



THE REPUBLIC OF UGANDA

**MINISTRY OF AGRICULTURE, ANIMAL INDUSTRY
AND FISHERIES**

National Adaptation Plan for the Agricultural Sector

November 2018

Abbreviations and Acronyms

ATAAS	Agricultural Technology and Agribusiness Advisory Services
ACCU	Agriculture Climate Change Coordination Unit
AEZs	Agro-Ecological Zones
AMCEN	African Ministerial Conference on the Environment
AR5	Fifth Assessment Report
ASSP	Agricultural Sector Strategic Plan
CAADP	Comprehensive Africa Agriculture Development Programme
CBA	Cost Benefit Analysis
CBOs	Community Based Organisations
CCA	Climate Change Adaptation
CCD	Climate Change Department
CDKN	Climate and Development Knowledge Network
CDM	Clean Development Mechanism
CDO	Cotton Development Organisation
CMB	Coffee Marketing Board
COCTU	Control of Trypanosomiasis in Uganda
CSA	Climate Smart Agriculture
CSOs	Civil Society Organisations
DDA	Dairy Development Authority
DDPs	District Development Plans
DFR	Directorate of Fisheries Resources
DLG	District Local Government
DRM	Disaster Risk Management
DSIP	Development Strategy and Investment Plan
FAO	Food and Agriculture Organization of the United Nations
GCCA	Global Climate Change Alliance
GCF	Green Climate Fund
GCMs	Global Climate Models
GDP	Growth Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gases
GOU	Government of Uganda
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
LDCs	Least Developed Countries
LEG	Least Developed Countries Expert Group
LMB	Lint Marketing Board
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MAFAP	Monitoring African Food and Agricultural Policies

MDGs	Millennium Development Goals
MoFPED	Ministry of Finance Planning and Economic Development
MTEF	Medium Term Expenditure Framework
MWE	Ministry of Water and Environment
NAADS	National Agricultural Advisory Services
NAGRC&DB	National Genetic Resource Centre and Databank
NAP	National Adaptation Plan
NAPA	National Adaptation Programmes of Action
NAP-Ag	National Adaptation Plan for the Agriculture Sector
NARO	National Agricultural Research Organisation
NCCP	National Climate Change Policy
NDA	National Designated Authority
NDP	National Development Plan
NIE	National Implementing Entity
NPA	National Planning Authority
NPL	Non-Performing Loan
UBOS	Uganda Bureau of Statistics
UCDA	Uganda Coffee Development Authority
UNDP	United Nations Development Programme
PMA	Plan for Modernization of agriculture
PMB	Produce Marketing Board
PFA	Prosperity for All
PPP	Purchasing Power Parity
RCPs	Representative Concentration Pathways
UDHS	Uganda Demographic and Health Survey
UNFCCC	United Nations Framework Convention for Climate Change

Foreword

The Agriculture Sector in Uganda is experiencing climate change effects manifested through, frequent, intense and prolonged dry spells, droughts, floods, increase in temperature and higher incidence of pests and diseases. This has resulted into shifts in farming seasons, which has led to loss and damages, and ultimately contributed to the low agriculture performance. These effects are predicted to increase in magnitude and intensity, thus, further constraining agricultural production and people's livelihoods. Therefore, sustainable agricultural production in the future will highly depend on a climate resilient agriculture sector, with an effective planning and integrated implementation approach.

The agriculture sector is a priority sector for the achievement of Uganda's development targets as highlighted in the National Vision 2040 and the global commitments in Agenda 2030 Sustainable Development Goals and the National Determined Contributions (NDCs) to the Paris Agreement. This National Adaptation Plan for the Agriculture Sector (NAP-Ag) contributes to the second National Development Plan (NDP II) priority of strengthening ecologically sound agricultural research and climate change resilient technologies and practices. Additionally, the plan contributes to different government policies and planning frameworks, such as the National Climate Change Policy (2013) and the Agriculture Sector Strategic Plan (ASSP).

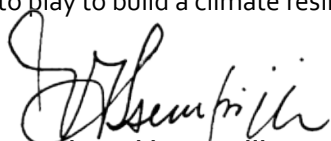
Overtime, the Government of Uganda has been addressing climate variabilities, especially drought and floods, in dispersed actions. The interventions have been mainly geared towards disaster risk reduction, humanitarian action, preparedness and response actions; with less focus on mid-term and long-term adaptation. Most agricultural landscapes and communities are characterised by low adaptive capacity, partly due to poor socio-economic circumstances, harsh biophysical environments, inadequate technology and poor infrastructure. Amidst these challenges, implementation of Climate Smart Agriculture (CSA) practices have been supported for continued production. However, its low scale of adoption has not enhanced sustainable management of natural resources and building of climate resilience. The NAP-Ag consolidates different climate actions, including CSA, into a systematic and integrated suite of adaptation responses.

The overall goal of the NAP-Ag is to increase resilience of the Agricultural Sector to the impacts of climate change, through coordinated interventions that enhance sustainable agriculture, food and nutritional security, livelihood improvement and sustainable development. The adaptation actions presented in this NAP-Ag target to boost production and productivity for all agriculture sub-sectors - crop, livestock, fisheries, forestry, land and natural resources. Ultimately, the plan is to ensure a resilient agriculture sector across all the sub-sectors through gender responsive actions guided by knowledge, evidence and information on climate change.

To foster implementation of the Plan, it is critical for the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) to foster an institutional arrangement that nurtures partnerships and better knowledge management. Cognizant of the existing institutional structures, the cross-cutting and emerging nature of climate change necessitates effective planning, coordination and management.

Implementation further calls for a multi-sectoral and multi-stakeholder involvement, building on existing policies, planning and budgeting processes. Reporting, monitoring and evaluation is therefore an essential part for implementation of this plan. It ensures that prospective benefits aimed at building adaptive capacities and enhancing resilience in the agricultural sector are achieved and reported.

The Government of Uganda looks forward to the full implementation of this plan, a process in which we all have a role to play to build a climate resilient agriculture sector.



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1 Introduction

1.1 Context

The two defining challenges of the 21st century are overcoming poverty and addressing climate change issues; and failing on one means failing on the other¹. Climate change affects all aspects of the development agenda; including agriculture and food security, poverty eradication, health care, economic growth and disaster risk reduction. The poor and most vulnerable people in developing countries are the most affected. Significant efforts are therefore needed to promote development that can mitigate and adapt to the impacts of climate change.

Across Uganda, climate is already changing with erratic weather patterns being observed, and by 2050 climatic trends are likely to intensify; complicating agricultural decisions, about where, what and when to plant. Average temperatures are likely to rise by 1-3°C by 2050. Rainfall patterns are expected to be more erratic impacting the social and economic growth and development of Uganda. Agricultural production, ecosystems and the livelihoods of rural agrarian communities will be particularly affected. Therefore, the future of Uganda's agriculture will need to adapt to a changing climate. Adaptation in the agricultural sector is critical to enhance food security, improve livelihoods and also contribute to the development of other sectors.

This plan presents a framework with climate change adaptation actions for the agriculture sector. The National Adaptation Plan for the Agriculture sector (NAP-Ag) is part of the overall Uganda national adaptation planning process. The National Adaptation Plan (NAP) process is a system that builds on a country's existing adaptation undertakings, to integrate climate change into national decision-making schedules and other planning opportunities. The NAP process was established in 2010 within the Cancún Adaptation Framework by the United Nations Framework Convention on Climate Change (UNFCCC). Parties to the UNFCCC adopted the NAPs process in 2011 in Durban, South Africa and the UNFCCC Least Developed Countries Expert Group (LEG) developed NAP guidance in 2012 (UNFCCC, 2014). NAPs are intended as a means for countries to reduce their vulnerability to the impacts of climate change, by building adaptive capacity and resilience, while facilitating the integration of climate change adaptation into development planning processes and strategies across all sectors and scales. For Uganda, therefore, preparing NAPs is in compliance with the requirements of UNFCCC. The NAPs process enables countries to formulate and implement NAPs as a means of identifying medium and long-term adaptation needs and developing and implementing strategies and programmes to address those needs.

Preparation of the agriculture sector NAP is aimed at supporting the in-country process on integrating agricultural sector priorities and concerns into the overall Uganda NAPs. It contributes to implementation and achievement of government development commitments including its National Development Plan, Vision 2040 targets, Sustainable Development Goals (SDGs) and Nationally Determined Contributions to the Paris Agreement (NDCs). The agricultural sub-sectors considered include crops, livestock, fisheries and the related sub-sectors taken into account are water, forestry and environment.

¹ Stern Nicholas: Managing climate change and overcoming poverty: facing the realities and building a global agreement. Available at: <http://www.ccepc.ac.uk/Publications/Policy/docs>

1.2 National Adaptation Planning for agriculture: The call for actions

Climate change threatens one of the most important sectors in many developing countries: agriculture. FAO (2015) estimates that the agriculture sector absorbs 25% of the total climate change related damage and losses². About 75% of the world's poor and food insecure people rely on agriculture and natural resources for their living.³ In many developing countries, agriculture accounts for a significant portion of the Gross Domestic Product (GDP) and employs a large part of the population. Agriculture is also central to food security, makes a major contribution to livelihoods and employment, and is a driver of economic growth.

Based on the projection on population growth and food consumption pattern in developing countries, there is likely to be a deficit in the food production by the year 2050. According to FAO, by 2050 the world's population will have increased by one-third, in a period of only 35 years⁴. The increasing population will increase the demand for food and to meet the increasing demand for food and ensure food security, agricultural production will need to increase by 60% by 2050, which calls for necessitates agricultural transformation. However, the adverse impacts of climate change make the task of agricultural transformation to increase food production more difficult under a business-as-usual scenario, requiring increased adaptation.

Agriculture is a crucial sector for Uganda; accounting for approximately 21.9 percent of Uganda's GDP, 85 percent of its export earnings, 68 percent of total employment and all food requirements⁵. More than 80% of Uganda rural population, most of them small holder farmers, rely on subsistence agricultural production. The contribution to the agricultural GDP by different sub-sectors include crops (67%), livestock (16%); fisheries (12%) and forestry (4%). In addition, agriculture also contributes 100% of all material resources for agro-based industries and food crop production. Given the pivotal role of rural women in Uganda's food production systems, agriculture also empowers women and guarantees that they feed their families, including children. Therefore, stable agricultural systems foster a cohesive rural society and contribute to balanced urban-rural dynamic; stemming migration and ensuring political and national stability. To that end investing in agriculture and rural development can yield significant dividends for sustainable development.

However, climate change threatens Uganda's agricultural sector. A heavy dependence on rain-fed agriculture and natural resources means that production is particularly vulnerable to climate variability and change, more especially the occurrence of droughts and floods. UBOS (2007) observes that 96% of the farming parcels depend on rain as their main source of water, 3% parcels use swamps/wetlands as their main water source and only 1% use irrigation as the main source of water.⁶ The Ugandan Agricultural Census reported that about 7% of the total of 3.95 million agricultural households was prone to flooding, mostly in the Eastern region⁷. It is striking that 8 out of the 10 most severe floods and droughts in terms of numbers affected since 1900 have occurred within the last 20 years.⁸ This supports claims that extreme weather events have been increasing in Uganda over the recent years. The effects of floods are devastating for the food security of local populations since it takes an estimated two years to recover from each such drought.⁹ The northern

² FAO (2015). The impact of disasters on agriculture and food security. Available at: www.fao.org

³ <http://www.fao.org/docrep/003/y6265e/y6265e03.htm>

⁴ FAO (2015). The impact of disasters on agriculture and food security. Available at: www.fao.org

⁵ UBOS, 2014. Statistical Abstracts 2014.

⁶ UBOS, 2007. Uganda National Household Survey 2005/2006.

⁷ UBOS, 2010. *Uganda Census of Agriculture 2008/2009*. Uganda Bureau of Statistics and Ministry of Agriculture, Animal Industry and Fisheries, Kampala: Republic of Uganda.

⁸ CRED, 2014. Centre for Research on the Epidemiology of Disasters, EM-DAT: The International Disasters Database – Uganda. Retrieved October 2014 from <http://www.emdat.be>

⁹ USAID, 2011. *Climate Change and Conflict in Uganda: The Cattle Corridor and Karamoja*, African and Latin American Resilience to Climate Change Project (ARCC), Discussion paper for Office of Conflict Management and Mitigation.

region is particularly prone to floods and droughts that affect food security, more especially in the Karamoja sub-region. On average, 30% percent of food needs in the region are covered by aid.¹⁰ The report on the impact of the 2010 – 2011 rainfall deficits by the Department of Disaster Management/Office of the Prime Minister¹¹ gives detailed estimates for damage and production losses. The estimate of loss and damage was US\$ 1.2 billion or about 7.5 percent of Uganda's GDP in that year.

Uganda's vulnerability to climate change is exacerbated by problems of food insecurity, poverty and weak social institutions and a rapidly growing population. The country's population is growing at a rate of 3.02% per year (one of the highest in the world) which translates into increased demand for food; in turn necessitating increased agricultural production and a climate resilient agriculture. However, coping with the impacts of climate change in Uganda is still difficult, given that agriculture is largely rain-fed and dominated by small holder farmers who are poor, lack education and have limited access to resources. Smallholder farmers, pastoralists and small scale fishermen are especially hard hit by the impacts of climate change and they end up degrading the natural resource base they survive on. In addition, smallholder farmers lack knowledge about appropriate adaptation options for their production systems. They also have limited assets and risk-taking capacity to access and use technologies and financial services to adapt to a changing climate.

As long as agriculture continues to be rain-fed, its vulnerability to climate shocks will continue to influence its performance in the short, medium and long-term. If the current farming practices in Uganda remain unchanged in the face of a changing climate, agricultural yields will fall drastically and the result will be increased food insecurity and high poverty levels.

NAPs are intended to be a means for countries to reduce their vulnerability to the impacts of climate change and for building adaptive capacity and resilience. They provide an opportunity for addressing constraints to agricultural transformation; which can in turn address food security, livelihood, and development pressures related to adapting to climate change. By encouraging countries to start integrating climate adaptation into their development agendas, including in agricultural policy and planning, the NAPs process will assist to reduce countries' vulnerabilities to climate change.

1.3 Methodologies of developing the Agriculture Sector NAP

Preparation of the Uganda NAP stems from the concerted efforts being made by the Government of Uganda to mainstream climate change considerations into national development planning in sectoral policies, strategies, programmes, plans and budgets. In preparing this agriculture sector NAP, a consultative approach was used by FAO Ministry of Agriculture, Animal Industry and Fisheries (MAAIF); the Climate Change Department (CCD) of the Ministry of Water and Environment (MWE). In particular, consultative meetings were held with the multi-stakeholder/multi-disciplinary MAAIF National Climate Change Task Force and the Climate Change Department.

Formulation of the NAP for Uganda followed steps proposed in the UNFCCC LEG guidelines. The process was participatory and inclusive, involving consultation with key stakeholders such as government officials at national and local levels from different sectors such as agricultural, environment, water, gender and youth; the private sector; development partners and civil society representatives.

¹⁰ USAID, 2011. *Climate Change and Conflict in Uganda: The Cattle Corridor and Karamoja*, African and Latin American Resilience to Climate Change Project (ARCC), Discussion paper for Office of Conflict Management and Mitigation.

¹¹ OPM, 2012. *The 2010–2011 Integrated Rainfall Variability Impacts, Needs Assessment and Drought Risk Management Strategy*. Department of Disaster Management.

With guidance from the MAAIF and CCD; the Food and Agricultural Organisation (FAO) facilitated the process of stakeholder consultation. The MAAIF climate change task force used its in-house capacity to provide a better understanding about the NAP process as per the UNFCCC/ LEG process. Based on the consultations, the agriculture sectors roadmap for NAPs was developed and aligned to the overall UNFCCC LEG NAP guidelines.

A multi-stakeholder national consultation workshop was held on 25th June 2015; to guide the NAPs process for the agriculture sector and to define priorities to be considered during the NAPs process. The workshop was also used to approve and launch a road map for Uganda agricultural sector NAPs process. The workshop involved participants from the agriculture sub-sectors and other sectors and institutions. During the workshop, a road map for the NAPs process for the agriculture sector in Uganda was launched by the Minister of State for Agriculture. Stakeholders identified and analysed priority areas and issues that should be considered in the NAP. Consideration was given to the fact that climate change issues are crosscutting and therefore their impacts affect many sectors.

Consultations were also made at local government level, to identify agricultural sector priorities for considering in the NAPs process. The local government consultations were also used to gather experiences on how NAPA priority areas were addressed and documentation of good practices. A consultative workshop in Luwero from 24th to 27th August 2015. The workshop provided an opportunity for working with local governments to identify agriculture sectors' priorities and concerns for mainstreaming into the National Adaptation Plans (NAPs). The workshop involved participants from 6 districts of the central cattle corridor (Sembabule, Mubende, Kiboga, Luwero, Nakasongola and Nakaseke). Impacts of climate change in the cattle corridor and individual districts were identified; the existing and priority interventions reviewed and potential partners proposed.

One NAPA pilot village in Nakasongola district was visited to share with the community challenges of climate change and the lessons learnt during the implementation of different adaptation technologies. The participants appreciated that there are lots of experiences from the NAPA pilot project that can be used in the process of NAPs. During the workshop, participants came to a consensus that climate change adaptation interventions can be integrated in District Development Plans, during policy making, planning, and resource allocation and at the monitoring stage. It was agreed that there is need to integrate activities in existing district outputs and where special projects are required then project proposals can be prepared and sent to potential donors and International Environmental Funding Agencies.

Development of a NAP for the agricultural sector in Uganda coincided with the process of preparation of a road map for the overall National NAP. The Agricultural Sector NAP process therefore generated lessons that may be used to develop the overall national NAP and other sector NAPs.

1.4 Structure of the report

This plan is presented in eight chapters;

Chapter 1 provides a background and context of preparing this NAP. It also highlights justification for the need for an agricultural sector NAP.

Chapter 2 describes the national circumstances and discusses Uganda's development context highlighting the agriculture and development nexus, and also presents the climate change profiles for Uganda.

Chapter 3 presents vulnerability analyses of Uganda's economy in relationship to the impacts of climate change; and in particular agriculture related sub-sectors. An overview of the key climatic

risks and hazards in Uganda; namely droughts and floods are presented with a view to informing key adaptation actions and options for the agriculture sector.

Chapter 4 provide a review of the policy and institutional framework that support the agriculture sector NAPs in Uganda.

Chapter 5 presents the proposed climate change adaptation actions in the different sub-sectors.

Chapter 6 provides proposed coordination and implementation arrangements for the NAP.

Chapter 7 presents a monitoring and evaluation framework for implementation of the NAP.

Chapter 8 highlights the financing and resource mobilisation strategies for implementation of the NAP.

