugees emergency preparedness in each occasion has been over whelmed by the effects of the most recent climatic events which included floods in 2007 and draught in 2009. Prediction from the IPCC paints a gloomy picture with yields from rain fed agriculture expected to fall by as much as 50 percent in tropical African countries. Fisheries production will likely also decline, according to the (IPCC 2007) report. Rural regions in Latin America are also expected to be affected. In the region's drier areas, climate change is expected to lead to increases in the saline content of the soil, which reduces crop productivity.

6.4 Climate Change, Rural Vulnerabilities and Migration

Uganda is one of the less industrialized countries that still depend on subsistence and rudimentary rain fed agriculture. This makes us more vulnerable to the effects of climate change. Specific changes in the local environments will have immediate and direct impact on the health and well-being of millions of households that depend on natural resources for their basic livelihoods. Weather variability in a country like Uganda reduces the livelihood options of rural families, and has become a major "push" factor forcing people to leave resource-depleted rural areas and move in search of new resources creating new migration patterns. Because

migration represents a tremendous force of social change, the potential for climate change to increase migration levels in Uganda deserves careful consideration and policy attention. This also has a high potential to create resource based conflicts between communities especially in cases like Uganda where rural households rely heavily on climate-sensitive resources such as local water supplies and agricultural land; climate-sensitive activities such as arable farming and livestock husbandry; and natural resources such as fuel wood and wild herbs. The “Bafuriki” case in Bunyoro, similar conflicts involving communities in Teso, Lango, Acholi and West Nile resisting the migrating Balalo and Karimojong pastoralists who are searching for water and pastures for their cattle. In the face of these environmental changes, communities or individuals may be forced to migrate in search of work and new resources. The “Balalo” and other pastoral communities are a case in point where government and local authorities in Uganda are currently grappling to offer clear solutions to a problem that has created serious political sensitivities which threaten the peace and food security of the affected communities. The most worrying form of migrations have seen able bodied youth move to do petty jobs and trade in urban centres depriving the agricultural sector of much needed labour for crop and animal production.

Economic immigrants from Africa are a major concern in Europe, many immigrants attempting to cross the Atlantic to Europe die every year when embarking on the perilous journey across the Atlantic. The more affluent Ugandans strive to move to the Diaspora, 21.6% Ugandans emigrate out of the country each year and 2.4% of these are net emigrants (Stephen Kaduuli 2008) and in all these cases the major push factor has been poverty. Migrants who find work abroad remit portions of their earnings back home, their families in the home communities may use the remittances to buy substitutes for goods previously produced or harvested from the local environment.

A link between migration and climatic factors has been documented in several rural regions of developing countries. Case studies in Burkina Faso show that residents of dry, rural areas are likely to migrate to rural regions with greater rainfall. In this way, migration is viewed by rural communities as a response to the threat of recurrent droughts and resource depletion. Migration is one of the many survival strategies also used by Ethiopian households in times of environmental stress. Other survival strategies include using food reserves, seeking local non-farm employment, selling livestock, borrowing food, or selling household and farm equipment. Still, once these livelihood options are exhausted, people often migrate to new environments.

6.5 Implications to Food Security and Women

FAO estimates that 776 million people living in 98 countries most of them in Sub-Saharan Africa and South Asia were food insecure in 1997/99 and they projected that the greenhouse gas induced climate change would further worsen the food security situation in these countries and the tropics. The gender dimensions of climate change in Uganda have not been well documented, what is certain is that over 80% of the population in Uganda lives in the rural areas and 90% of these depend on agriculture as a source of livelihood. Most studies and accounts show that women form the majority of the work force on the farms from which rural folks derive their livelihood. Women play a major role in looking after the family welfare. They represent one of the primary groups with greater vulnerability to food insecurity caused by changes in the climatic conditions which lead to a fall in crop yields.