2 National Circumstances

2.1 Introduction

Uganda, like other African countries, is currently bearing the brunt of climate risks and hazards and thus there is need for a coordinated approach to address the related vulnerabilities. Adaptation and building climate resilience remain Uganda's, and indeed Africa's priority response to climate change. This has been affirmed by the African Ministerial Conference on the Environment (AMCEN) that has reiterated the call 'for a global goal for adaptation, which takes into account adaptation needs and associated costs. The AMCEN call also advocates for mechanisms for facilitating adaptation actions; including support for developing countries, while recognizing the need to increase adaptation investments in developing nations. This chapter provides an overview of the national circumstances for Uganda, in the context of national development. The chapter discusses the nation development context, agriculture and development and climate change trends and projections.

2.2 National Development Context

This NAP is aligned to Uganda's development context and planning framework; guided by the Uganda Vision 2040, National Development Plan and the agricultural sector plan - vision and objectives.

Uganda is a Low Income Country; which in spite of its recent growth spurt continues to be one of the poorest nations in the world, with about 20 percent of the population still living in poverty, below USD 1.25 a day¹². Nonetheless, after a varied history, punctuated with periods of conflict in the 1970s and 1980s, Uganda has enjoyed significant economic growth over the last two decades. GDP growth has exceeded 6% for most years since 1997. This has helped reduce poverty, which fell from 31.1% in 2005/2006 to 19.7% in 2014/2015. Actually, Uganda has been able to achieve the first Millennium Development Goal (MDG) of halving people living in poverty.

The year 2015 marked a turning point for the development agenda of Uganda and globally, as it was the deadline for the Millennium Development Goals (MDGs) and the starting date for the Sustainable Development Goals (SDGs)¹³. Uganda's development agenda is clearly articulated by the Uganda Vision 2040¹⁴, the country's long-term term development blue print. Uganda's overarching goal as provided in the Uganda Vision 2040 is to become **a Modern and Prosperous Country, by the middle of the 21st Century**; with the aim *to transform Uganda from a predominantly peasant and low income economy to a competitive upper middle income economy; through promoting growth, employment and socio-economic transformation*. Among the aspirations of the Vision is achievement of a green economy and clean environment, in the context of sustainable development and poverty eradication.

The Vision 2040 foresees a consistent growth rate of around 8.2% in per capita Purchasing Power Parity (PPP) GDP, reaching US\$4,300 in 2030 and US\$9,500 in 2040 (see Figure 1).¹⁵ It is an ambitious programme, that foresees poverty in terms of the Non-Performing Loan (NPL) falling from 25% in 2009 to 5% in 2040 and the economy becoming much less agriculture based, with the share of the agricultural sector falling from 22% in 2010 to 10% in 2040.

¹² Republic of Uganda, 2014. Poverty Status Report 2014.

¹³ Ministry of Finance Planning and Economic Development, 2015. Uganda Sustainable Development Report 2015. Strategies for Sustainable Landuse and Management, Final Report.

¹⁴ Republic of Uganda, 2010. Uganda Vision 2040. National Planning Authority

¹⁵ These figures are in PPP\$ at 2011 prices.

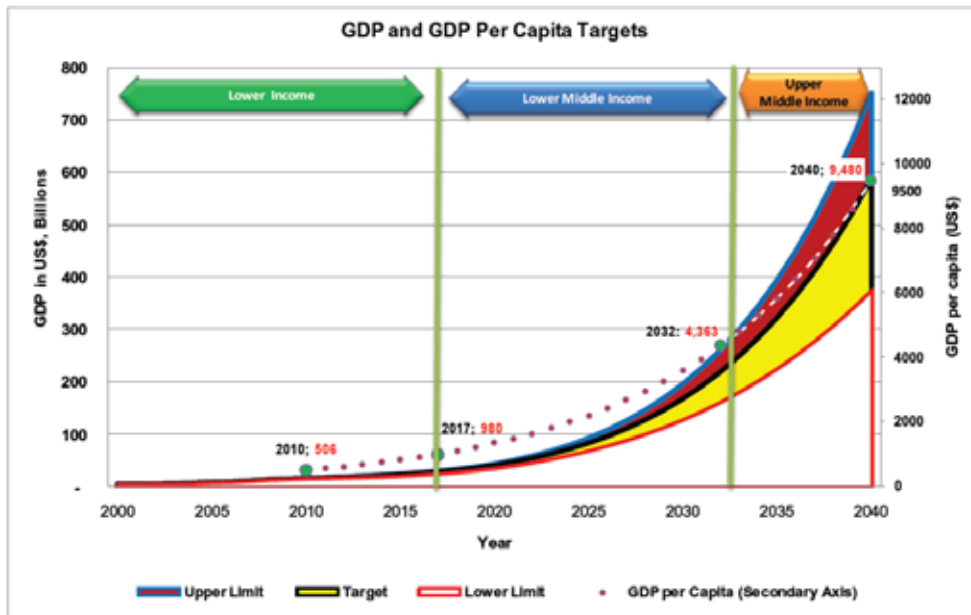


Figure 1: The Growth Path to the Upper Middle Income Status by 2040 (Source: Uganda Vision 2040, from NPA estimates)

At the same time, it is projected that industry will grow from 26% to 31% and services from 51% to 58%. These changes and the associated growth in GDP will be achieved through an increase in investment, from 24% of GDP at present to 30%, and major programmes of investment in transport, energy, water and urban infrastructure. The urban population will increase from 18% currently to 60% by the end of the period. Energy sources will change such that dependence on fuel wood and traditional biomass will be replaced by electricity and LPG gas, with much of the former coming from new hydro and nuclear plants, as well as some domestic gas.

There is a relationship between development and vulnerability to climate change. Results of the study on economic impact of climate change examine the relationship between the level of development and adaptation to climate change¹⁶. A higher rate of growth in real incomes, generally results in a greater reduction of poverty. The less poverty there is in a country, the fewer, other things being equal, is the number of people vulnerable to climate related events such as floods, droughts and landslides. Those affected by such events have the capacity and resources to construct more durable structures and take measures to protect property and human lives. Furthermore, the government would have access to a larger tax base, from which they can finance expenditures that fall under the category of public goods and that would not be undertaken by private citizens. But at the same time it is also true that higher growth in an economy will lead to more assets that need protection and therefore a higher adaptation budget.

Demographically, Uganda has one of the world's highest population growth rates, at 3.03% per annum (2002-2014). The country's population is currently estimated at 35 million people; having increased almost fourfold, from 9.5 million in 1969¹⁷. The population is projected to hit the 100 million mark by 2050 (UBOS 2014; UN Population Division, 2014). The life expectancy is estimated to be 50.4 years; the infant mortality rate is approximately 54 deaths per 1,000 live births and 360 women die per 100,000 live births (World Bank data). Moreover, the population is still predominantly rural, with 82% of households living in rural areas¹⁸. Driven by growing population

¹⁶ Ministry of Water and Environment, 2015. Economic assessment of the impacts of climate change in Uganda.

¹⁷ UBOS, 2015. Uganda National Population and Housing Census 2014, Provisional Results.

¹⁸ UBOS, 2015. Uganda National Population and Housing Census 2014, Provisional Results.

pressures, unsustainable land management practices characterise the agricultural sector and unplanned urban sprawl is on the rise. Consequently, Uganda is annually losing over 2% of its forest cover and wetlands. In addition, the rangelands, mainly in Uganda's cattle corridor, are being degraded at an alarming rate. However, Vision 2040 emphasises enhancing the ability of the country to exploit and use its national resources gainfully and sustainably. Climate change and sustainable utilization of the natural resources are recognised as the major constraints to achievement of these Vision 2040 goals.

The launch of the first National Development Plan (NDP I) in 2010 – the first of six five-year plans under the Vision 2040 framework – signalled a shift in the country's development priorities towards the economy's long-term productive capacity and job creation potential. The Second National Development Plan (NDP II) has further narrowed the Government's focus to physical infrastructure investments, in order to address bottlenecks that are constraining the rate of growth and structural transformation. The goal of the NDP II¹⁹ is "to attain middle income status by 2020 through strengthening the country's competitiveness for sustainable wealth creation, employment and inclusive growth". One of the development objectives of NDP II is to *"increase sustainable production, productivity and value addition in key growth opportunities"*.

Agriculture is one of the four priority development areas in NDP II. The sector is considered central to the country's economic growth, poverty reduction strategy, and industrialisation (agro-processing and light manufacturing). For the NDP II period, focus is placed on investing in the following agricultural enterprises along the value chain: cotton, coffee, tea, maize, rice, cassava, beans, fish, beef, milk, citrus and bananas. These enterprises were selected for a number of reasons, including high potential for food security (maize, beans, cassava, bananas); high contribution to export earnings (e.g. maize - USD 21 million in 2005; coffee -USD 388 million in FY 2007/08; fish - USD 143 million at its peak; tea - USD 56 million in 2007). Focus is also put on increased female labour force participation in cash crop production; high multiplier effects in other sectors of the economy; great potential to increase production and productivity through better management; high returns on investment; favourable agro-ecological conditions; high potential for regional and international markets; percentage contribution to GDP and high potential for employment generation, while being mindful of the nutritional needs of the country. The agricultural value chain has been earmarked for improvement at all stages: production, transportation, storage, processing, as well as, marketing and distribution.

However, climate change remains a constraint to the achievement of long-term sustainable development envisioned in the Vision 2040 and National Development Plans. This is because climate is the country's most valuable natural resource and a major determinant of other natural resources like soils, water, forests and wildlife; as well as the dependency of human activities on natural resources. Uganda's economy is still fragile and highly sensitive to natural events such as floods and droughts, which have been on the rise over the years. Therefore, climate change potentially poses one of the greatest challenges for Uganda to realize its Vision 2040. Failure to manage climate change will irretrievably damage Uganda's prospects for development and achievement of the Vision 2040. Poverty is significantly affected by extreme weather events in Uganda, which can cause people to fall back into poverty. For example, droughts have a devastating effect for the food security of local populations since it takes an estimated two years to recover from each severe drought.²⁰

Evidence from studies, such as the Climate and Development Knowledge Network (CDKN) supported study on economic assessment of the impacts of climate change in Uganda²¹ indicate

¹⁹ Republic of Uganda, 2015. Second National Development Plan 205/2016 - 2019/2020

²⁰ USAID (2011). U.S. International food assistance report. Written and submitted to the U.S. Congress by the Office of Food for Peace, in conjunction with the U.S. Department of Agriculture and USAID/Farmer to Farmer program.

²¹ Ministry of Water and Environment, 2015. Economic assessment of the impacts of climate change in Uganda.

that Uganda's development prospects will only be achieved if the impacts of climate change in Uganda are mitigated because the impacts of climate change are expected to be felt across all the sectors, to varying degrees. The study foresees that if no action is taken to adapt to climate change, Uganda could lose between US\$3.1 billion and 5.9 billion per year by 2025, which is more than 20 times the cost of adaptation (USD 406 m over the next five years, 2015–2020). To address the vulnerability of Uganda's economy and population, climate change concerns have been integrated in NDP II.

For Uganda therefore, addressing climate change through adaptation planning is essential to achieve sustainable development, and adaptation and development goals need to complement each other. This view is clearly articulated in the Vision 2040 and the National Climate Change Policy (NCCP) and both documents recommended mainstreaming climate change into development planning. The NAP process, and agriculture sector NAP in particular, builds on the foundation laid by the NCCP and NDP II, where a detailed analysis of adaptation in various economic processes was conducted and a long list of potential actions suggested.

2.3 Agriculture and development

Uganda's agricultural sector has contrasts. Despite having a rich base of land and water resources and a favourable climate in most areas, the sector is hampered by low productivity and persistent poverty. Crop diversity is high, but the majority of households engaged in the agricultural sector grow a limited number of food crops for subsistence, and despite the resource endowments, these households are vulnerable to food security and economic shocks. Notwithstanding growth in Uganda's economy and in the agriculture sector, little has translated to the poor, who still depend on rudimentary technologies and uncertain rainfall for their livelihood and food security. These factors influence the impact climate variability and climate change will have on the agriculture sector, as well as the capacity to adapt to a changing climate.

Uganda is divided in 10 main agro-ecological zones (AEZs).²² Figure 2 shows an indication of the key agricultural products in each zone. The zones are characterized by different farming systems; determined by soil types, climate, and socio-economic and cultural factors. The AEZs experience varying levels of vulnerability to climate-related hazards; which include drought, floods, storms, and pests and diseases.

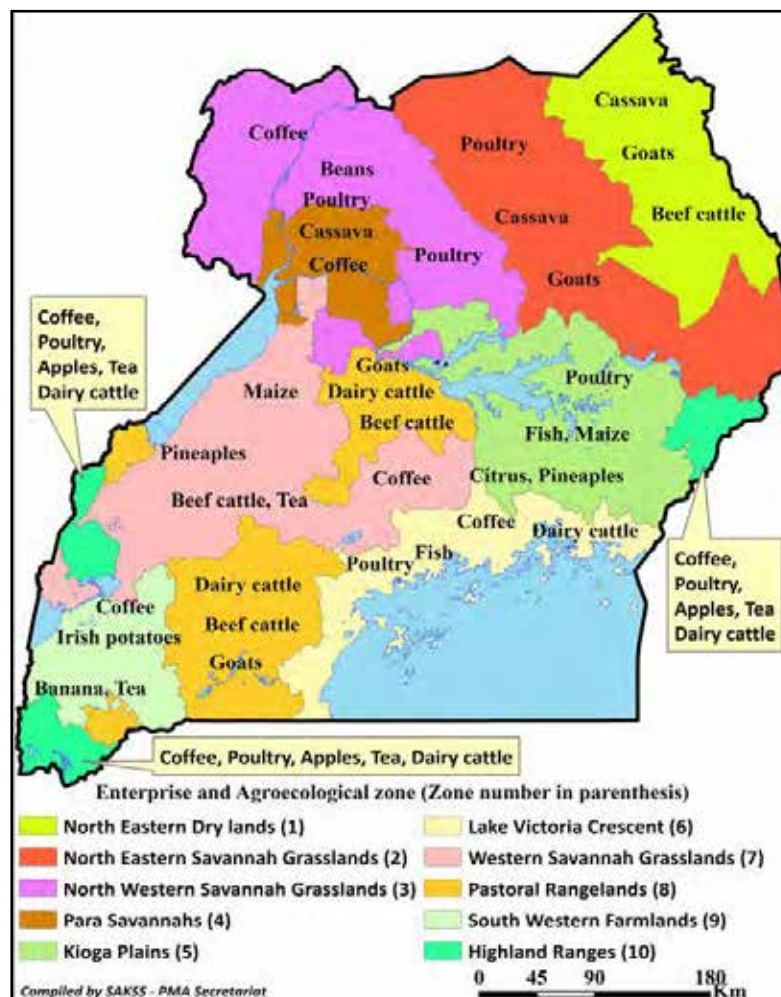


Figure 2: Agro-ecological Zones in Uganda

2.3.1 Agriculture and the economy

Agriculture has been and continues to be the most important sector in Uganda's economy. The sector is key to GDP (see Table 1) and provides employment, food security, livelihoods improvement and overall economic development. In its Development Strategy and Investment Plan (DSIP), 2010/11-2014/15; the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) emphasizes the renewed recognition of the fundamental importance of agriculture in the Uganda's Economy and the central role it plays in development, economic growth and poverty reduction.

²² MAAIF (2010) *Agriculture for Food and Income Security, Agriculture Sector Development Strategy and Investment Plan 2010/11-2014/15*, Ministry of Agriculture, Animal Industry & Fisheries (MAAIF).

The NDP II expects the agricultural sector to contribute to wealth creation and employment along the agricultural development value chain. Within the context of the NDP II, the sector's key focus areas include:

- Increasing production and productivity,
- Addressing challenges in the selected thematic technical areas including critical farm inputs mechanization and water for agricultural production, and
- Institutional strengthening for agricultural development

Uganda has committed itself to the Maputo Declaration on the Comprehensive Africa Agriculture Development Program (CAADP), which advocates for: (i) the principle of agriculture-led growth as a main strategy, (ii) the pursuit of a 6% average annual growth rate for the agricultural sector, and (iii) increasing the share of the national budget allocated to agricultural sector to reach the eventual target of 10%. Therefore, at least for the foreseeable future, agriculture will continue to be one of the most important sectors in Uganda's economy.

Table 1: Contribution of Agricultural Sector to GDP (2012).

	<i>GDP at current prices (Bill. UGS in Billions)</i>	<i>GDP at current prices (million \$)²³</i>	<i>Share of total GDP (%)</i>
<i>Total GDP at market prices</i>	53,202	19,685	100
<i>Agriculture, forestry and fishing:</i>	11,789	4,362	22.2
<i>Cash crops</i>	869	322	1.6
<i>Food crops</i>	6,571	2,431	12.4
<i>Livestock</i>	1,001	370	1.9
<i>Forestry</i>	1,886	698	3.5
<i>Fishing</i>	1,461	541	2.7

Source: Assembled from data in UBOS 2013²⁴.

2.3.3Crop production

The Uganda Agricultural Census²⁵ shows that 17 major food crops are grown in the country including: Cereals (Maize, Millet, Sorghum, Rice); Root crops (Cassava, Sweet potatoes, Irish potatoes); Pulses (Beans, Cow peas, Field peas, Pigeon peas); Oil crops (Groundnuts, Soya beans, Sim sim), Plantain Bananas (for Food, Beer, Sweet types). The total area planted in 2012 for all the crops was about 5,700,000 ha; with maize, potatoes, cassava, and bananas being among the crops with the highest production quantities. The main cash crops of Uganda are coffee, tea, cotton and tobacco. Of these cash crops, coffee forms a major source of foreign exchange for the country and dominates exports in terms of value (see Section 4). The agricultural sector contributed about 50 percent of the total export revenues in 2012. Livestock production accounts for about 8 percent of the total agricultural sector GDP, with widespread rearing of cattle, sheep, goats, pigs and poultry²⁶.

Over the NDPI period the agricultural sector registered sluggish growth; as is depicted in Table 2; with 1.0 percent in 2010/11, 0.68 percent in 2011/12, 1.13 percent in 2012/13 and 1.33 percent during FY2013/14.

²³ Calculated with exchange rate of 1 Shs = \$0.00037 at Dec 2012.

²⁴ UBOS (2013) *Statistical Abstract 2013*. Uganda Bureau of Statistics (UBOS), Kampala.

²⁵ UBOS (2010) *Uganda Census of Agriculture 2008/2009*. Uganda Bureau of Statistics and Ministry of Agriculture, Animal Industry and Fisheries, Kampala: Republic of Uganda.

²⁶ UBOS (2013) *Statistical Abstract 2013*. Uganda Bureau of Statistics (UBOS), Kampala.

Table 2: Real GDP growth for Agriculture Sector

	2010/11	2011/12	2012/13	2013/14
Agricultural Sector GDP	1.00	0.68	1.13	1.33
Cash crops	-1.25	6.93	3.05	2.92
Food crops	0.58	-1.44	0.17	1.68
Livestock	2.49	2.37	2.96	2.92
Forestry	2.32	2.79	1.74	1.94
Fishing	1.49	1.60	2.18	-4.51

Source: Background to the budget by MFPED, 2014/15

Crop productivity growth has been on a downward trend; averaging only around 1% per year over the last decade, as compared to around 6% per year in better-performing countries in the region²⁷. Moreover, the increase in agricultural production in Uganda is attributed to area expansion rather than increase in productivity. For instance, in 2012 total area planted of food crops increased by 2 percent to 5,729,000 ha. Historically, Uganda was relatively sparsely populated and land for agriculture was therefore abundant. As a result, traditional farming practices have been characterised by the extensive use and rapid depletion of land and the limited use of other inputs. This agricultural system is not sustainable in light of the rapid population growth. For example, the area of agricultural land has grown at around 1% a year over the last decade and if this trend continues, more than 90% of Uganda's land will be used for agriculture by 2040, which would essentially eradicate the country's forest cover and wetlands. To avoid such an environmental and ultimately economic catastrophe, Uganda's agricultural systems must shift from using land extensively to using land intensively. Without such a turnaround in agricultural performance, the economy will be able to support a large population, the non-agricultural workforce and foster socio-economic transformation as targeted by Vision 2040.

A heavy dependence on rain-fed agriculture, with only about 0.1 per cent of production from irrigation, means that agricultural production is particularly vulnerable to climate variability and change.²⁸ Across Uganda, loss and reduction in crop yields, loss in livestock production, and degradation of ecosystems and loss of biodiversity are common features in all areas associated with a changing climate. For example, a drought in 2008 caused losses of approximately 3% of the value of all food and cash crops that year.²⁹ Two years later, the country suffered economic losses of US\$470m in food crops, cash crops and livestock, as a result of the 2010/11 droughts.³⁰ This equates to about 16% of the total annual value of these crops in 2011. It is estimated that by 2050, the value of the coffee crop could fall by half, due to contraction of the area that can support its production (as a result of a changing climate); with may cost up to USD 1,235 million, and if no action is taken on

²⁷ Ministry of Finance, Planning and Economic Development, 2015. Uganda Sustainable Development Report 2015. Strategies for Sustainable Landuse and Management, Final Report.

²⁸ Republic of Uganda, 2007. *Climate Change - Uganda National Adaptation Programmes of Action*, Government of Uganda.

²⁹ NEMA (2008) *State of Environment Report for Uganda 2008*. Kampala: National Environment Management Authority (http://www.nemaug.org/reports/n_s_o_e_r_2008.pdf).

2. OPM (2012) *Office of the Prime Minister: The 2010–2011 Integrated Rainfall Variability Impacts, Needs Assessment and Drought Risk Management Strategy*. Kampala: Office of the Prime Minister (http://gfdrr.org/sites/gfdrr/files/UGANDA_PDNA_Report_2012.pdf).

³⁰ OPM (2012) *Office of the Prime Minister: The 2010–2011 Integrated Rainfall Variability Impacts, Needs Assessment and Drought Risk Management Strategy*. Kampala: Office of the Prime Minister (http://gfdrr.org/sites/gfdrr/files/UGANDA_PDNA_Report_2012.pdf).

climate adaptation, Uganda could lose up to USD 1.5 billion on food crops, due to the impacts of climate change impacts³¹.

The effects of climate change on crop production have a gender dimension. Men and women have different assets and resources at their disposal to build resilience. Women are more vulnerable since they are mainly involved in the production of food crops as compared to the men who are largely involved in income generating crops.

2.3.4 Livestock development

The livestock sub-sector's contribution to GDP in Uganda is currently estimated at 1.9%. In recent years, livestock population growth rates have been estimated to grow at 1.4, 2.5, 4.3 and 3.0 for cattle, sheep, goat and chicken, respectively. However, the productivity of the livestock is still low. The 2008 Uganda livestock census projected average weekly milk production per milked to be around 8.5 litres and egg production rates per week at 4 and 5 for exotic layers and indigenous chicken, respectively. The low productivity was mainly attributed to poor husbandry practices including, feeding and nutrition, poor breeding and animal health. The other factor leading to low productivity is the dominance of indigenous breeds estimated at 93.6% and 87.7% for cattle and chicken, respectively. The census report revealed that about 26.5% of the households that own livestock are female headed with households within dry pastoral zones like Karamoja sub-region accounting for the largest share (49%). Furthermore, the share of labour within households that engage in livestock was reported as 28% for boys, 25.4% for girls, 24.3% for adult females and only 22.3% for adult males. These factors are likely to be exacerbated by climate change if appropriate adaptation strategies are not sought.

2.3.5 Fisheries

Ugandan fisheries sub-sector has been mainly dependant on natural water bodies, with lakes accounting for 90% of the total fish catch and aquaculture that comprises of fishponds and fish cages, contributes 10% of the total fish catch. The fisheries sector is a direct source of livelihood for more than 1.5 million Ugandans, and majority of those employed in the sub-sector are women and youth who comprise 70 – 87 percent. Fisheries activities are mainly carried out in open water sources comprising of five major lakes (Victoria, Albert, Kyoga, Edward and George), which are the main sources of fish in the country. Uganda is endowed with proportionately large open water resource accounting for almost 20% of the total surface area (241,550 sq.km). Lake Victoria continues to be the most important water body in Uganda, both in size and contribution to the fish catch; followed by Lake Albert, and then Lake Kyoga. In addition to the 5 major lakes, Uganda also has over 160 minor lakes and various rivers, flood plains and swamps that partly contribute to fish production.³² However, over the years, there has been a decline in production levels of fish from Uganda's water bodies as shown in Figure 3. The fisheries subsector has the potential of generating 1,000,000MT of fish per annum, however the current production is only 460,000MT of capture fisheries and 100,000MT from aquaculture (Draft Fisheries policy 2017). This decline has a direct and indirect impact on the suitability of fisheries resources to supply environmental services; especially those

³¹ Ministry of Water and Environment, 2015. Economic assessment of the impacts of climate change in Uganda. Ministry of Water and Environment.

³² Atukunda G., Ahmed M., 2012. Analysis of incentives and disincentives for fish in Uganda. Technical notes series, MAFAP, FAO, Rome.

linked to the food chain. The main challenge for natural wild catch is over fishing and use of poor traditional methods of capture. The other threat is posed by proliferation of the invasive water weeds such as the water hyacinth, which affect fish breeding sites and recruitment. The predicted climate change (increased temperatures and reduced rainfall) is likely to reduce water levels in lakes and aquaculture production units, which will negatively affect fish production. Other climate change effects such as floods, landslides lead to silting of the lakes, destruction of aquaculture production units and transmission of fish diseases.

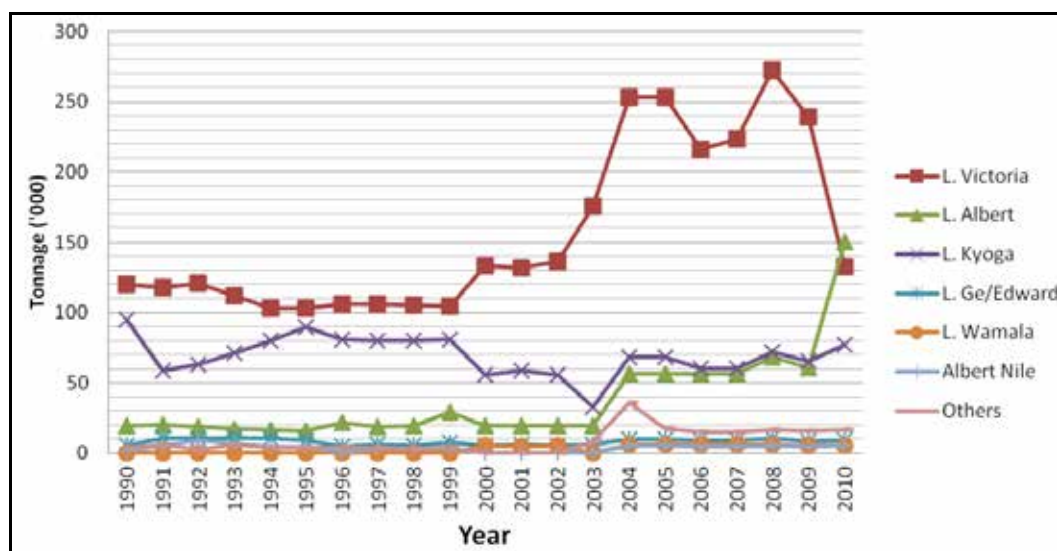


Figure 3: Estimated fish quantities landed at major water bodies in Uganda

2.3.6 Food security and nutritional trends

Uganda is generally food secure, with 89% of the country's population minimally food insecure (according to the Integrated Food Security Phase Classification - IPC - Phase 1). This population still has normal access to food from own production and the market, but still, 10% of the total population in the country is food stressed (IPC Phase 2). However, major inter- and intra-regional variations exist, due to localized food crop failures of varying magnitudes and vulnerability. Some regions and districts have had food surpluses on an annual basis, but on the other hand, some regions and districts have pockets of persistent food shortage annually, especially the Karamoja sub-region and some other parts of Northern Uganda. Areas with higher levels of vulnerability to food insecurity largely align with the cattle corridor and semi-arid zones.

As far as nutrition is concerned, the 2016 Uganda Demographic and Health Survey (UDHS)³³ indicates that 29% of children under 5 years in Uganda are stunted (9% are severely stunted), 11% are underweight (2% are severely underweight), and 4% are wasted (1% are severely wasted). In addition, 50% of women and 73% of children less than 5 years are anaemic. One out of every five children (20%) and one out of every 5 women (20%) are vitamin A deficient. Countries with wide spread iron deficiency, as it is the case in Uganda, are known to lose 2% of their GDP every year due to poor learning ability and low productivity due to iron deficiency.

Farmers in Uganda are already experiencing climate change effects manifested through more frequent, intense and prolonged droughts, floods, increase in temperature and higher incidence of pests and diseases which have all resulted into loss of track of the planting season. The predicted changes in climate will intensify droughts, floods, increase in temperature and higher incidence of

³³ UBOS, 2016. Uganda Demographic and Health Survey 2016. Key Indicators.

pests and diseases, which will further constrain agricultural production and result into food and nutritional security. Therefore, ensuring food and nutritional security in the future will highly depend on building a climate change resilient agriculture sector. The NDP II prioritises strengthening ecologically sound agricultural research and climate change resilient technologies and practices. Operationalization of this aspiration calls for development of an agriculture sector NAP.

2.4 Climate change profiles

2.4.1 Past Climate trends

2.4.1.1 Global climate change profiles

The Intergovernmental Panel on Climate Change (IPCC) released its Fifth Assessment Report (AR5) in 2013 to 2014. The report confirms that the earth's climate has been warming since the 1950s and that the rate of global warming has been unprecedented, compared to previous decades and millennia. Each of the last three decades has been warmer than all previous ones since 1850. The first decade of the twenty-first century (2001-2010) has been the warmest since 1850.³⁴ The report also confirms human responsibility in the climate change process, mainly through Greenhouse Gas (GHG) emissions.

The average temperature at the Earth's surface was also reported to have increased by about 1°C, over the period 1901-2012. Ocean warming represents the biggest change in the energy content of the earth. The oceans have absorbed 90% of the energy accumulated on earth between 1971 and 2010. The most significant warming occurs on the surface (from 0 to -75 meters): + 0.11°C per decade between 1971 and 2010 i.e. +0.44°C in less than 40 years.

Confidence in precipitation change averaged over global land areas since 1901 is low prior to 1951 and medium afterwards. Averaged over the mid-latitude land areas of the Northern Hemisphere, precipitation has increased since 1901 (medium confidence before and high confidence after 1951). For other latitudes, area-averaged long-term positive or negative trends have low confidence

Changes in many extreme weather and climate events have been observed since about 1950. It is very likely that the number of cold days and nights has decreased and the number of warm days and nights has increased on the global scale. It is likely that the frequency of heat waves has increased in large parts of Europe, Asia and Australia. There are likely more land regions where the number of heavy precipitation events has increased than where it has decreased. The frequency or intensity of heavy precipitation events has likely increased in North America and Europe.

There is evidence that warming over land across Africa has increased over the last 50–100 years. Surface temperatures have already increased by 0.5–2°C over the past one hundred years. Data from 1950 onwards suggests that climate change has altered the magnitude and frequency of some extreme weather events in Africa already. There is strong evidence that observed temperature increases exceed natural climate variability and have been influenced by greenhouse gas emissions due to human influence. Most areas of Africa lack sufficient observational data to draw conclusions about trends in annual rainfall over the past century. Where data are available, these indicate a very likely decrease in annual rainfall over the past century in parts of the western and eastern Sahel region in northern Africa and very likely increases over parts of eastern and southern Africa.

2.4.1.2 Observed climate trends for Uganda

The climate change trends observed worldwide have also been confirmed in Uganda; manifested through increased temperatures, observed rainfall and extreme weather events (Table 3):

³⁴ IPCC (2013). Climate Change 2013: The Physical Science Basis. Headline Statements from the Summary for Policymakers.

Increased temperature: In Uganda, observed averages in annual near-surface temperatures are around 21°C. The observed temperatures between 1900 and 2009 shows an increase in average annual temperature of between 0.8°C - 1.5°C, with typical rates of warming around 0.2°C per decade. The period 1960 - 2008 has been progressively warmer. It was also found that the nights are warming faster compared to the days.

Observed rainfall: Observed annual rainfall totals for Uganda vary from 500 mm to 2800 mm, with an average of 1180 mm. The observed rainfall for 1900–2009 rainfall indicates that for the period 2000–2009, rainfall has been on average about 8 percent lower than rainfall between 1920 and 1969. Although the June–September rainfall appears to have been declining for a longer period, the March–June decline has only occurred recently. Three long epochs of below-normal rainfall occurred between 1940 and 1960, around the 1970s and again around the 1980s and 1990s. Above-normal rainfall periods occurred during the early 1960s and late 1970 and late 1990s. It is interesting to note that episodes of exceptionally high rainfall totals during the 1960s and 1970s were preceded by relatively long low rainfall periods.

Extreme weather events: It is estimated that 90% of Uganda's natural disasters are climate change related. The country has been repeatedly affected by extreme events such as droughts and floods. Available evidence suggests that droughts in Uganda are becoming more frequent and more severe³⁵. For example, between 1991 and 2000, Uganda experienced seven severe droughts. Over 5 million people in Uganda have been affected by climate related disasters since 1979 - over four million have suffered severe droughts, about one million affected by floods. The western, northern, and north-eastern regions have been experiencing more frequent and longer-lasting droughts than seen historically. Climate related disasters have negatively affected agriculture. For example, an average of 800,000 hectares of crop is destroyed annually by climate-related effects, resulting in losses in excess of UGX120 billion. During the 1997/1998 floods, there was a 60 per cent drop in coffee exports and suspension of tea estates operations in eastern parts of the country; while 300 hectares of wheat were lost in Kapchorwa District, due to these floods. In September 2010, flood disasters hit the Teso sub-region; leading to crop damage and loss worth UGX8 billion, through rotting cassava, sweet potato tubers and groundnuts. Economic losses resulting from transport accidents, fires and other climate related disasters in Uganda have been estimated at UGX 50 billion annually.

³⁵ Inter-governmental Authority on Development (IGAD). 2010. *IGAD Environment Outlook*.

Table 3: Summary of Past Climate trends

	Temperature	Precipitation	Extreme weather events
Global	<ul style="list-style-type: none"> • Average temperature on the surface: + 1°C (1901-2012) • Annual mean temperature of sea surface : + 0.44°C in less than 40 years 	<ul style="list-style-type: none"> • No clear trends 	<ul style="list-style-type: none"> • Global mean sea level rise Over the period 1901 to 2010 - 0.19 [0.17 to 0.21]m; i.e. 1.7 mm/year; • Increase in sea level almost twice as fast since 1993 (3.2mm/year)
Uganda	<ul style="list-style-type: none"> • Average temperatures + 0.8 - 1.5°C (1900 -2009) i.e. warming of about 0.2°C per decade. 	<ul style="list-style-type: none"> • Between 2000 and 2009, rainfall has been on average about 8 percent lower than average rainfall between 1920 and 1969. 	<ul style="list-style-type: none"> • 90% of Uganda's natural disasters are climate change related. • Since 1990, the magnitude and frequency of droughts and floods has increased with over 5 million people directly affected.

2.4.2 Projected climate trends

The IPCC conducts climate assessments and projections at regular intervals. To assess climate change and its impacts, IPCC uses different models of the climate system, as well as economic and demographic studies; representing a wide range of possible climate changes. Climate simulations take into account many factors, distributed in two groups:

- Natural factors – such as volcanic eruptions and solar activity;
- Anthropogenic factors such as emission of Greenhouse Gases (GHG) and aerosols.

Global climate change projections

The IPCC AR5 (Working Group I) in 2013 confirmed that the global climate system is changing and that warming will continue, depending on the level of emissions of greenhouse gases in the 21st century. In assessing future climate change, the IPCC AR5 presents four scenarios, known as Representative Concentration Pathways (RCPs) – see Figure 4.³⁶ The scenarios show the result of different levels of emissions of GHG, from the present day to 2100, on global warming. In all scenarios, carbon dioxide concentrations are higher in 2100 than they are today. The low-emissions scenario assumes substantial and sustained reductions in greenhouse gas emissions. The high-emissions scenario assumes continued high-emissions. The two intermediate scenarios assume some stabilization in emissions.

³⁶ Climate and Development Knowledge Network (CDKN). (2014). The IPCC Fifth Assessment report. What is it for Africa?

Projected rise in temperatures: The average surface temperature of the planet will increase by the end of the 21st century from 0.3 to 4.8°C depending on the GHG emission scenarios over the period 1986-2005. This warming will continue after 2100.

Based on simple extrapolations, the costs of the impacts of extreme weather alone could reach 0.5 - 1% of world GDP per annum by the middle of the century, and will keep rising if the world continues to warm. With 5-6°C warming - which is a real possibility for the next century - existing models that include the risk of abrupt and large-scale climate change estimate an average 5-10% loss in global GDP; with poor countries likely to suffer costs in excess of 10% of GDP (Nicholas Stern Review: The Economics of Climate Change).

During this century, temperatures in the African continent are likely to rise more quickly than in other land areas, particularly in more arid regions. Increases in average temperatures are very likely in the mid and late 21st century under both low and high emissions scenarios. Under a high emissions scenario, average temperatures will rise more than 2°C, the threshold set in current international agreements, over most of the continent by the mid-21st century. Average temperatures will rise more than 4°C across most areas by the late 21st century. Changes in average temperature are projected to be greater over northern and southern Africa and relatively smaller over central Africa. Under a low emissions scenario, average temperature rises across Africa are projected to be less than 2°C by both the mid and late 21st century.