Climatic change affects all the four dimensions of food security i.e., food availability, food accessibility, food systems stability and food utilization. The World Food Summit (November 1996) defined food security as a state in which “all people at all times have physical or economic access to sufficient safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life”. Notably, FAO asserts that “food security depends more on socio-economic conditions than on agro-climatic ones, and on access to food rather than the production or physical availability of food”. To evaluate the potential impacts of climate change on food security, “it is not enough to assess the impacts on domestic production in food-insecure countries. One also needs to (i) assess climate change impacts on foreign exchange earnings; (ii) determine the ability of food

surplus countries to increase their commercial exports or food aid; and (iii) analyse how the incomes of the poor will be affected by rise in food prices due to climate change” (FAO, 2003b: 365-366).

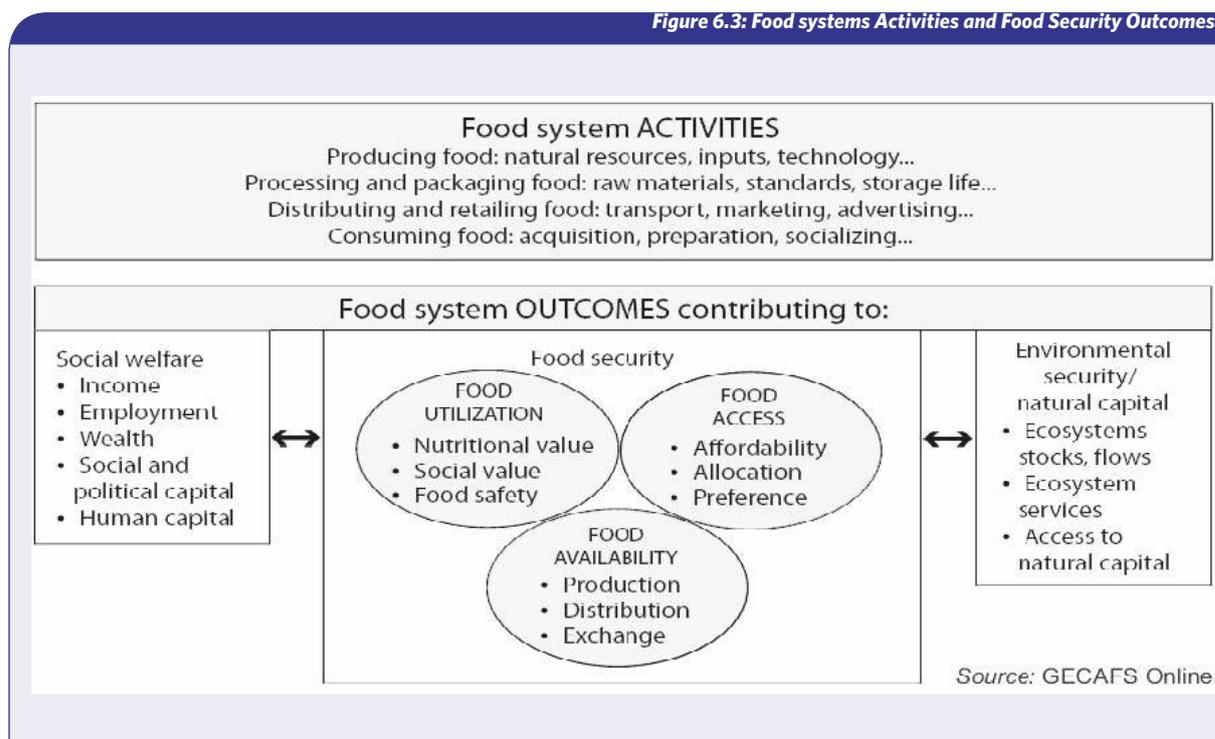
Food systems encompass a series of processes which deliver food to the Plate. Such activities relate first to the production, processing, distribution, preparation and consumption of food, secondly to the factors that determine food availability through self production and trade, thirdly food accessibility factors such as affordability, allocation and food preference and finally food utilization with specific emphasis on nutritional value, social value, and health and food safety variables. These components of the food system combine to form the food chain. A food chain is a holistic set of simultaneously interacting processes which form a sequence of activities that must occur in order for people to obtain food. It is often described as the food pipeline or with phrases like from “plough to plate”.