In the Eastern Africa region, projections for medium to high emissions scenarios indicate that

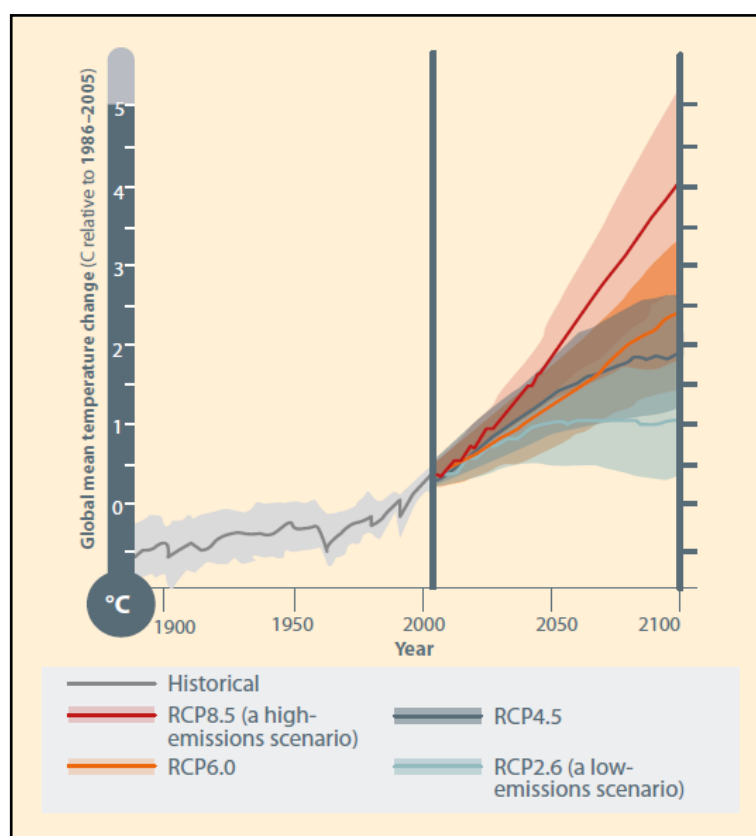


Figure 4: Observed warming and warming under IPCC scenarios

maximum and minimum temperatures over equatorial East Africa will rise and that there will be warmer days compared to the baseline by the middle and end of this century. Climate models show warming in all four seasons over Ethiopia, which may result in more frequent heat waves.

In terms of precipitation, changes in the global water cycle will not be uniform in response to warming in the 21st century. There will be contrast between areas of precipitation; wet and dry seasons will increase, even though there will be regional exceptions.

For African region, projections for rainfall are less certain than projections for temperature. Most areas of the African continent do not show changes in annual average rainfall under low-emissions scenarios. However, projections do show a very likely decrease in annual average rainfall over areas of

Southern Africa beginning in the mid-21st century, and expanding substantially by the late 21st century, under a high emissions scenario. In contrast, likely increases in annual average rainfall are projected over areas of central and Eastern Africa, beginning in the mid-21st century for the same high-emissions scenario.

In spite of the declining global rainfall trend observed, projections suggest that by the end of the 21st century, the climate in Eastern Africa will be wetter, with more intense wet seasons and less severe droughts in October-November-December and March-April-May, a reversal of recent historical trends. Regional models suggest that most parts of Uganda, Kenya and South Sudan will be drier in August and September by the end of the 21st century. Projections indicate shorter spring rains in the mid-21st century for Ethiopia, Somalia, Tanzania and Southern Kenya, and longer autumn rains in Southern Kenya and Tanzania.

2.4.3 Climate change projections for Uganda

Global climate models (GCMs) have been used to simulate Uganda's future climate. Three major climate change projection; namely DEWPoint (2012)³⁷, USAID (2013)³⁸ and CDKN (2014)³⁹ have been completed. The CDKN study, in particular, has used the IPCC AR5 projections, with a grid box distribution of 14 x 14 = 196 over Uganda.

The studies are in agreement that projected annual rainfall totals are expected to differ little from what is presently experienced, with projected changes within a range of less than plus or minus 10% from present rainfall. However, less rainfall is expected to occur over most of Uganda, with slightly wetter conditions over the west and north-west. Rainfall totals might drop significantly over Lake Victoria (where Kampala city is situated) - (to about 20% from the present). What is significant on a seasonal time scale is the projected increase in seasonal rainfall for the DJF season (up to 100% from present), which is indicative of a longer wet season that extends from SON towards DJF.

Projected near-surface temperatures are in the order of +2°C in 50 years from present, and in the order of +2.5°C in 80 years from present. Temperatures are expected to rise more during the MAM and JJA seasons in comparison to the DJF and SON seasons. A lower temperature increase of about 1°C is expected for Lake Victoria.

Under the more extreme climate change (RCP8.5), projected annual rainfall total changes are very similar to that of the RCP4.5 projections, and therefore still close to what is currently observed. On a seasonal time scale, the MAM and JJA seasons might expect slightly less rainfall, while the percentage increase in DJF rainfall, as in the RCP4.5 projections, is again very significant. A similar drop (-20%) over Lake Victoria is projected.

Projected near-surface temperatures are in the order of +3°C in 50 years from present, and in the order of +5°C in 80 years from present. Seasonal temperatures are expected to increase between +2°C and +3°C for DJF, MAM and JJA in 50 years from present, with a slightly lower increase for SON. In 80 years from present, temperatures might rise as much as +5.5°C during the JJA season (currently the coolest season), while increases of between +4°C and +5°C are expected for the seasons DJF, MAM and SON. Smaller changes are expected over Lake Victoria. Table 2 gives a summary of results from studies on projected climate.

The decrease in rainfall in most of Uganda, combined with a significantly wetter DJF season, will result in significantly drier conditions for the rest of the year (longer wet season that extends from SON towards DJF). This will also combine with significant temperature increases, especially during the MAM and JJA seasons.

³⁷ DEWPoint. (2012) Support to the Strategic Programme Review for Climate Change in Uganda: Understanding the implications and appraising the response. Update to 2008 LTS Scoping Study.

³⁸ USAID, 2013. Uganda climate change vulnerability assessment report. African and Latin American resilience to climate change project.

³⁹ Ministry of Water and Environment, 2014 Regional-scale Climate Change Projections of Annual, Seasonal and Monthly Near-Surface Temperatures and Rainfall in Uganda. A Report as part of the outputs of the Economic Assessment of the Impacts of Climate Change in Uganda.

Overall, those changes will require a number of adaptation strategies. A significant drop of total rainfall over Lake Victoria (-20% from present), combined with about 1°C temperature increase, will impact the lake water level. The increased warming, with high average air temperatures, will most likely amplify water stress and increase the impact of water shortages. Warming temperatures are likely to adversely affect agriculture production, which is an important economic activity for Uganda.

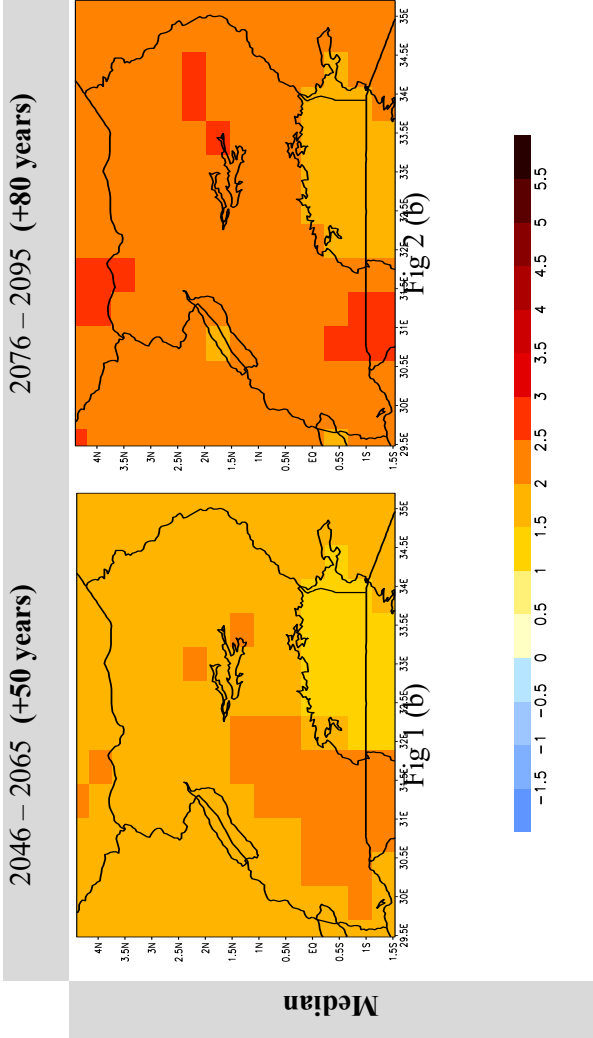
Table 4: Summary of Projected Climate

	<i>Temperature</i>	<i>Precipitation</i>	<i>Extreme weather events</i>
Global	<ul style="list-style-type: none"> Average temperature on the surface will increase by 0.3 to + 4.8 ° C, by the end of the 21st century 	<ul style="list-style-type: none"> No uniform change in global water cycle Increase contrast in areas precipitation; increase in wet and dry seasons 	<ul style="list-style-type: none"> Continued ocean warming and acidification Decrease in the thickness of ice Accelerated rise in sea level: 26-82 cm by 2100
Uganda	<ul style="list-style-type: none"> Average temperatures +2°C to +5°C by the end of the 21st century 	<ul style="list-style-type: none"> 10mm to -20mm (mostly in the northern half) to -30mm per month (mostly in the south). Over -100mm per month over Lake Victoria 	<ul style="list-style-type: none"> The magnitude and frequency of droughts and floods will increase.

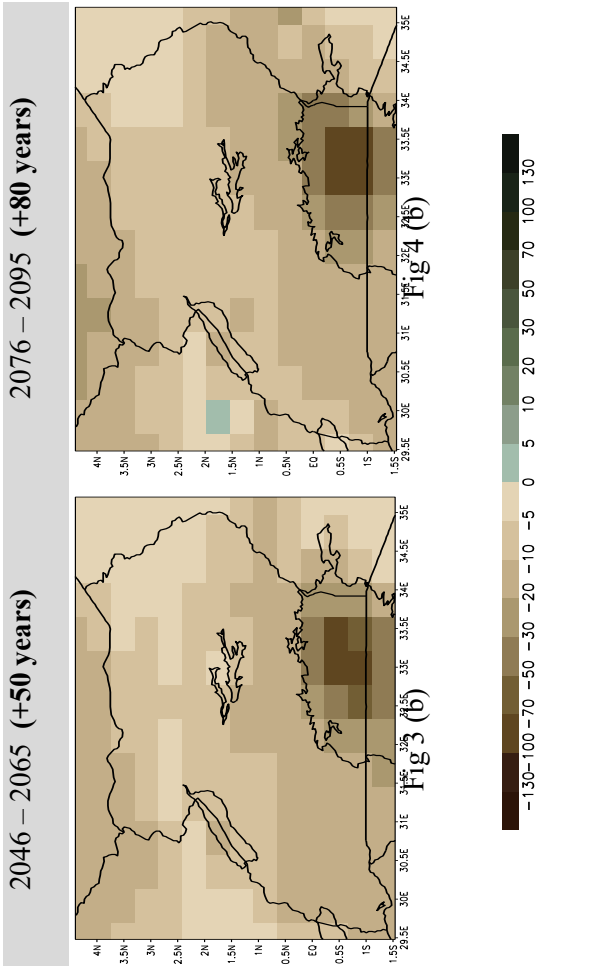
Maps of the annual mean near-surface temperature change and total rainfall change from the median projected over 50-years and 80-years from present, under both the RCP 4.5 and the RCP 8.5 concentration scenarios, are presented in Figure 5.

Figure 5. Annual mean near-surface (2m) temperature (°C) change and total rainfall (mm/month) change from the median projected over 50-years (average 2046-2065) and 80-years (average 2075-2095) from present (average 1985-2005) under the RCP 4.5 concentration scenario⁴⁰.

RCP 4.5: Annual temperature change (°C) relative to 1985-2005



RCP 4.5: Annual rainfall change (mm/month)

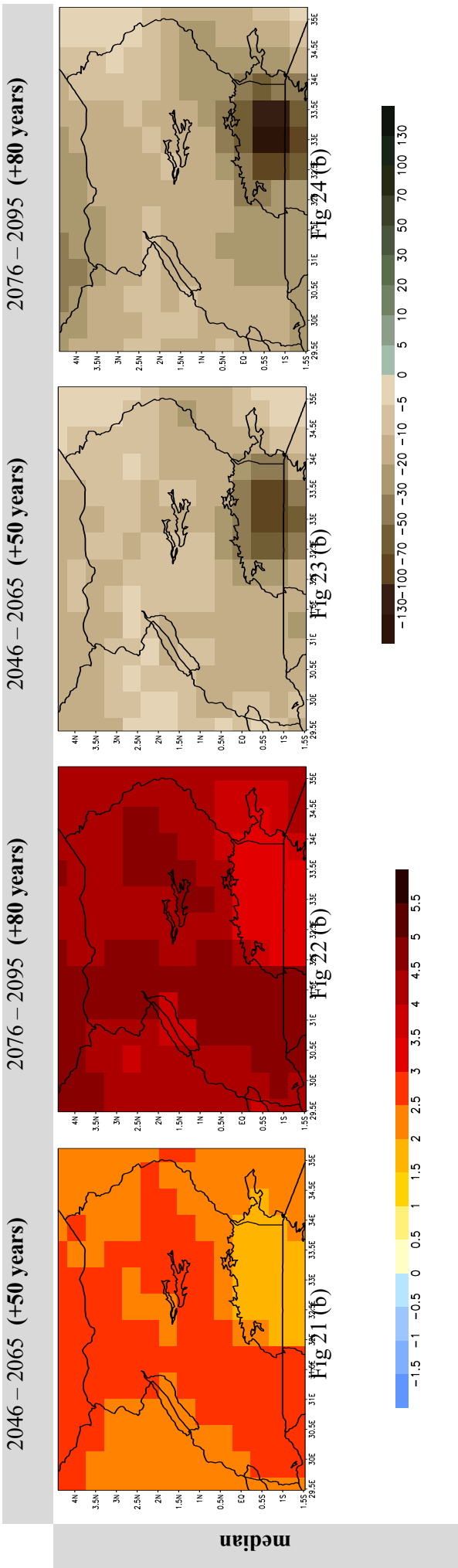


⁴⁰ Ministry of Water and Environment, 2015. Economic assessment of the impacts of climate report in Uganda, Final Report.

Figure 6: Annual mean near-surface (2m) temperature (°C) change and total rainfall (mm/month) change from the median projected over 50-years (average 2046-2065) and 80-years (average 2075-2095) from present (average 1985-2005) under the RCP 8.5 concentration scenario⁴¹.

RCP 8.5: Annual temperature change (°C) relative to 1985-2005

RCP 8.5: Annual rainfall change (mm/month)



⁴¹ Ministry of Water and Environment, 2015. Economic assessment of the impacts of climate report in Uganda, Final Report.

3 Climate change impacts and vulnerability analysis

3.1 Introduction

Uganda faces a number of risks from climate variability and change. Vulnerability to climate change may result from exposure to the associated external risks such as floods, droughts, extreme temperatures and other climate hazards; or to internal factors that minimise the capacity of farmers to effectively respond to climate hazards.

During preparation of the NCCP, detailed vulnerability analyses of different sectors of the economy to the impacts of climate change were conducted. In addition, various climate vulnerability studies have been conducted by UNDP⁴², USAID⁴³, CDKN⁴⁴, and FAO⁴⁵, and some of these are specific on agriculture. In this section, an overview of the key climatic risks and hazards in Uganda; namely droughts and floods are presented, with a view to informing key adaptation actions for agriculture.

3.2 Climate change impacts

3.2.1 Droughts

Drought is one of the recurrent natural disasters in Uganda. Evidence suggests that droughts in Uganda are becoming more frequent and more severe⁴⁶. The western, northern, and north-eastern regions have been experiencing more frequent and longer-lasting droughts than seen historically⁴⁷. Between 1991 and 2000 there were seven droughts in the Karamoja region, and the years 2001, 2002, 2005 and 2008 also saw major droughts⁴⁸. Each of these drought events has caused severe crop and livestock losses, famine and population displacement in the country. In the north-eastern Karamoja region and the rest of the cattle corridor in Uganda, consecutive years of crop failure and low livestock productivity due to erratic weather conditions and below normal rainfall have had a strong and adverse impact on food security, calling for relief supplies and resettlement, which have budgetary implications on the economy. Droughts worsen the food and nutrition insecurity, affecting the vulnerable groups of the elderly, children and women. In addition, a significant percentage of Uganda's population relies on water from streams and other open water bodies that dry up during droughts.

Drought leads to secondary impacts like degraded grazing and cropping lands, and overall environment degradation that result into drying up of water ponds, reduced surface water and river flows, drying up or reduced underground water levels, increased wild fire outbreaks, dust-storms, and increased temperatures; leading to uncomfortable hot and dry air, among others. Prolonged droughts, combined

⁴² UNDP 2012. Climate Risk Management for Sustainable Crop Production in Uganda: Lessons from Rakai and Kapchorwa Districts

⁴³ USAID, 2013. Uganda climate change vulnerability assessment report. African and Latin American resilience to climate change project.

⁴⁴ Ministry of Water and Environment, 2015. Economic Assessment of the Impacts of Climate Change in Uganda.

⁴⁵ FAO, 2015. Cost Benefit Analysis (CBA) of Climate Change Adaptation and Prioritization in Agriculture, Environment and Water Sectors in Uganda. Vulnerability assessment report, Final Draft.

⁴⁶ Intergovernmental Authority on Development (IGAD). 2010. *IGAD Environment Outlook*.

⁴⁷ Republic of Uganda, 2007. Climate Change: Uganda National Adaptation Programmes of Action (NAPA) 2007.

⁴⁸ EM-DAT website (2011). *Disasters in Uganda*. The international Disaster Database. Centre for Research on the Epidemiology of Disasters (CRED). School of Public Health, Université catholique de Louvain, Belgium Retrieved Jun-23-2011. <http://www.emdat.be>.

with poor resource and land use management, can eventually lead to desertification; a devastating and long-lasting side-effect of drought that is extremely challenging to reverse.

Climate change introduces an additional uncertainty into existing vulnerabilities, particularly in the cattle corridor and semi-arid lands. The projected increase in temperatures are likely to exacerbate the drought conditions already experienced and may have a significant impact on water availability, agriculture and general well-being.

3.2.2 Floods

Flooding in Uganda occurs relatively frequently and is linked with El Niño or La Niña episodes, which can lead to extreme weather in the country and region. In addition, the seasonal to inter-annual variability (especially as driven by the ENSO events) is reflected in variations or shifts in the seasonal rainfall, intra-seasonal dry spell occurrence and rainfall intensity, thunderstorms, lightening and hailstones. Recent years have seen more erratic onsets and ends to rainfall seasons, and rainfall events have been heavier and more violent. Since the 1990's ENSO events have also been observed to be shorter and more irregular⁴⁹ (IGAD, 2010).

In 2007, the Teso sub-region in Eastern Uganda and part of Northern Uganda experienced the heaviest rainfall in 35 years (One World, 2008). During this period, an estimated 50,000 households were affected and many people faced food insecurity due to the loss of their first and second season harvests, and water and sanitation facilities were severely impacted (NEMA, 2008). Not only did the floods disrupt lives of thousands of people and destroyed crops, but they also led to increase in water borne diseases. In March 2010, floods submerged crop fields and vital infrastructure; including trunk and rural roads, which disrupted transport of food in Butaleja District in the Eastern Uganda (OCHA, 2010). In Kapchorwa District, about 300 hectares of wheat were destroyed. Nationally, coffee exports dropped by 60% between October and November 1999, partly due to disrupted transport system. In 2014, the flooding of River Nyamwamba in the Mt. Rwenzori region not only resulted in loss of food production and property; leaving people homeless and without food, but also led to serious soil erosion and destroyed irrigation infrastructure, both on the hill slopes and down the valleys.

Urban flooding is also progressively becoming an issue, especially in Kampala city. Due to poor urban planning and loss of green spaces in cities, flooding events are becoming frequent which lead to loss of infrastructure, loss of lives and destruction of property.

Flood impacts lead to secondary impacts of landslides, soil erosion, silting of dams and drainage channels, bursting of dams and river banks, water logging in low lying valleys and wetlands, water leaking, displacement, outbreaks of epidemics of animal and crop diseases and pests. Floods and landslides are on the rise in Uganda and increasing in intensity. For example, since 2000, extreme rainfall conditions have been regularly experienced in Eastern Uganda, where there has been an increase of approximately 1500 mm of precipitation in the December to January rainy season resulting in flooding⁵⁰.

3.3 Vulnerability of agriculture to the impacts of climate change

Uganda's agricultural sector; including crops, livestock and fisheries, is dependent and sensitive to climate variability and climate change. Therefore, climate change has serious direct and indirect impacts on the food security, livelihoods, and socio-economic development of Uganda. Climate change can potentially impact agricultural production by: (i) reducing the area suitable for agriculture, (ii) altering the length of the

⁴⁹ Intergovernmental Authority on Development (IGAD). 2010. *IGAD Environment Outlook*.

⁵⁰ NEMA, 2008. State of the environment report for Uganda. Kampala, Uganda.

growing season, (iii) reducing the yield potential, (iv) increasing the frequency and severity of extreme events (in particular droughts and floods) and (v) increasing the incidence of plant pests and diseases.⁵¹

3.3.1 Impact and vulnerability of crop production

Climate change is likely to reduce yields of desirable crops in the long-term. A number of indirect impacts, such as increased rates of runoff and soil erosion, and increased crop losses from pests, diseases and weeds, could significantly magnify production losses. A number of studies have documented the effect of climate variability and change on crop yields (FEWSNET, 2012; MWE, 2014; USAID, 2013). The observed shift in rainy seasons (September-November) and (March-May) and short or prolonged dry seasons in some regions distorts growing seasons; confusing farmers on deciding on timing for planting activities. This affects timing of field preparation and planting; affecting crop growth, intensification of crop diseases and pests, resulting in lower yields. The shift in rainfall patterns also leads to reduction in amounts of rain water harvested; affecting both hillside and valley irrigation projects, through either decreased water levels in ponds/dams or high amounts of water destroying dam/pond embankments and causing erosion and silting.

Crop production is also directly affected by heavy rains, which damage crops and livestock. For example, the unusually heavy rains in March 2010 caused landslides in the Bududa district of the Mount Elgon region burying three whole villages, including crops and livestock. In 2011, the District of Bulambuli was also strongly affected by landslides, which destroyed homes and crops. Landslides also frequently destroy crops and livestock in the highlands of south-western Uganda.

Value chain analysis of crops most widely grown in Uganda showed that many crops are vulnerable to rising temperatures, increasing dry season and unrealizable rainfall (USAID, 2013); with Arabica coffee being particularly vulnerable, while cassava is the least vulnerable. From the study, most to least sensitive crops are: Arabica coffee, Robusta coffee, rice, maize, East African Highland Banana (matooke), beans, sorghum, sweet potatoes, and cassava. Other key findings indicate the following:

- **Coffee:** Rising temperatures and erratic rainfall increase the risk of disease and pest infestations in coffee. Robusta coffee has become more vulnerable to red-berry disease, while Arabica coffee is more vulnerable to coffee berry and leaf rust diseases.
- **Rice:** Two major rice diseases (blast and bacterial leaf blight) affect rice yields and are significantly aggravated by weather conditions; such as higher temperatures, air humidity, or soil moisture.
- **Maize:** It is vulnerable to water stress during poor rains, as well as Aflatoxin contamination when the harvesting period coincides with off-season rains. Aflatoxin contamination represents a serious threat to the marketing of maize and will likely worsen if dry season rainfall increases.
- **East African Highland Banana (Matooke):** While matooke is less vulnerable to increasing temperatures than coffee, the potential impact of pests and diseases on the crop is significant. The most common are Banana Bacterial Wilt, Banana Weevils and Nematodes and Black Sigatoka Disease.
- **Beans:** Beans are vulnerable to fungal and viral diseases, when excessive rain falls during critical growing periods at the flowering and pod formation growing stages. They are also often attacked

⁵¹ World Bank (2013) *Turn Down the Heat: Climate Extremes, Regional Impacts, and the Case for Resilience*. A report for the World Bank by the Potsdam Institute for Climate Impact Research and Climate Analytics. Washington, DC: World Bank. License: Creative Commons Attribution—NonCommercial—NoDerivatives3.0 Unported license (CC BY-NC-ND 3.0).

by aphids in times of water stress.

- **Multiple Grains:** Erratic rain could increase post-harvest storage losses of crops typically dried in the sun (e.g., maize, beans, coffee and rice.), due to increased pests and rotting.
- **Sorghum:** Coupled with irregular precipitation, increased temperatures could result in the proliferation of Striga, a parasitic weed that affects sorghum and is prevalent in areas with degraded soils.
- **Cassava:** It grows well at temperatures much higher than the current, but the crop is also vulnerable to pests and diseases, especially the Cassava Mosaic, cassava brown streak and aphids. It is also highly vulnerable to water logging.

The findings of a study on economic impact of climate change reveal that the largest impact of climate change on agriculture is on food crops, followed closely by the export crops such as coffee, tea and cotton. The loss on food crops is estimated at about USD 1.5 billion per year by 2050 (considering eleven crops - cassava, groundnuts, maize, millet, pigeon peas, potatoes, rice, sorghum, soybean, sugar cane and sweet potato). Agricultural exports will also be severely affected. For example, the Arabica coffee growing area will significantly reduce by 2050, due to the predicted climate change. Climate induced yield losses for coffee are in the order of 50-75% by 2050, due to yield reductions and more importantly loss of areas where coffee can be grown. This is a major impact on the economy, which is currently deriving 18% of its export earnings from coffee. Estimates of impacts on tea growing areas also indicate significant losses of up to 50% (fall in production) by 2050. An IFPRI modelling shows potential losses of cotton production due to yield impacts in the range of 60-77% by 2050.

Adaptation measures should therefore focus on boosting productivity of both cash and food crops, especially building capacity of smallholder farmers to increase yields, and better understanding the impact of temperature rise and rainfall variability on key crops.

3.3.2 Impact and vulnerability of livestock rearing

Climate change affects livestock production through its effects on water and pasture availability, incidence of livestock pests and diseases and mobility of livestock in the country. Increasing temperatures and warming due to climate is expected to alter the feed/water access and intake, mortality, growth, reproduction, maintenance and production of animals - all of which have negative impact on livestock productivity.⁵²

Pastoralism is the dominant form of livestock keeping in Uganda, especially in the *cattle corridor*. Given the nature of recourse to mobility to manage climate variability, pastoralism is inherently adaptive. However, the increased occurrences of extreme weather events multiply the impact of factors that constrain pastoralists' livelihoods. Prolonged dry spells and drought will cause severe water shortage, leading to loss of animals, low production of milk, food insecurity, increased food prices, and a general negative effect on the economy. For example, the 2010–2011 Integrated Rainfall Variability Impacts, Needs Assessment by OPM revealed that damage and losses in the agriculture sector were estimated at UGX 2.2 trillion (US\$ 907.0 million), accounting for 77% of total damage and losses across all economic sectors. About US\$ 45.35 million of the total damage and losses for agriculture was due to animal deaths. Furthermore, within the livestock sub-sector, 83% of the damage and losses for livestock was attributed to production losses, 9% was due to damage due to animal deaths, and the remaining 8% was due to higher production costs.

⁵² Kipkoech A., Tambi E., and Bangali S., FARA 2015. State of Knowledge of CSA on Africa, Case studies from Ethiopia, Kenya and Uganda. FARA Accra, Ghana.

Prolonged dry spells and drought in livestock grazing systems reduces the availability of water and pasture/fodder both directly and indirectly. Water deficits reduce access to water for production, and grazing landscapes. The accrued limitations on access thus reduce productivity and prolong seasonal scarcity of this resource, which accounts for about 70% of value chain production costs. These factors drive a feed price increase, which forces livestock owners to sell their cattle. Massive sales, while there is a reduced demand, push cattle prices down, forcing farmers to sell even more cattle, to buy feed. These effects on prices reduce farm and household income and assets. Moreover, the changes in prices reduce the value of assets (livestock) and the productive capital for the future. Prolonged or repeated drought also has long lasting degrading effects on land: a combination of drought and overgrazing, particularly near watering points destroys the vegetation cover; increasing soil erosion. Furthermore, the integrated rainfall variability impacts needs assessment revealed, a tendency of pastoral communities to migrate with livestock (assets) away from settlements leaving women and vulnerable gender groups to tend crops near homesteads.

3.3.3 Vulnerability of fisheries

Capture fisheries and aquaculture are vulnerable to climate change and variability (Allison et al, 2009; Williams & Rota, 2012). Fisheries have a critical thermal maxima and minima and cannot survive temperatures that exceed their threshold. Fisheries production systems are affected by climate change from the following effects:

- Increasing water temperatures;
- Extreme weather events which lead fluctuations in water levels (floods, droughts, storms);
- Changes in water quality parameters such as pH, conductivity and turbidity;
- Decreasing pH, and;
- Changes in current open water productivity patterns.

The above effects are worsened by the lack of knowledge, skills and awareness of adaptation options. These are result of lack of farmer-to-farmer extension services.

Value chain analysis indicate that the impacts of climate change on fisheries in Uganda result from an increase in mean air temperature, changes in rainfall patterns, and an increase in extreme weather events (Timmers, 2012). Small pelagic species (*Mukene, Enziri, and Agogi*) and large species (Nile perch, Tilapia) value chains differ significantly, but may be impacted by climate change and variability in similar ways related to production, processing and transport. Artisanal fish processing in which majority of women and youth are involved and is dependent on firewood and sunshine is highly vulnerable to climate change. Aquaculture value chain shows weaknesses in input supply and delivery, resulting in low productivity. A combination of climate-related threats may further weaken input supply and threaten pond productivity. However, dwindling fish production in fresh water systems, such as those of Uganda, is not only as a result of climate change, but also due to pollution and overfishing.

3.3.4 Vulnerability of other sectors related to agriculture

The impacts of climate change also affect (directly and indirectly) the other sectors that influence the performance/productivity of the agriculture.

3.3.4.1 Impact on water

Climate change will amplify the existing pressures on water resources from poor management, degradation and competing uses. The growing population and its rising need for water will increase water demand. Climate change is already affecting water availability and the trend towards water scarcity is expected to increase and this will affect water availability for agriculture and households. Already, people are moving long distances to collect water, which is reducing the time put in farming. A study on economic assessment of the impacts of climate change in Uganda finds that between 2010 and 2050, the demand for water in Uganda is expected to increase ten-fold from 408 million cubic metres to 3,963 million cubic metres⁵³. Droughts will lead to shortage of water for irrigation, livestock and domestic consumption. For example, the damage of drought on water availability is estimated at USD 237 million per year. The largest economic loss on water availability is expected in the Lake Victoria, Albert Nile and Lake Kyoga watersheds.

Rice and sugarcane are some of the prioritized crops in the country but both crops require relatively more water than other crops and require significant irrigation investment. However, limited assessment has been carried out on the sustainability of such investments, especially in the face of existing water stress and future variability. **Moreover, though irrigation can help adapt to climate change, it also poses risks of maladaptation.** Existing irrigation schemes are already reporting water shortages that are linked to multiple factors, including climate change, an increased number of irrigators, and increasing non-agricultural water uses. With a projected decrease in rainfall in some areas, which, together with temperature rise, will increase evaporation of surface water, water shortages may be amplified. Rising temperatures will also lead to decreased soil moisture. As populations grow and agriculture expands, demand on water resources is expected to increase, and together with potential climate impacts this will put at-risk efforts to sustainably scale up irrigated agriculture.

Therefore, irrigation alone will not be sufficient to help adaptation to climate change, and can indirectly drive vulnerability, if water resources are not well managed. Adaptation measures for improved water, soil and land management are urgently needed to build resilience to current variability and future climate change by both smallholders and commercial farms.

3.3.4.2 Impact on forestry and energy access

Uganda relies largely on traditional biomass energy, which is already short in supply due the high rates of deforestation. The current balance between supply and demand for biomass is fragile and by 2020 and beyond, there will be a large deficit. With biomass energy short in supply, long distances have to be moved to collect biomass, which affects agriculture production. Deforestation arising from increased demand for biomass increases land degradation, which also reduces agricultural productivity. Climate change will certainly reduce availability of biomass and thus the country needs to seek alternative energy sources. There is shortage in supply of electricity and modern energy. This hinders agro-processing and improvement of agriculture value chains. Moreover, Uganda relies on hydro-electricity, which is vulnerable to the impacts of climate change on water availability.

3.3.4.3 Impact of transport

Transport infrastructure is also at the risk of climate change impacts and extreme weather events. The roads, bridges and railways are washed away by floods and storms and this affects the marketing of agricultural products. Climate variability is likely to increase in the future, and therefore climate proofing rural transport infrastructure should be a priority.

3.3.5 Vulnerability and adaptive capacity of Uganda's farmers to the impacts of climate change

⁵³ Ministry of Water and Environment, 2015. Economic assessment of the impacts of climate change in Uganda. Final Report.

Socio-economic factors of farmers across Uganda make them vulnerable to climate change. Uganda's average vulnerability score is 52.58⁵⁴ and the high population growth (3% per annum) is one of the driving factors behind the over-use of resources. The high population growth is a driving factor; where agricultural land is experiencing increasing densities and pressure on resources and is a factor that is increasing land degradation and vulnerability. In fact, land degradation is a major threat to Uganda's land resource and threatens to significantly undermine the future productivity growth in agriculture and forestry sectors. Estimates of the economic loss attributed to land degradation in Uganda in the 1990s range from 4 to 12 percent of GDP.⁵⁵ In addition, Uganda's Human Development Index is low, ranking at 167 out of 187 countries⁵⁶.

Kipkoech *et al* (2015) posit that Uganda's Economic Vulnerability Index (EVI) is low, at 36.2 in 2012, because seven indicators used to construct the index are not favourable:⁵⁷

- High population density (174 persons per sq/km in 2014);
- Dilapidated infrastructure, influencing access to markets;

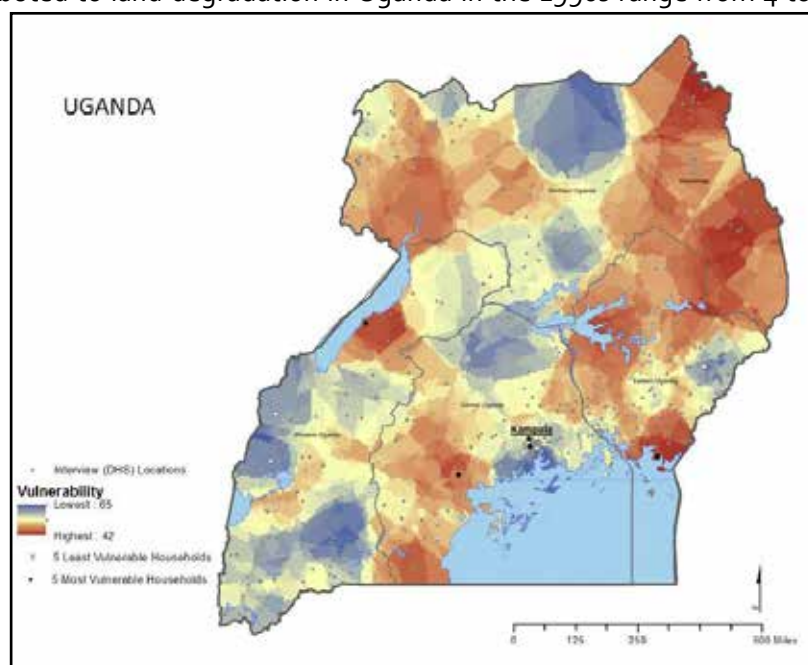


Figure 7: Uganda's vulnerability map
Source: Richmond *et al.* (2015)⁵⁸

- Low participation in export markets by local population (small holder farmers);
- High share of agriculture, forestry and fisheries on GDP;
- Displacements due to natural disasters (floods, droughts) and conflicts;
- Unstable agricultural production, dependent on natural climatic factors; and
- Unstable exports of goods and services.

Uganda has a high environmental vulnerability because the majority of Uganda's population is rural and relies on the environment for their livelihood. The vulnerability map (Figure 7) indicates higher vulnerability in the semi-arid areas of Uganda and generally the cattle corridor, dominated by pastoralists and agro-pastoralists. Livelihoods and vulnerability in Uganda are largely determined by the access to clean water, which is greatly dependent on access to sanitation.

⁵⁴ Richmond A.K., Malcomb D. and Ringler K. (2015). *Household vulnerability mapping in Africa's Rift Valley*. Journal of Applied Geography, n°63, pp. 380-395.

⁵⁵ NEMA, 2001. National State of the Environment Report for Uganda, 2000/2001.

⁵⁶ Richmond A.K., Malcomb D. and Ringler K. (2015). *Household vulnerability mapping in Africa's Rift Valley*. Journal of Applied Geography, No. 63, pp. 380-395.

⁵⁷ Kipkoech A., Tambi E., and Bangali S., FARA 2015. State of Knowledge of CSA on Africa, Case studies from Ethiopia, Kenya and Uganda. FARA Accra, Ghana.

⁵⁸ Richmond A.K., Malcomb D. and Ringler K., 2015. *Household vulnerability mapping in Africa's Rift Valley*. Journal of Applied Geography, n°63, pp. 380-395.