The stability of the food system is critical to ensuring food security. Rural households spend 50% of their incomes on food (UBoS Statistical Abstract 2009). Any future effects on the stability of food systems will affect the purchasing power of most rural households, especially the households where women are the main bread winners. Some studies have indicated that women are now more involved in petty trade besides farming thanks to several development programs which have exclusively targeted to empower women economically. The downside is that these interventions have positioned women as major bread winners and relegated men to dependants which has put an additional burden on the women. A point to note is that changes in the food systems directly impact on the purchasing power of the people; the rising food prices, and increasing inflation rates have not been matched by a similar rise in incomes. Any improvements in household incomes obtained from trading activities will likely be wiped out by the escalating food prices as self production of food becomes less efficient due to climatic change.

The tendency of extreme events like floods to destroy livelihood assets and infrastructure such as transport infrastructure will not only result in a drop in food production but also food availability and food accessibility. Figure 6.3 and 6.4 illustrates the dynamic interactions between and within the biogeophysical and human environments that underpin food security. A food system is shown as a complex array of multiple food chains operating at the local, national and global levels. A simple example of a food chain in Uganda starts with a rural household which practices rain fed agriculture, and grows maize as a staple food, the farmer harvests the maize and takes it to the local mill from where it returns back to the farmers household in form of bags of Maize flour (Posho) and finally into the cooking pot on the way to the plates of the members of the household.

The farmer also participates in more complex food chains. When the farmer obtains salt from the local kiosk and energy in form of firewood or charcoal from the local vendors for cooking the cereal meal he enters another food chain where he is not the primary producer. It is obvious that the rural farmer must have some cash income to be able to participate in the food system even if it is to buy salt alone. In practice the food system in a typical household comprises of food chains in which the household participates in an effort to meet its consumption requirements and dietary preferences. These interactions and feedback loops connect the different parts of the food chains making it almost impossible for a typical household to achieve food security without some cash expenditure. All households need sources of livelihood that will give them sufficient purchasing power to buy the food that they need but cannot produce for their own consumption. The envisioned adverse effects of climate change such as damage of the transport and distribution infrastructure will affect other non-agricultural parts of the food system. Climate as a key driver of crop production will affect the quantities and types of food produced and the adequacy of production-related income.