Although Uganda is well endowed with water resources, access to clean water varies greatly across and within regions and seasons⁵⁹. Rapid population growth puts added pressure on Uganda's water sources; and continued degradation of lakes, rivers, springs and wetlands makes it increasingly difficult to supply clean water. Rampant poverty, weak institutional capacity, limited financial resources, poor land use planning, and an economy which depends entirely on the exploitation of natural resources are some other factors that make Ugandans vulnerable to adverse effects of climate change. Sustained environmental destruction of wetlands, deforestation, and lake contamination are Uganda's largest environmental threats that make it vulnerable. Environmental degradation has a significant impact on human wellbeing by decreasing agricultural yields, contaminating water and subsequently degrading health. Health is another significant factor in vulnerability. The low life expectancy, high prevalence of HIV/AIDS and high numbers of orphans and vulnerable children, because of the impact of HIV prevalence; all increase vulnerability.

Therefore, adaptation measures need to consider how to reduce climate shocks to smallholder farmers, promote agricultural practices that boost productivity and safeguard natural resources, and appropriately target vulnerable groups and areas.

⁵⁹ World Water Assessment Programme, 2006. National water development report: Uganda.

4 Policy and institutional framework

4.1 Introduction

This chapter presents the policy and current institutional arrangement for agriculture and climate change adaptation. An analysis of the national development, as well as agriculture and climate change, is also presented.

4.2 Current Institutional Arrangements

The Agriculture sector under the leadership of the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) is mandated: to promote and support sustainable and market oriented agricultural production, food security and household incomes in the country. The sector comprises of three sub-sectors, namely Crop, Animal and Fisheries Resources; with a mission of transforming subsistence farming into commercial agriculture in the country.⁶⁰ The sector has the following semi-autonomous agencies: Control of Trypanosomiasis in Uganda (COCTU), Cotton Development Organisation (CDO), Dairy Development Authority (DDA), Agricultural Advisory Services, National Agricultural Research Organisation (NARO), National Genetic Resource Centre and Databank (NAGRC&DB), Uganda Coffee Development Authority (UCDA), and the Districts Agriculture Sectoral Conditional Grants.

The coordination of climate change activities is currently the responsibility of the Climate Change Department (CCD) in the Ministry of Water and Environment (MWE). CCD is the National Focal Point for the United Nations Framework Convention on Climate change (UNFCCC). CCD works with climate change coordination units in different Ministries, Departments and Agencies (MDAs) to ensure the mainstreaming of climate change in the different sectors of the economy.

CCD also works with the National Planning Authority (NPA) to ensure the integration of climate change in the NDP and Sectoral Development Plans. CCD works with the Ministry of Local Government (MoLG) and NPA to ensure integration of climate change in District Development Plans (DDPs). The MWE is the National Implementing Entity (NIE) for the Adaptation Fund, while the Ministry of Finance Planning and Economic Development (MoFPED) is the National Designated Authority (NDA) for the Green Climate Fund (GCF).

The MAAIF established a Climate Change Task Force in 2012 to collaborate and link with the climate change lead sector - CCD in MWE, to:

- Coordinate the development, implementation and review of policies, strategies, laws and programmes meant to mitigate effects of climate change in the agricultural sector;
- Develop guidelines for climate change proofing and mainstreaming of climate change issues into the agricultural sector programmes, projects and activities;
- Develop climate change training and information dissemination materials, relevant to the agricultural sector;
- Compile and analyze trends and events on climate variability and climate change and provide information for policy review, planning and intervention;
- Provide technical back-up support and building capacity of MAAIF departments, agencies and District Local Governments (DLGs) on climate change agricultural related issues;

⁶⁰ Republic of Uganda, 2015. Second National Development Plan 2015/2016 - 2019/2020

- Liaise with the CCD and other relevant authorities in the development and dissemination of technologies and practices for adaption and mitigation of climate change;

The Task Force considered that adaptation of the agricultural sector is a critical issue. This Agriculture Sector NAP was developed through a participatory process under the leadership of the Ministry of Agriculture Animal Industry and Fisheries with guidance from the CCD, MWE.

4.3 Policy framework

4.3.1 Overarching national policy framework

The policy on environment in Uganda is unique in liberalizing the economy to a great extent. The government focuses on providing public goods and creating an enabling environment for economic growth. The first round of reforms that affected the agricultural sector started in 1987, with the IMF/World Bank supported Economic Recovery Programme (ERP).⁶¹ The ERP that ended in 1992 and ushered in the liberalization policy and the privatization policy that among other actions privatized state-owned enterprises, such as the Coffee Marketing Board (CMB), Lint Marketing Board (LMB), and Produce Marketing Board (PMB).

The weaknesses in ERP led to the development of the Poverty Eradication Action Plan (PEAP) in 1997 as the country's 10-year (1997 – 2007) planning framework for accelerating growth, reducing poverty and promoting sustainable development⁶².

The PEAP 1997 was organized under four pillars or goals: i) macroeconomic policy, ii) institutional framework for poverty eradication, iii) policy framework to increase incomes of the poor, and iv) measures to improve the quality of life of the poor. The PEAP 1997 was later revised to PEAP 2001⁶³ following the introduction of the Poverty Reduction Strategy Paper (PRSP) initiative, by the World Bank in 2000. The PEAP 2001 also had four pillars, configured differently as: i) creating an enabling environment for economic growth and structural transformation, ii) achieving good governance and security, iii) increasing the ability of the poor to raise incomes, and iv) improving the quality of life of the poor.

The PEAP 2001 was later revised to PEAP 2004, into five pillars: i) improving economic management, ii) enhancing production, competitiveness and incomes, iii) improving security, conflict resolution and disaster management, iv) promoting good governance, and e) realizing human development. As a poverty reduction framework, the PEAP focused mainly on areas that would enhance rural incomes, such as agriculture, rural roads, education and health.

In 2010, the PEAP was replaced with the First 5-year National Development Plan (NDP I) as a medium-term planning framework. The NDP is part of the long-term planning process in implementation of the Uganda Vision 2040, which aims at transforming Uganda from a low income country to an upper middle income country by 2040 (already discussed in Section 2.2). The NDP I addresses structural bottlenecks in the economy, aimed at accelerating socioeconomic transformation that will deliver prosperity. The plan was implemented between 2010 and 2015 after which it was reviewed and the NDP II was developed which will

⁶¹ Ministry of Finance Planning and Economic Development, 2000. Uganda's Economic Performance since 1986, when the NRM Government came to power, Ministry of Finance, Planning and Economic Development. Republic of Uganda.

⁶² FAO, 2013. Monitoring African Food and Agricultural Policies (MAFAP) Review of Food and Agricultural Policies in Uganda 2005-2011, Country Report.

⁶³ Ministry of Finance Planning and Economic Development, 2001. Poverty Status Report. MoFPED Kampala. Uganda

be implemented between 2015 and 2020 (see Section 2.2). As already mentioned, agriculture is one of the development priority areas in NDP II.

4.3.2 Agricultural policy framework

4.3.2.1 Plan for Modernization of agriculture (PMA)

Uganda developed the **Plan for Modernization of agriculture (PMA)** in 2000, as a framework and strategy to implement the second pillar of the PEAP 1997. The PMA had four main objectives, all of which were focused on improving the livelihood of agricultural households. However, only two (out of seven) implementation areas were implemented through the National Agricultural Research Organization (NARO) and the National Agricultural Advisory Services (NAADS) secretariat. Attempts to increase farmer access to financial services were not very successful.⁶⁴

Effective implementation of the PMA strategy mainly started with creation of the **National Agricultural Advisory Services (NAADS)** programme in July 2001. The NAADS is a 25-year donor funded extension services and input subsidy delivery programme that is implemented under MAAIF. NAADS contributes to the attainment of the Government goal of Prosperity for All (PFA), which aims at increasing the incomes of the poor and is implemented in all the districts of Uganda.

The first phase was supposed to end in July 2007, but needed an extension until 2010 – as NAADS II was being designed. Implementation of the first phase of NAADS was tainted with challenges, partly compelling the government to consider other interventions such as the Rural Development Strategy (RDS) in 2005 and Prosperity for All (PFA) in 2006, aimed at reaching a wider spectrum of the rural population. A review of NAADS I suggested a weak relationship between research institutions and extension agents in access to quality technologies and providing research-based advice to farmers in the country.⁶⁵ To strengthen this linkage, the Agricultural Technology and Agribusiness Advisory Services (ATAAS) Project, co-implemented by NAADS and NARO was designed as the NAADS II programme. The ATAAS is a 5-year project funded by the World Bank, Global Environment Facility (GEF) Trust Fund, IFAD, the European Union, DANIDA and the Government of Uganda; at a total project cost of USD 665.5 million, over the five-year project period. Currently, NAADS is under review as it has not been very effective.

Uganda's development policy has been dominated by the need to improve rural areas; because the majority of the population live there and their livelihoods are rural-based. The Government of Uganda formulated the rural Development Strategy to facilitate profound agrarian productivity. The main objectives of the RDS were to: (i) increase farm productivity of selected commodities produced by households; (ii) increase household outputs of the selected agricultural products; and (iii) promote value-addition and ensure a stable market for these agricultural products.⁶⁶ In 2005, the Uganda Cabinet decided to integrate RDS into the budget framework for the Financial Year (FY) 2005/06 and the Medium term Expenditure Framework (MTEF). This led to the identification of specific interventions and activities for Government action by MAAIF. The outcome of this process identified the following interventions to focus on: (a) Integrated Support to Farmers' Groups; Micro-finance (savings and credit); (b) Community information systems; (c) Cotton subsidies; (d) Water for agricultural production (water stressed areas and

⁶⁴ FAO, 2013. Monitoring African Food and Agricultural Policies (MAFAP). Review of Food and Agricultural Policies in Uganda 2005-2011, Country Report.

⁶⁵ World Bank, 2010. A Project Appraisal Document on 'Agricultural Technology and Agribusiness Advisory Services Project'. Washington D.C. - The World bank.

⁶⁶ Ministry of Finance Planning and Economic Development, 2005. Budget Framework Paper 2005/06 2006/07.

rehabilitation of irrigation schemes (Doho in Tororo District); and (e) Water harvesting; and (f) NAADS roll out.⁶⁷

4.3.2.2 The Agricultural Sector Development Strategy and Investment Plan

MAAIF launched a 5-year Agricultural Development Strategy and Investment Plan (DSIP) 2010/11 - 2014/15 in 2010. The DSIP, whose aim was '*enhancing agricultural production in an environmentally sustainable manner*', was formulated as one precondition to signing of the Comprehensive Africa Agriculture Development Programme (CAADP); a continental initiative to increase economic growth in Africa, through greater investment in agriculture. The DSIP was tailored on the NDP I and has four programme areas of implementation that aim to promote private sector investment and raise productivity in the sector including; (i) enhancing agricultural production and productivity; (ii) improving access to and sustainability of agricultural markets; (iii) creating an enabling environment for investment in agriculture; and (iv) institutional strengthening in the agricultural sector. In general, the DSIP focused on increased rural incomes and livelihoods, and improved household food and nutrition security.

The plan identified climate change as a key cross-cutting issue and recognizes that vulnerability to climate shocks will influence the performance of the agricultural sector, and hence climate change considerations are central to improving agriculture. Having expired in 2015, a new 5-year Agricultural Sector Strategic Plan (ASSP) 2015/16 - 2019/20 aligned to NDP II is being prepared and will soon be launched.

4.3.2.3 National Agricultural Policy, 2013

The **National Agricultural Policy (2013)** was developed to harmonize the different thoughts and approaches to national agricultural development. The vision of the policy is "a competitive, profitable and sustainable agricultural sector", while the mission of the policy is to: "transform subsistence farming to sustainable commercial agriculture." The overall objective of the policy is to achieve food and nutrition security and improve household incomes through coordinated interventions that focus on enhancing sustainable agricultural productivity and value addition; providing employment opportunities, and promoting domestic and international trade.

The policy states that agricultural development strategies will be developed and pursued according to the agricultural production zones through a commodity-based approach. Furthermore, the policy states that Government shall ensure that key agricultural resources, including soils and water for agricultural production, are sustainably used and managed to support adequate production for the current and for future generations. Among other things, the agricultural policy seeks to ensure household and national food and nutrition security for all Ugandans. It seeks to increase incomes of farming households from crops, livestock, fisheries and all other agriculture-related activities; and promote specialization in strategic, profitable and viable enterprises and value addition through agro-zoning. Most importantly the policy seeks to ensure sustainable use and management of agricultural resources. Thus promoting sustainable land use and management is one of the issues that the agricultural policy seeks to address.

The policy recognises that climate change effects are adversely impacting agricultural productivity and sustainability of farmer livelihoods. It recognizes that ensuring sustainable use and management of agricultural resources requires among others, developing capacity (at all levels) for planning and implementation of activities to address climate change and its impact on agriculture. Nonetheless, the agricultural policy does not comprehensively mainstream climate change. There is thus need to review the policy and climate proof it, so as to guide climate smart agricultural systems. The Policy review should also

⁶⁷ Republic of Uganda, 2008. Prosperity for All Policy: Tackling Poverty at Household Level

address agro-ecological zoning; to encourage farmers to grow specific crops, based on the suitability of the agro-ecological zones they live in. In addition, the zoning should be reviewed to take into account the current and future impacts of future climate change on the agro-ecological zones and their suitability to specific crops/animals.

4.3.2.4 National Coffee Policy

Coffee remains the most important commercial agricultural commodity and the major foreign exchange earner and has been contributing an annual average of 20% of Uganda's total export revenue for the last ten years. The **National Coffee Policy (2013)** was developed to guide and regulate activities of various stakeholders in the coffee industry; so as to improve production, roasting, processing and marketing of coffee. The policy seeks to, among others, increase coffee production and productivity at farm level in a sustainable way that addresses the social, ecological and economic dimensions and to support and strengthen coffee farmer organizations to participate effectively in all the stages of the coffee value chain.

The policy recognizes that climate change has implications on changing production patterns and increased incidence of pests and diseases. However, the policy mostly focuses on interventions for overall commercial and environmental sustainability, but does not explicitly address adaptation to climate change and the need for promoting a climate smart coffee sector. There is thus need to review the policy, with a view to mainstream climate change and specifically taking into account global best practices of coffee farming, such as supporting and promoting the use of multipurpose shade trees in the context of climate change, making sure that the species selected do not harbor pests, and taking into account climate change impacts on coffee value chains; so as to build climate resilient coffee values chains.

4.3.2.5 National Fisheries Policy

The **National Fisheries Policy (2003)** provides for decentralization and co-management of the fisheries resources, with the relevant local stakeholders; including the poor. As a mechanism to involve local ecosystem managers – the fisher communities, 12 Beach Management Units (BMUs) have been established, and legal powers have been delegated to these units; to plan and manage the fisheries resources. The BMU approach seems to be yielding results in fostering sustainable fisheries management, for a number of reasons:

1. the BMU committees are democratically elected by all local stakeholders;
2. representation of the poor and women is guaranteed;
3. they have a clear mandate, a situation that facilitates collaboration with local authorities; and
4. a national network of BMUs has been established, creating avenues for local capacity building and exchange of information.

But most importantly, for poverty reduction, BMUs involve the exploited poor fishing crew (locally referred to as *barias*) in the decision making process, and provides avenues for improving their livelihoods. The goal of the fisheries policy is “to ensure increased and sustainable fish production and utilization by properly managing capture fisheries, promoting aquaculture and reducing post-harvest losses”. The policy specifies that fisheries will be managed and developed to promote socially, economically and environmentally sustainable use and development of the resources so as to meet the needs of present generations without compromising the ability of future generations to meet their needs. It also states that adverse environmental impacts on fisheries will be minimized and that mechanisms will be established at appropriate levels to achieve this. The policy states that research will include scientific, biological, social and economic investigations to improve decision-making at all levels for effective fisheries management,

development, and utilization. Although the foregoing are climate change related and one could say that adaptation issues are implied in the policy, climate change is not mentioned in the policy. Under the MAAIF's DSIP, the government focuses on strengthening controls of illegal fishing, promoting and supporting aquaculture and cage farming—especially of tilapia (currently at negligible levels but with clear potential for export to neighbouring countries), and stocking small water bodies, including dams. Emphasis will also be placed on ensuring fish quality at all levels.

With climate change, reduction in water levels will lead to decline in fish stocks and other aquatic resources. To reverse the decline of the fishing industry, interventions are urgently required to stop illegal activities and to exploit existing opportunities. The fisheries policy needs to be reviewed to promote and encourage climate change resilient fishing practices.

4.3.2.6 Food and Nutrition Policy

The **Food and Nutrition Policy (2003)** is intended to ensure that the entire food chain, from production to consumption, is efficiently managed within the overall development strategy, through building capacities at all levels for adequate action to improve household food security. However, the policy contains limited discussion on the relationship between food security and climate change; most especially building climate resilient food value chains and hence needs to be reviewed.

4.3.2.7 Draft Rangeland Policy

Uganda's Draft Rangeland Policy recognises overgrazing and overstocking as the major causes of rangeland degradation. Other causes are uncontrolled fires during the dry season, flooding, drought, invasive species, erosion and harvesting of wood for charcoal, fuel wood and timber. There is increasing threat of agricultural (cropping) expansion into areas that were hitherto considered suitable for livestock rearing and this is mainly due to increasing human population. Poor land management practices such as draining of wetlands is also contributing to rangeland degradation. Species loss, due to ecological and human factors, is on the rise and this may affect the capacity of Uganda's rangelands to continue providing the expected ecosystem services.

Bush encroachment and spread of invasive plant species is affecting rangeland and forest ecosystem in Uganda. Bush encroachment in rangelands has been mainly caused by overgrazing and rearing of large herds of livestock. This is because overgrazing leads to reduced fuel load and consequently makes fire less intense thus less damaging to trees and eventually results to increased woody vegetation in the rangelands. Bush encroachment leads to suppression of green grass biomass production and, thus, the rangeland's grazing capacity for livestock.

4.3.3 Other policies related to agriculture

4.3.3.1 The Land policy

Land is Uganda's prime and critical asset in development; and thus a central issue in the country's policy and development context. The way it is used and managed will play a key role in the achievement of Uganda's vision 2040. With agriculture continuing to be a sector of strategic importance for Uganda's socio-economic transformation, improving land use and management constitutes a key development priority and a determinant of Uganda's aspiration to become an upper-middle income country by 2040.

The Uganda National Land Policy 2013 vests land in the citizens of Uganda and the State exercise residual sovereignty over all land on behalf of and in trust for the citizens of Uganda. The policy envisions a transformed Uganda society through optimal use and management of land resources for a prosperous and industrialized economy that has a developed services sector. The goal of the policy is to ensure efficient, equitable and optimal utilization and management of Uganda's land resources for poverty reduction, wealth creation and overall socio-economic development. Among other things, the policy seeks to re-orient the land sector in national development, by articulating its centrality vis-à-vis other sectors in economic development.