Figure 6.3: Food systems Activities and Food Security Outcomes



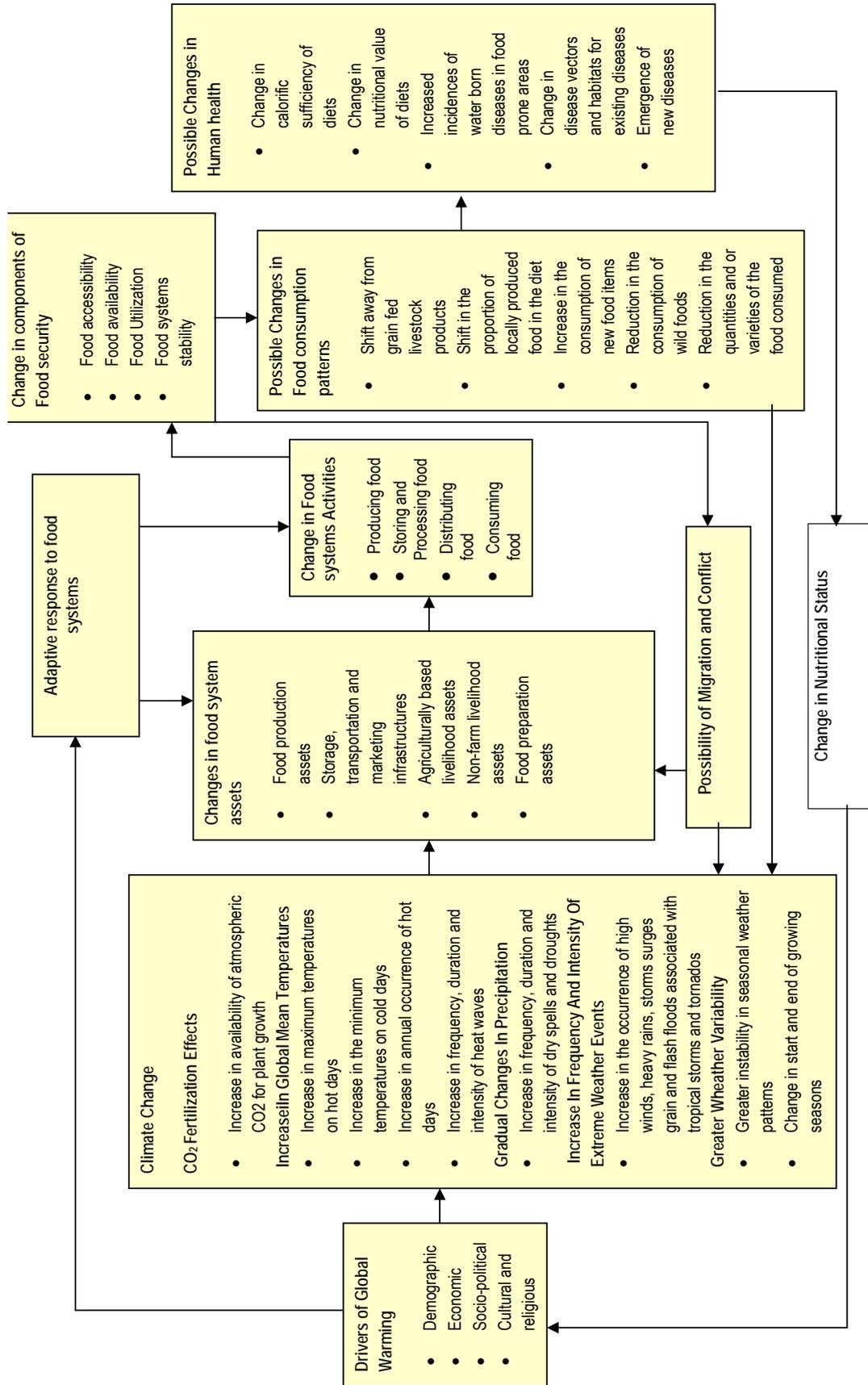
6.6 Policy Implications to Uganda

Although climate change is occurring and will continue to do so, a clear policy on climate change and food security is not yet in place, key policy actions need to be developed to mitigate the likely effects of climate change and reduce climate-related migration, particularly in rural areas of Uganda. Key policy areas will need to address adaptive measures that Uganda should undertake to mitigate the outcomes of climate change by establishing emergency response mechanisms to make the food system more responsive in the face of catastrophic weather events. The Ministry of Relief, Disaster Preparedness and Refugees is currently overwhelmed by the number of people in need of food aid, most of them women and children partly because the country has no functional food security policy in place. The Red-Cross estimated 1.8 million people were at risk of starvation in the first half of 2009, if food aid was not forthcoming. The red Cross made an appeal for over Ushs. 5.0 billion in food aid to mitigate the risk.

The Government will need to strengthen Uganda National Adaptation Programs for Action (NAPA) capacity to monitor changes in mean temperatures and variations in rainfall patterns around the country in order to design appropriate response mechanisms against regional disruptions in the food system. These policies need not be climate-specific, but should serve to enhance household livelihood options, to make them more resilient changes in their resource-base. In this way, development efforts and programs to reduce poverty will lessen livelihood vulnerability, ultimately reducing the need for families to migrate because of climate induced changes in their local environment.

Although residents of less industrialized countries have contributed little to climate change, they are going to suffer disproportionately from the effects, therefore developing countries will need a commitment from the industrialized countries to help develop mitigation measures in these countries to reduce the impact of climate change in the less industrialized countries. Policy considerations should address the possible impact of climate change to the interactive processes in the food system, the understanding of these process in Uganda is fundamental to for making the right policy choices.