The Land Policy also seeks to address the disparities in ownership, access to and control of land by vulnerable groups; displacement, land grabbing and landlessness resulting from high population growth and the increasing demand on land for investment, particularly the communal lands that are neither demarcated nor titled. The policy also provides for incentives to enhance land utilisation for development and discourages the practice of holding large tracts of land for speculative purposes, while serious developers or landless people are without access to land. It also re-focuses attention from an over-emphasis on property rights per se to the essential value of land as a resource in development, recognizing that the protection of property rights over land and its efficient use have to go hand in hand. Other issues addressed by the land policy include underutilization of land due to poor planning and land fragmentation, environmental degradation and climate change, poor management of the ecological systems due to their trans-boundary nature and unsustainable exploitation arising out of the conflicting land uses and inadequate enforcement of natural resources management standards and guidelines.

Climate change is fairly mainstreamed in the Land policy. For example, the policy prioritises (i) the need for sustainable utilization, protection and management of environmental, natural and cultural resources on land for socio-economic development; ii) supporting planned, environmentally friendly, affordable and orderly development of human settlements for both rural and urban areas, including infrastructure development; iii) promoting integrated land use planning and management, with a view to achieving coordination among various sectoral land use activities; iv) recognizing that climate variability and change impacts (droughts, desertification and floods) hamper the realization of Uganda's development goals; (v) planning for adapting and mitigating of climate change and complying to international climate change agreements.

4.3.3.2 National Environment Management Policy

Land degradation is a major threat to agricultural productivity in Uganda. Agricultural practices are already having an impact on Uganda's natural ecosystems and this is undermining the delivery of ecosystem services. Moreover, ecosystem services are crucial for agricultural production and the encroachment of cultivation into natural ecosystems is itself severely undermining the sustainability of agricultural growth.

Uganda has put in place policies to ensure sound environment management. The **National Environment Management Policy (1995)** seeks to promote a development that enhances environmental quality and resource productivity on a long-term basis to meet the needs of the present generations, without compromising the ability of future generations to meet their own needs. Implementation of the policy involved, among other actions, enacting a number legislative instruments, including regulations on Environment Impact Assessment (EIA); Standards for Discharge of Effluent into Water or on land; regulations on waste management; management of hilly and mountainous areas; regulations on wetlands, river banks and lakeshore management; minimum standards for management of soil quality; and management of Ozone Depleting Substances and Products (ODSs), among others. All these legal instruments are initiatives to protect the environment and enhance certain basic services derived from ecosystems. Many of these regulations, however, remain largely ineffective mainly due to institutional

capacity weaknesses and lack of political will. For instance, degradation of river banks continues to cause siltation of the rivers, especially River Nile, which is a trans-boundary environmental resource; and so is the cultivation of steep hills and mountainous areas and wetlands, which have been encroached as a result of dwindling arable land in the wake of unprecedented population growth and acute land degradation.

Although climate change has an impact on sustainable environment and natural resources management, the environment management policy was developed before climate change emerged as a serious challenge. As a result, climate change is mentioned only once in the guiding principles and there are no specific policy interventions that address climate change. The policy is currently being reviewed and this provides an opportunity for climate proofing it.

4.3.3.3 National Policy for the Conservation and Management of Wetland Resources

The Wetlands Policy (1995) and the Wetlands Sector Strategic Plan (WSSP) 2011-2020, recognize the importance of wetlands as sources of essential goods and services (food, incomes, water, and aesthetic beauty) to local populations. Wetlands provide a large array of ecosystem services to the population and the system of interconnected wetlands plays a crucial role at a regional level by filtering pollutants and regulating water flows (influencing groundwater recharge, flood impacts, and water availability during the dry season). Wetlands can act as a reservoir to store carbon dioxide and mitigating climate change impacts. Wetlands are vulnerable to climate change but they also play a critical role in mitigating climate change and building resilience to climate change impacts.

In accordance with the RAMSAR convention, the GoU has adopted the wise use approach. By the nature of the wide public goods and services, wetlands have varied stakeholder interests. In this respect, the National Environment Act and the Land Act 1998 entrusted all wetlands into the hands of the state to ensure their protection and wise use; which is aimed at harmonising the multiple interests. These efforts notwithstanding, wetlands continue to face immense pressure from expanding populations and dwindling productive land.

Uganda's wetland policy was also developed when climate change was not yet recognised as an apparent challenge. Consequently, the policy does not specifically highlight climate change anywhere. Building climate resilience in the agriculture sector requires reviewing and enforcing the wetland policy to further prevent wetland degradation and encroachment.

4.3.3.4 Water Policy

Water is essential for all forms of life. Water is vital for agriculture, livestock, household needs, fishing, energy, mining, manufacturing and a range of other services. Climate change is already affecting water availability, quality and security across Uganda and this affects agricultural production.

The **National Water Policy, 1995** provides a framework to support management of Uganda's water resources in an integrated and sustainable manner, so as to secure and provide water of adequate quantity and quality for all social and economic needs of the present and future generations; with participation of all stakeholders. The policy addresses among other actions, formation of water committees; Local Governments partnering with user groups in operating, maintaining and managing water systems and protection of natural resources with assistance of extension staff. The Policy is relevant to climate change as it provides guidance on the orderly development and use of water resources to minimise harmful effects to the environment and establishes responses to emergencies such as droughts and floods. At the time the policy was developed, climate change issues were not prominent. However, the policy establishes responses to emergencies such as droughts and floods, which are integral to adaptation.

The MWE has developed a ***Water for Production Strategy and Investment Plan 2010 – 2035*** and the ***Draft National Irrigation Master Plan***; which are aimed at promoting the use of water in agricultural production through supporting farming system diversification, private investment in bulk water infrastructure; service delivery and more Public-Private Partnerships. These two plans are relevant to climate change as they enhance resilience to droughts.

Generally speaking, the water policy and regulatory framework needs to be reviewed to make it climate change relevant. Climate proofing the policy will enhance its direction to enhance climate change resilient water supply systems, including: promotion of rain water harvesting techniques at household and institutional levels; water catchment management; supporting small scale irrigation technologies; and developing and maintaining an appropriate stock of water infrastructure (dams, water pans, supply lines).

4.3.3.5 Forest Policy

Uganda has accommodated its fast-growing population by increasing the proportion of land used for agriculture; including converting forest land into agricultural land. In addition, biomass energy (firewood and charcoal) accounts for more than 90% of Uganda's energy needs. The demand for biomass energy has also contributed to deforestation and land degradation. Uganda's forest cover is estimated to have been reducing at a rate of 2% per annum in the last 20 years (MWE, 2013).

Uganda's **National Forest Policy, 2001** aims at conserving Uganda's rich forest biodiversity to meet the needs and aspirations of present and future generations. The policy emphasises watershed management and soil conservation, all of which contribute to sustainable land management. The policy is also in conformity with the various national policies, plans and strategies. Uganda has developed a National Forest Plan 2011/12 - 2021/22 (MWE, 2013) aimed at: (i) increasing forest cover to the 1990 levels (24% of Uganda's land area), (ii) raising incomes for households through forest-based initiatives, and (iii) restoring and improving ecosystem services derived from sustainably managed forests.

The Forestry Policy particularly emphasises the promotion of private investment in forestry activities. The Sawlog Production Grant Scheme (SPGS) funded by the EU has invested enormous amount of funds and technical resources to facilitate commercial wood plantation development on private land and public forest reserves. This incentive-based scheme has received good attention, including planting on private land. Wood production (timber, firewood) has been boosted; and the establishment of forest plantations has also generated opportunity for environmental services (notably carbon sequestration).

The Forest policy emphasizes watershed management and soil and water conservation, all of which contribute to climate change resilience. It promotes community forestry, addresses the concern of forests on private land and government land. The policy also promotes commercial forestry, collaborative forest management, farm forestry, forest biodiversity conservation, urban forestry, and supply of tree seed and planting material; which contribute to climate change adaptation and mitigation. Again, the policy was developed before climate change came to the forefront and climate change is not highlighted in the policy statement.

4.3.3.6 Uganda Strategic Investment Framework for Sustainable Land Management 2010-2020

The GoU recognizes land degradation as a major impediment to sustainable growth in agriculture, natural resources productivity, and national economic development. In addition, it is recognized that land degradation threatens to significantly undermine the future productivity and growth in the agriculture and forestry sectors in Uganda. To that end, the GoU has put in place a ***Strategic Investment Framework for Sustainable Land Management 2010-2020*** whose purpose is "to upscale sustainable land management (SLM) practices across sectors programmatically and to avoid duplication across stakeholders and sectors.

The strategic framework is expected to tap into synergies across sectors and promote sharing of common baselines, knowledge and monitoring and evaluation.” The Strategic Investment Framework (SIF) is cross sectoral; covering agriculture, environment and natural resources, energy, lands and settlements, and trade sectors.

The SIF is climate change relevant and its development objective is ‘to strengthen sector cooperation in order to halt, reverse and prevent land degradation/ desertification and to mitigate the effects of climate change and variability. The SIF targets to: i) raise crop and range productivity; ii) reduce deforestation; iii) secure ecosystem services such as water filtering, biodiversity, and carbon storage; and (iv) improve rural livelihoods. It is important these targets are integrated in sectoral policies in agriculture, water, forestry, wetlands, energy and trade policies.

4.3.4 Climate change policy framework

4.3.4.1 Global and regional commitments

At the global level, Uganda is a signatory to both the UNFCCC and Kyoto Protocol. By being a signatory, Uganda has obligations to address climate change challenges through climate change policy formulation and implementation. Uganda is also a member of the East African Community (EAC) which put in place the EAC climate change policy in 2010, and all member countries (Uganda inclusive) are obliged to implement it by putting in place national climate change policy frameworks and mainstreaming climate change in national development plans and sectoral policies and plans. Responding to commitments under Article 4 and 12 of the UNFCCC, Uganda developed and submitted the Initial National Communication (INC) to UNFCCC in 2002 and the Second National Communications in 2014, comprising of a national GHG inventory system, vulnerability and adaptation to climate change, and recommendation for adapting and mitigating climate change.

The UN established NAPAs to build the capacity of developing nations to identify short-term priority climate change adaptation, so as to reduce their vulnerability to climate change impacts (<http://www.napa-pana.org>). In conformity to commitments to UNFCCC, Uganda developed and submitted its NAPA to UNFCCC in 2007. The NAPA, presents a list of nine priority projects including: community tree growing, land degradation management, meteorological services, community water and sanitation, water for production, drought adaptation, pest and disease control, indigenous knowledge in natural resource management, climate change and development planning; all at a cost of approximately USD 40 million. The NAPA projects were implemented in four areas:

- (i) Apac district, addressing sanitation and deforestation;
- (ii) Bundibugyo district, addressing soil erosion and deforestation;
- (iii) Nakasongola district, addressing food insecurity and drought; and
- (iv) Pallisa district addressing soil degradation and pests and diseases.⁶⁸

4.3.4.2 National Climate Change Policy Framework

Article 39 of the Constitution of the Republic of Uganda (1995) guarantees the right of every person in Uganda to a clean and healthy environment. Article 245 states that “Parliament shall, by law, provide for measures intended: (a) to protect and preserve the environment from abuse, pollution and degradation; (b) to manage the environment for sustainable development; and (c) to promote environmental awareness”. To that end, the constitution, in an indirect way, caters for climate change. Catering for the right to a clean

⁶⁸ Africa Climate Change Resilience Alliance (ACCRA), 2014. The NAPA Experiences in Uganda (supported by CDKN).

and healthy environment requires, among other actions, promoting climate smart development and the critical starting point is formulation of climate change policy, followed by integrating climate compatible development interventions the national development planning processes. In order to guide the systematic and coherent implementation of public policy, government has put in place a national planning framework for defining its priorities and resource allocation modalities⁶⁹. The country's guide to policy development and management emphasizes that ministries, departments and agencies should conduct a range of impact assessments, including Environmental Impact Assessments, Social Impact Assessments, and Poverty Assessments. Such assessments can include climate change.

As already mentioned in the introduction, the first NDP indicates that climate change will affect the national economy and hence addressing the challenges of climate change is crucial to enhancing sustainable economic and social development. NDP II has integrated climate change response actions. The Uganda Vision 2040 indicates that achievement of the long-term goals depends on opportunities and resources that are climate sensitive, including agriculture.

4.3.4.3 National Climate Change Policy, 2015

Uganda has developed a National climate Change Policy (NCCP)⁷⁰ approved by Cabinet in April 2015. The goal of the NCCP is 'to ensure a harmonized and coordinated approach towards a climate-resilient and low-carbon development path for sustainable development in Uganda'. The overarching objective of the policy is 'to ensure that all stakeholders address climate change impacts and their causes through appropriate measures, while promoting sustainable development and a green economy'.

The NCCP, with a Costed Implementation Strategy, gives policy direction and guidance on the institutional arrangements needed to comprehensively address climate change challenges. The Policy also provides direction for the key sectors that are and/or likely to be affected by climate change to facilitate action on climate smart development. Importantly, the policy also provides a framework for ensuring coordinated action, with adequate attention paid to capacity development and climate financing mechanisms. The specific objectives of the NCCP are to:

1. Identify the top-priority adaptation and mitigation issues for Uganda;
2. Support appropriate awareness raising, information exchange, capacity building and technology transfer in addressing climate change;
3. Support the integration of climate change issues into planning, decision making and investments in all sectors and trans-sectoral themes;
4. Support research and the dissemination of scientific information and innovations on climate change;
5. Develop and implement appropriate climate change adaptation strategies;
6. Develop and implement appropriate climate change mitigation strategies; and
7. Facilitate the mobilisation of financial resources to address climate change in Uganda.

The policy is not meant to replace sectoral policies, but rather to provide a framework for the harmonisation and coordination of the various sectoral efforts, already underway and to be put forth in the future. At the core of the NCCP is the recognition that climate change is fundamentally a multi-sectoral issue, and that all sectors and categories of stakeholders must therefore be actively involved during the implementation of the policy. This especially calls for mainstreaming climate change concerns in the relevant sectoral, national and local policies, plans and budgets.

⁶⁹ GoU, 2009. *A Guide to Policy Development and Management in Uganda*. Cabinet Secretariat, Office of the President. Kampala, Uganda.

⁷⁰ Republic of Uganda, 2015. National Climate Change Policy for Uganda. Ministry of Water and Environment.

Agriculture is one of the priority sectors in NCCP and Implementation Strategy: The policy priorities for adaptation in the agriculture sector emphasize (i) promotion of climate change adaptation strategies that enhance resilient, productive and sustainable agricultural systems; and, (ii) promotion of value addition and improving food storage and management systems to ensure food security at all times, as a factor of resilience. The Specific strategies for addressing policy priorities for adaptation in agriculture include:

- i) Promoting and encouraging highly adaptive and productive crop varieties and cultivars in drought-prone, flood-prone and rain-fed crop farming systems;
- ii) Promoting and encouraging highly adaptive and productive livestock breeds;
- iii) Promoting and encouraging conservation agriculture and ecologically compatible cropping systems, to increase resilience to the impacts climate change;
- iv) Promoting sustainable management of rangelands and pastures, through integrated rangeland management, to avoid land degradation and deforestation;
- v) Promoting irrigated agriculture by encouraging irrigation systems that use water sustainably;
- vi) Promoting and encouraging agricultural diversification, and improved post-harvest handling, storage and value addition, in order to mitigate rising climate related losses and to improve food security and household incomes;
- vii) Supporting community-based adaptation strategies through stretched extension services and improved systems for conveying timely climate information to rural populations to enhance the resilience of agricultural systems to the impacts of climate change; and
- viii) Developing innovative insurance schemes (low-premium micro-insurance policies) and low-interest credit facilities to insure farmers against crop failure due to droughts, pests, floods and other weather-related events.

4.3.4.4 Meteorology Policy

Uganda's meteorology policy seeks to promote, monitor weather and climate, maintain a climate database, provide regular advice on the state of weather and climate and provide accurate and timely climate and weather information to various stakeholders. The policy is climate change compliant, since it recognizes the need to improve the accuracy and reliability of weather forecasts and advisory services to customers, through the development of climate predictions and short-term weather forecasting capacities. **The Uganda Meteorology Act (2012)** led to the creation of the Uganda National Meteorological Authority (UNMA).

Interventions by the UNMA prioritizes mitigation of social and economic impacts of natural disasters, promotion of the use of meteorological data and information for social and economic activities, promotion and enhancement of the quality of the environment, and monitoring and provision of warnings about adverse weather conditions. The major challenges faced by UNMA are shortage of skilled human resource, inadequate funding, inadequate infrastructure, inadequate equipment, low levels of awareness among the public on use of meteorological data and wrong interpretation. There is need to increase funding to the UNMA to recruit, train and remunerate staff and acquire appropriate weather monitoring data collection, analysis, storage, and management equipment and systems.

4.3.4.5 Disaster Preparedness and Management Policy

Uganda put in place a **Disaster Preparedness and Management (DPM) Policy (2010)**. The policy goal is "to establish institutions and mechanisms that will reduce the vulnerability of people, livestock, plants and wildlife to disasters in Uganda". The policy focuses on risks, including those related to climate hazards (especially droughts, floods and landslides). The DPM policy identifies policy actions to make agriculture less vulnerable to extreme weather events and offers a number of specific interventions to achieve this goal. Climate change is among the policy's guiding principles and it recognizes the importance of

addressing climate change issues and the need to develop adaptation and mitigation measures. However, the linkages between climate hazards and climate change are not clearly addressed.

4.3.5 Barriers to successful climate change policy implementation

Overall, Uganda's policy formulation process is inclusive and consultative and the climate change policy framework is adequate. In addition, Uganda's decentralized governance structure, at least in theory, leverage funds to respective local government level sectors for further decision-making and policy implementation. Such a structure, if well implemented, provides opportunities for local level participation in decision-making on climate-related issues. It also gives local governments responsibility to address planning, developmental and environmental issues. This is important, since local-level planning is key in generating uptake of climate change adaptation practices. However, a number of challenges undermine effective policy implementation.

1. **Overlapping mandates:** At the national level, the reviewed policies demonstrate need for stronger cross-sectoral coordination and accountability, as there are overlapping mandates between sectors. For instance, the National Environment Policy seeks to promote land stewardship through strengthening land and resource tenure rights, while the Land Policy pursues the same objective. Such overlaps sometimes miss out on synergies between sectors, which could lead to a situation whereby none of the sectors is accountable or some conflicting goals and outputs.
2. **Limited technical capacity:** There is limited technical capacity among national level staff in some sectors and thus there is need for more technical, climate-knowledgeable staff members to support policy formulation and implementation. Technical expertise is also lacking at the local government levels. District- and sub-county officials lack knowledge to translate climate change issues into locally appropriate and adaptive practices and actions. This constrains efforts to mainstream climate change issues in planning and budgeting right from the local levels.
3. **Institutional coordination:** Some of the policies and plans from the various governmental sectors are not aligned or coordinated. For example, the National Agriculture Policy acknowledges the effects of climate change on agriculture and highlights the significance of joint planning between MAAIF and MWE. However, up to now there is no deliberate mechanism on how specific activities can be coordinated to jointly address the impacts of climate change on agriculture. MWE, as the focal point for UNFCCC has the mandate to coordinate mainstreaming of climate change by different sectors. Its mandate includes monitoring how climate change is mainstreamed across different sectors and coordinating national climate related initiatives. However, the coordination faces a challenge of limited equipment and low staffing by the Climate Change Department (CCD), which is the lead agency for climate change issues.
4. **Skewed budget allocations:** Climate change related sectors, including agriculture, natural resources and land management received the least proportions of the budget while education and roads received the highest allocation of funds. The disparity of budget allocations demonstrates to some degree a limited commitment to sectors highly vulnerable to climate change, and subsequent implementation of much needed adaptive activities. As a result, a number of climate initiatives at the national and local levels remain unimplemented.
5. **Limited policy literacy at local levels:** There is little awareness and knowledge of development and implementation of climate change mainstreamed policies and plans. At the local level, the language barrier is one of the serious concerns since policies are most often documented in English and not translated into local dialects.