Figure 6.4 Climatic change and Food Security



Source: GECAFS Online

6.7 Conclusion and Policy recommendations

Uganda remains highly vulnerable to climate change and migration, floods and droughts which have taken turns to ravage parts of the country since 2007 and have shown how tightly the economy and livelihood of the people in Uganda is entwined with the climate. Food price related inflation rose to 15.8% in 2008 compared to a decline of 3.8% in 2007 (UBoS Statistical Abstract 2009). The weakness of the food system in Uganda has severally been exposed; scenarios where parts of country have an abundance of food while others parts of the country suffer from dire famine are a common occurrence. Ugandans should be bracing for more disruptive patterns of climatic events in the future and as a nation we need to initiate and speed up adaptive responses to cope with such disruptions which have proved capable of severely disrupting our already fragile food system, and triggering widespread local and international migrations.

Failure to contain these disruptions could result in severe damage to the existing national infrastructure, agriculture production capacity, the environment and ecosystems will put great pressure on natural resources like water bodies and forest resources which risks reversing the economic gain from the last two decades. Undoubtedly the implication to food security can not be over emphasised; women, children, the elderly make up the bulk of the 31.1% poor of the population and will be the hardest hit. In wiping out the peoples purchasing power; a fall in purchasing power is capable of triggering a rise in poverty levels and changing the down ward trends so far registered in the last decade. The key policy recommendations to contain the impact of climatic change and migration should include the following as key priorities of government's response to climatic change and its effects.

1. *Strengthen the capacity of the National Adaptations Programs for Action (NAPA) to monitor change in rainfall patterns and mean temperatures and develop early warning mechanisms.*

Rain fed agriculture continues to be a strong pillar of the Ugandan economy accounting for 23% of GDP and directly or indirectly offering employment to about 73% of Ugandans, Policy action should focus on developing adaptive responses to the effects of climatic changes through effective monitoring of rainfall variations and mean temperatures. This should be supported by an early warning mechanism and a rural information system to guide the rural farmers on any changes in rainfall patterns, planting seasons and the right plating time for the staple food crops that constitute the back bone of food security in the rural households. Currently most farmers plant at the onset of rains largely guided by traditional season calendars rather than reasonable forecast information. The meteorological station and NAPA should be sufficiently strengthened both technically and logistically to generate, analyse, provide and disseminate relevant information for the design of adaptive response mechanisms.

2. *Expedite the development of a national food security policy and emergency preparedness action plan;*

A national food security policy should urgently be put in place to provide a coordinated response by agencies addressing food security concerns. The recent conflicting accounts from members of aid agencies, parliament and the cabinet shows lack of a coordinated understanding of the famine situation in the country. The policy design should focus on coordinating and using accurate information to increase food availability and accessibility for the most vulnerable sections of the population. A national food security policy will also improve on measures to increase the responsiveness and cost efficiency of the food system in terms of production, processing, storage and transportation for food delivery around the country. Issues of food security should not be left to the natural market mechanisms due to inherent market imperfections; government should play an intervening role to protect the vulnerable from these market imperfections.

3. *Refocus economic empowerment programs to create increased household earnings as a strategy to mitigate effects of crop failure and widen options for food accessibility.*

The (UBoS 2009) Statistical Abstract underlines the significance of purchasing power to food security in the country. Fifty percent (50%) of rural household expenditure and 45% overall is spent on food, drinks and tobacco, another 16% is spent on rent, energy and fuel making a total expenditure of approximately 66%. This represents a substantive proportion of income for the rural households and any decline on the purchasing power will affect any or all the four dimensions of food security especially availability, accessibility and utilization besides access to other related services like health which impact on food utilization and nutritional well-being. Economic empowerment initiatives aimed at increasing earnings of households should be targeted to build financial resilience to widen the options for coping with crop failures and food access. Most rural communities rely on self production to meet their food needs. While Uganda as whole is fertile and suitable for crop production, dependence on rain fed agriculture and variability due to weather patterns has resulted in a major drop in crop yields in some parts of the country. Policies to widen food security options need to be strengthened in order to focus on increasing accessibility to food through exchange besides self production. Poverty eradication initiatives put in place by government like the “Prosperity for All” programs should be made more accessible to the rural poor and entrepreneurs to increase levels of investments and widen household income options in order to boost household purchasing power and ability to buy food which they cannot otherwise produce.

4. *Climatic change mitigation measures into agricultural development programs and policies*

Measures to mitigate the effects of rising mean temperatures and increasing variability in rainfall patterns should be strongly mainstreamed into the National Development Plan (NDP), PMA and NAADS to ensure sustainable use of natural resources for crop production. The policy should also consider a systematic shift from total reliance on rain fed agriculture and intensify efforts to modify the crop production structure through irrigation agriculture, crop and animal breeding to create adaptive technologies and sustainable exploitation of natural resources like rivers, forestry resources and soils.

5. *Put in place a migration policy to address both planned and unplanned migration.*

Natural migration is an inevitable social coping mechanism in most communities, however climate induced migration is likely to be unplanned and haphazard. This is likely to increase in the foreseeable future and, along with it will come resources driven conflicts and settlement patterns that can be detrimental to the environment and hamper any measures to forestall the effects of climatic change. Government should have a clear policy on migrations and manage settlements that arise from such migrations in a manner that ensures social integration, acceptance and eliminate potential for conflict, which in itself will severely worsen the food security situation of the affected communities.

6. *Explore opportunities under the clean development approaches and voluntary carbon markets*

Climate change mitigation through the Clean Development Mechanism and Voluntary Carbon markets should be exploited in order to offer alternative income sources to the rural communities through restoration of destroyed forestry cover in a commercially sustainable manner. Emerging private investments like “Green life international” in West Nile which is promoting commercial tree farming should be supported by government to access investment resources as an efficient mechanism to speed up reforestation initiatives in rural communities without compromising their livelihood options. This if promoted deliberately can represent a large income source for rural households to significantly improve their ability to access food, reverse the destructive trend of settlements and farming patterns that have eroded natural resources as well as mitigate climatic effects by reducing the impact of adverse events like storms, winds and droughts.

References:

1. IPCC (2007-05-04). “Summary for Policymakers” Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.
2. ⁱ Karl TR, Trenberth KE (2003). “Modern Global Climate Change”. *Science* 302 (5651): 1719–1723. doi:10.1126/science.1090228. <http://www.sciencemag.org/cgi/content/abstract/302/5651/1719>
3. ⁱ ^ http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf AR4 SYR SPM page 5
4. ⁱ Dr Goulden’s PhD research and subsequent work collates the outputs of available modeling exercises and provides a rigorous contemporary understanding of future climate trends in Uganda.
5. ⁱ Izabella Koziell and Jacqueline Saunders, eds., *Living Off Biodiversity: Exploring Livelihoods and Biodiversity* (London: International Institute for Environment and Development, 2001); and Charlie Shackleton and Sheona Shackleton, “The Importance of Non-Timber Forest Products in Rural Livelihood Security and as Safety Nets: A Review of Evidence From South Africa,” *South African Journal of Science* 100 (2004): 658-64.
6. ⁱ Roger-Mark DeSouza, “Using Return Migration as a Development Tool—Are the Right Policies in Place?” (2006), accessed online at www.prb.org, on June 1, 2007; and Philip Martin and Elizabeth Midgley, “Immigration: Shaping and Reshaping America, 2d ed., *Population Bulletin* 61, no. 4 (2006), accessed online at www.prb.org, on June 1, 2007.
7. ⁱ Hans G. Bohle, Thomas E. Downing, and Michael J. Watts, “Climate Change and Social Vulnerability: Toward a Sociology and Geography of Food Insecurity,” *Global Environmental Change* 4, no. 1 (1994): 37-48; and Jouni Paavola, “Justice in Adaptation to Climate Change in Tanzania,” in *Fairness in Adaptation to Climate Change*, ed. W. Neil Adger et al. (Cambridge, MA: MIT Press: 2006): 223-37.
8. ⁱ Food and Agricultural Organization (FAO) 2000; *The state of World Food Insecurity*
9. ⁱ *Climate Change and Food Security: A Framework Document*; Food and Agricultural Organization of the United Nations Rome 2008
10. New Vision daily news paper 11th July 2009
11. ⁱ Elisabeth Meze-Hausken, “Migration Caused by Climate Change: How Vulnerable Are People in Dryland Areas?” *Mitigation and Adaptation Strategies for Global Change* 5, no. 4 (2004): 379-406.A

APPENDIX: DATA SHEETS ON DEMOGRAPHIC, SOCIAL AND DEVELOPMENT INDICATORS OF UGANDA

A 1: UGANDA: KEY DEMOGRAPHIC, SOCIAL AND DEVELOPMENT INDICATORS 2008

SUMMARY OF INDICATORS

1.	Total Population (million) (projection 2009)	30.6
2.	Total Male Population (million)	14.9
3.	Total Female Population (million)	15.7
4.	Total Urban Population (million)	4.5
5.	Population Growth Rate (%)	3.2
6.	Urban Population Growth Rate (%)	5.1
7.	Maternal Mortality Ratio per 100,000 live births	435
8.	Infant Mortality Rate per 1,000 live births	76
9.	Under five Mortality Rate per 1,000 live births	137
10.	Total Fertility Rate	6.7
11.	Contraceptive Prevalence Rate (%)	24
12.	Supervised Deliveries (%)	42
13.	Full Immunization (%)	46
14.	Unmet Need for Family Planning (%)	41
15.	Stunted Children (%)	38
16.	HIV Prevalence Rate (%)	6.4
17.	Literacy Rate (%)	69
18.	Life Expectancy (years)	50.4
19.	Population in Poverty (%)	31
20.	Human Development Index	0.581
21.	GDP per capita in 2007 (US \$)	370
22.	Real GDP Growth Rate 2007/08 (%)	8.9
23.	Private investment Growth in 2007/08 (%)	15
24.	Public investment Growth in 2007/08 (%)	23

Source: Uganda Bureau of Statistics, Background to the Budget2008/09 and Human Development Report 2008

A1: TRENDS OF SELECTED DEMOGRAPHIC, SOCIAL AND DEVELOPMENT INDICATORS

Key Indicators	Year	
	2002	2008
Health		
Infant mortality rate (IMR) per 1,000 live births	88	76
Under five mortality rate per 1000	152	137
Maternal mortality ratio per 100,000 live birth	505	435
HIV Prevalence rate	6.4	6.4
Immunization rates for DPT3	72	85
Percentage of births delivered by a skilled provider	39	42
Immunization rates against measles	83	85
Total Fertility rate (TFR)	6.9	6.7
Children Age 6-59 months with Vitamin A deficiency	27.9	20.4
Social		
Literacy rate (Aged 10 Years and above)	70	69
Access to toilet facilities (% of Households)	83.8	88
Access to safe drinking water (% of Households)	60.9	68
Pupil teacher ratio (Primary School)	53	57
Pupil classroom ratio (Primary School)	87	72
Primary school Pupils with adequate sitting space		64
Orphanhood rates (Aged less than 18 years)	13.2	14.6
National Public Expenditure on Education as percent of GDP		4.0
Economic		
GINI Coefficient (Inequality measure in household consumption)	0.428	0.408
Urban Unemployment rate	12.2	6.9
Mean per capita consumption expenditure (1997/98=100)	26,663	29,280
GDP per Capita (US \$)	280	370
Human Development		
Human development index	0.488	0.581
Literacy rate	65.3	
Life expectancy	50.4	-
Poverty Development		
Percentage of population below the poverty line	38.8	31.1
Human poverty index	36.0	25.2
Gender Empowerment		
Gender Empowerment measure	0.549	0.583
Female Adult literacy rate	59	58
Burden of Diseases		
Children age 6-59 months that are anaemic	65	73
Prevalence of fever in Children under five years	43.9	40.9
Prevalence of Diarrhoea in Children under five years	19.6	25.8
Children under five with symptoms of ARI	22.5	14.5

A2: TRACKING PROGRESS AGAINST ICPD -POA USING SELECTED INDICATORS (ICPD+15 YEARS)