6. **Little attention to local contexts:** National policies do not often consider include community-level social, cultural, environmental and economic challenges and contexts. For example, the land policy proposes formalization of land held in customary tenure, without taking into account the socio-cultural interpretation of land ownership, control, transfer or the historical perspectives and consequences of the land tenure. The National Agricultural Policy also has limited considerations for the local context. The Policy aims at “transforming subsistence farming to sustainable commercial agriculture”. However, farming at the local community level is mainly carried out at small-scale, by women and other family members, with limited labor and financial capacity to conduct commercial farming. Local levels should be equipped with information about climate change issues, such as climate impacts and adaptive measures, and how these affect different agro-ecological zones and specific farming communities. The local knowledge is key in ensuring policies are adapted to various local social and cultural contexts.

5 Adaptation Actions

5.1 Introduction

Overtime, the Government of Uganda has been addressing some climate change impacts, especially drought and floods. However, the interventions have been mainly geared towards disaster risk reduction, humanitarian action, preparedness and response actions. In the agriculture sector, the adaptive capacity of smallholder Ugandan farmers is low due poor socio-economic circumstances, harsh biophysical environments, inadequate technology, and poor infrastructure. Climate smart agriculture is not commonly promoted by government agencies and local farmers. Though a few elements of climate smart agriculture exist, they are being implemented in piecemeal; with many of the technologies designed with the primary purpose of increasing production, instead of protecting the natural resource base and building climate resilience.

As agriculture becomes more vulnerable to the impacts of climate change and future climate change risks and vulnerabilities are expected to increase; efforts are needed to enhance climate smart agriculture so as to ensure food security, livelihood improvement, eradication of poverty to achieve sustainable development and the Vision 2040 goals. This chapter provides proposed adaptation actions for the agriculture and related sectors, with examples¹ of ongoing efforts.

5.2 Vision and Objectives

5.2.1 Vision and mission

The vision of the agriculture sector NAP in Uganda is: **"A climate resilient and sustainable agricultural sector contributing towards achievement of the Uganda Vision 2040"**

The mission of the agriculture sector NAP is: **"To reduce vulnerability and enhance adaptive capacity of Uganda's agricultural sector to the impacts of climate change in order to achieve sustainable agricultural development"**.

Vision and Mission

In line with its mandate (to promote and support sustainable and market oriented agricultural production, food security and household incomes), MAAIF is making commitments through the NAP to integrate climate change adaptation, and specifically climate smart agriculture, in the agricultural development and the sector's internal functioning. This is intended to promote a climate resilient and sustainable agricultural sector for increased agricultural production, food and nutritional security, improved rural livelihoods, poverty reduction and sustainable development. Although climate resilient actions are implemented at the local level and in communities and households, the Ministry must take the lead not only through policy and planning but also be an example, acting first where it has responsibilities and on its own impacts. By climate proofing its policies, plans, strategies and internal functions, MAAIF will hold other agencies, local governments and the population to understand the meaning of adaptation planning and contributing by showing a concrete example.

A specific governance arrangement coordinated by the MAAIF climate change task force is designed to involve all the stakeholders and to mobilize the staff of MAAIF in the implementation and the continuous improvement of the NAP.

5.2.2 Objectives of the NAP

The overall objective of the agriculture sector NAP is to increase the resilience of Uganda's agricultural sector to the impacts of climate change, through coordinated interventions that enhance sustainable agriculture, food and nutritional security, livelihood improvement and sustainable development.

To achieve the broad objective, MAAIF shall pursue the following specific objectives:

1. Promote climate resilient cropping systems and value chains.
2. Promote climate resilient livestock production systems and value chains.
3. Promote climate resilient fisheries and integrated fisheries resource management.
4. Strengthen climate information, early warning and disaster preparedness mechanism for a better informed agricultural planning and decision making.
5. Promote sustainable natural resources management that enhances the resilience of agriculture and agrarian communities to a changing climate.
6. Promote climate smart agricultural research and innovations
7. To enhance knowledge of good practices and partnerships to reduce vulnerability of the agricultural sector to the impacts of climate change
8. Promote a gendered climate smart agriculture programme to reduce the vulnerability of women, youth and other groups

5.3 Guiding principles

The MAAIF Climate Change Task Force has developed a set of guiding principles for the National Adaptation Plan, to foster sustainable development. The principles serve two important purposes. First, they reflect the Task Force's understanding of the impacts and opportunities associated with climate change in Uganda. Second, the principles identify the values that inform the NAP and provide guidance for *how* the Adaptation Plan's goals and strategies can best be achieved. Therefore, the guiding principles reflect both what the Task Force has learned through the planning process, and the values it believes should be carried forward in implementation.

Climate change is a growing concern for Uganda's agricultural development

The Task Force recognizes that there is evidence that climate is changing in unprecedented ways, mainly resulting from human activity. Climate change, particularly through extreme weather events (droughts and floods), is already impacting farmers and their ability to plan. Climate change is also creating greater uncertainty about the future of agricultural development and an increasing need for more accurate and reliable climate information, as well as early warning and disaster preparedness systems.

Current information and data is insufficient

Although, over the last decade, a foundation of knowledge has been built in MWE, MAAIF and other institutions, that has facilitated the development of this NAP, one of the Task Force's important messages is that practical information and data to guide decision making on climate change is still scanty. This is particularly more insufficient with local governments, community and farm level. Data systems are needed that are relevant, timely, accurate and adequately supported. Continuing to build knowledge and improve data collection is a primary focus of the NAP.

A national food security strategy is required

While this NAP supports the agriculture sector in addressing many challenges and opportunities associated with the impacts of climate change, there are issues that fall beyond its scope. The NAP will be most effective if adopted as part of a comprehensive national food and nutritional security, strategy, which

supports the development and maintenance of a sustainable and secure food system in the context of a changing climate.

Increasing agricultural production capacity is needed

Climate change is anticipated to affect global food systems by resulting in: food shortfalls, altered trade patterns, population migrations and growing interest in more secure local food supplies. Within this context, the declining food production capacity and lack of processing capacity is not acceptable. Rather, Uganda must seek to expand its capacity for food production, build agricultural production and processing infrastructure and develop expertise to serve local and regional markets and to diversify agricultural products.

Prioritized actions based on risk

The NAP employs a risk-based approach to recognize uncertainty, and prioritize actions according to the most urgent and severe risks. A participatory method was used to combine the complexities of climate science with local expertise and priorities in order to ensure that higher priority risks are identified and more effectively managed through actions and investments.

Reducing dependence on rainfed and traditional agriculture

Traditionally, farming practices in Uganda are characterised by rainfed agriculture, extensive use and rapid depletion of land and the limited use of other inputs such as fertilisers. Uganda must shift from reliance on rain fed agriculture, agricultural growth driven natural factors and the extension of land under cultivation to integrated irrigation farming and using the limited land more efficiently through use of modern inputs, higher-value crops, and soil conservation measures; among other strategies.

No-regrets actions

Given the uncertainties of climate projections and impacts on crops and livestock, the NAP focuses on no-regrets actions. The status will be maintained until a strong base of evidence for more informed agricultural decision making that considers climate change is set up.

Increase competitiveness of Uganda's agricultural products

Actions or strategies that reduce the economic viability or competitiveness of Uganda's agriculture will not improve the environmental or social health of the country. The sector is also characterized by limited value addition, which is attributed to poor post-harvest handling techniques, inadequate bulking and storage facilities, and high electricity costs. The NAP will be effective if it promotes value chain integration, increases competitiveness and enhances integration of agriculture into domestic, regional and international markets.

Decision-making is influenced by scale

While maintaining a national and pro-agricultural perspective, it must also be acknowledged that the impacts and opportunities associated with climate change vary according to different geographical factor, capacity and perspective. Responding effectively to climate change requires an understanding of the differing circumstances and time horizons applied at various scales of decision-making. While it is critical for policy development and sector-wide strategic planning to focus on long term and nation-wide strategic outcomes, the economics of agriculture dictate a focus on more immediate and localized outcomes. This means that strategies to support adaptation must take into account how community, household and farm level decisions are currently made and the need for regional and farm scale solutions. Likewise, factoring longer term outcomes into investment decisions may ultimately improve the viability of Uganda's agricultural production and businesses.

Success requires collective action

The NAP is based on the assumption that there is a continued need for the sector to act collectively. Due to its significant diversity, at any given moment in time, crops, livestock and agrarian communities in different areas of Uganda may be facing seemingly distinct climate change-related challenges. For some crops adapting to drought and reduced access to water supply may be the priority while for others it is floods, marketing, post-harvest handling and processing. In all cases, applying a strategic and coordinated approach strengthens the ability of the agricultural sector to respond effectively.

Need for continuous improvement

Adaptation Planning is a continuous process. Improving the situation of agriculture at national, local and community levels in the light of sustainable development objectives is about continuously improving the contents and implementation methods of the plan. This implies putting in place and improving tools that will help review, follow-up and assessment of the impacts of implementation of the NAP actions.

Partnerships are necessary

Due to the economic importance of agriculture and diversity of actors, the NAP emphasizes a need to build partnerships. In tackling the challenges associated with climate change, the Uganda agriculture sector cannot (and should not) act in isolation. There is immense potential benefit in cultivating partnerships with others interested in achieving similar outcomes; including across sectors, government MDAs, local governments, development partners, civil society and the private sector –. Therefore, there are many strategies and actions in the plan focused in strengthening partnerships.

Adaptation, while promoting mitigation co-benefits

Whereas the agricultural sector NAP focuses on climate change adaptation, it should be noted that some actions have a mitigation aspect. This re-affirms the point that interventions with mitigation co-benefits and opportunities can also be considered as priorities as long as they promote climate smart agriculture.

5.4 Proposed adaptation actions

The priority adaptation actions presented in this chapter are based on the vulnerabilities described in Chapter 3. Stakeholders prioritised different adaptation actions for the agriculture related sectors (agriculture, livestock, fisheries, water, forestry and environment) during the NCCP development process providing a long list of priority actions. From the long list, some actions were prioritised for integration in the NDP II. The proposed adaptation actions are also in line with Uganda's Intended Nationally Determined Contribution (INDC)⁷¹ submitted to UNFCCC in October 2015. The INDC development process was very consultative and informed by the NCCP. These priority adaptation actions were further refined by the MAAIF Climate Change Task Force. The criteria used to develop a shorter list were:

- i) Urgency and ease of implementation in the short-term;
- ii) Compatibility with the NCCP adaptation actions;
- iii) Compatibility with the NDP II actions;
- iv) Compatibility with the INDC priority actions, and;
- v) No regret and low-regrets option if implemented.

⁷¹ Ministry of Water and Environment, 2015. Uganda's Intended Nationally Determined Contribution (INDC). Submitted to UNFCCC in October 2015.

In the completion process of this sector NAP the actions presented in this chapter have been subjected to further scrutiny by the MAAIF Climate Change Task Force. The actions are grouped into the macro adaptation actions, which have possible sub-actions listed alongside them; current ongoing projects; timeframe; budgets and proposed implementing agencies. The budgets are estimates, derived from different sources, which include the NCCP, current sector spending, the Medium Term Expenditure Frameworks and the adaptation costing for different adaptation activities; carried out during the development of the NCCP implementation strategy process.

During the formulation of Local Adaptation Plans, Districts should be encouraged to identify their priority actions from the actions presented herein and customise them to suit their local context after conducting risk/vulnerability assessments. Districts can also include adaptation actions not listed in the national priority list as long as they are in line with their District Development Plan (DDP) priorities and do not lead to maladaptation.

It should be noted that the actions proposed are meant to complement or upscale other adaptation actions that are ongoing through various projects and programmes being implemented by the national and local governments, civil society, private sector and academia and not duplicate ongoing efforts.

5.4.1 Crop Production

Objective:

Promote climate resilient cropping systems and value chains.

Summary:

Crop production contributes about 12.4% of the Uganda's GDP; supports smallholder farmers, contributes to food and nutritional security and delivers foreign exchange earnings. The agricultural crop sub-sector, however, is very climate sensitive and is negatively affected by current climate variability (e.g. drought, flooding, erratic and intense rainfall); leading to reduced productivity and insecure livelihoods. Negative impacts are also projected under future climate scenarios for many parts of the country, while some agricultural areas and products are projected to improve. Promotion of sustainable climate smart agriculture is key to making the sector more resilient to the impacts of climate change.

Action 1	Promote and encourage highly adaptive and productive crop varieties and cultivars in drought-prone, flood-prone and rain-fed crop farming systems
Ongoing Projects	<ul style="list-style-type: none"> • Support for Tea and Cocoa Project • Vegetable Oil Development Project - Phase 2 (Supporting supply of highly adaptive oil crops (Sunflower, Palm Oil, Soya beans etc) • Rice Development Project (generation dissemination of adaptive rice varieties with support from JICA) • Agriculture Cluster Development Project (increased farmer yielding technologies and varieties) • Commercialization of Agriculture in Northern Uganda • Agriculture Technology Transfer (AGITT) Cassava Value • Water Efficient Maize (WEMA) research project
Gaps/challenges	<p>Awareness, capacity building and finance</p> <p>Inadequate Pest and Disease tolerant and resistant varieties</p> <p>Counterfeit/fake inputs available on market</p> <p>Limited access to timely climate and weather information</p>

	Affordability of available climate related technologies by farmers
Detailed sub-actions - Short term	1. Conduct a crop vulnerability and suitability assessment in all agro-ecological zones of Uganda
	2. Conduct studies on climate resilient crop varieties and cultivars (early maturing and drought tolerant) in the different agro-ecological zones
	3. Conduct field trials and demonstrations of climate resilient crops and cropping practices
	4. Build capacity of nursery operators in all agro-ecological zones and support them to expand and improve quality of seedlings
	5. Build capacity of quality seed producers and support them to expand and improve the quality of seed
Detailed sub-actions - medium and long-term	1. Increase awareness on the need for and type of climate resilient crop varieties
	2. Scale up access to climate resilient crop varieties by farmers and communities in different agro-ecological zones
	3. Support farmer-researcher linkages for adaptive research, multiplication of improved varieties and technology transfer
	4. Increase timely access to quality agricultural inputs and their efficient use; including inorganic fertilizers.
	5. Establish linkages with the private sector on development and transfer of affordable technologies
Budget	USD 28,089,981
Responsibility	MAAIF, NARO, MoLG, Universities, LG, Civil Society and Private Sector
Action 2	Promote and encourage conservation agriculture and ecologically compatible cropping systems to increase resilience to the impacts of climate change
Ongoing Projects	<ul style="list-style-type: none"> • The Sustainable Land Management (SLM) Project • Climate Smart Agriculture Programme • Programme on Increasing Drought Resilience (by IGAD) • Sustainable Irrigated Rice Production in Eastern Uganda • Global Climate Change Alliance Project (GCCA)
Gaps	Awareness, capacity building and finance
Detailed sub-actions - short term	1. Identify and conduct field trials on climate resilient cropping practices in different agro-ecological zones of Uganda using conservation agriculture and related practices
	2. Conduct demonstrations of climate resilient cropping patterns in association with water management systems
	3. Identify and establish trials for high value, multipurpose tree crops and agroforestry systems
Detailed sub-actions - Long term	1. Promote and scale up climate resilient cropping practices appropriate for different ecological systems in the country
	2. Promote and scale up conservation agriculture practices such as agro-forestry and sustainable land management
	3. Promote appropriate climate smart agriculture technologies and practices
Budget	USD 13,014,701
Responsibility	MAAIF, MWE, MoLG, NARO, Universities, LG, Civil Society and Private Sector

Action 3	Strengthen water harvesting and irrigation farming to build resilience to droughts and floods
Ongoing Projects	<ul style="list-style-type: none"> • Irrigation Scheme Development in Central and Eastern Uganda Project - with support from JICA (still at design stage) • Heavy Earth Moving equipment for Labour Saving Technologies (to develop water harvesting infrastructure) • Construction/rehabilitation of valley dams and water tanks with complete abstraction systems for animal watering and for micro-irrigation systems; • Construction of strategic dams for multi-purpose use including irrigation • Promoting water harvesting technologies at household and community levels • NAPA pilot projects • Farm Income Enhancement and Forestry Conservation (FIEFOC) Project - involves rehabilitating and construction of 5 medium scale irrigation schemes with support from AfDB • Agriculture Cluster Development Project with support from the World Bank (irrigation development)
Gaps	Awareness, capacity building and finance
Detailed sub-actions - short term	1. Identify suitable sites for rainwater harvesting and agricultural water management schemes
	2. Train farmers/ household members in water harvesting and agricultural water management technologies
	3. Facilitate the construction of water harvesting structures at household and community levels
	4. Conduct studies on the irrigation potential and identify sites in various river floodplains and underground water sources for micro-irrigation systems
	5. Develop appropriate efficient small-scale irrigation technologies and packages
	6. Train extension workers on irrigation and water management technologies and impart skills to enable them undertake irrigation extension
	7. Undertake comprehensive management needs assessment of existing large-scale irrigation schemes
Detailed sub-actions - Medium to long-term	1. Train farmers and private sector in the installation, operation and maintenance of recommended irrigation technologies
	2. Disseminate and scale up appropriate efficient small-scale irrigation technologies and packages
	3. Construct water basins and pans
	4. Establish links to input and output markets and service providers of irrigation technologies
	5. Build capacity of water committees in watersheds to manage water for irrigation and other production purposes
	6. Support innovative paddy rice production techniques that can increase productivity, better manage water resources, and reduce GHG emissions
Budget	USD 54,652,627
Responsibility	MAAIF, MWE, MoLG, NARO, LG, Civil Society and Private Sector

Action 4	Promote and encourage agricultural diversification and improved post-harvest handling, storage, value addition and marketing
Ongoing Projects	<ul style="list-style-type: none"> • Agriculture Cluster Development Project (ACDP) • Commercialization of Agriculture in Northern Uganda Project • Agriculture Technology Transfer Project (AGRITT) • Agricultural Technology and Agribusiness Advisory Services (ATAAS) Programme • Agricultural Marketing Promotion and Regional Integration • Uganda Multi-sectoral Food Security Nutrition Project (UMFSNP)
Gaps	Awareness, capacity building and finance
Detailed sub-actions - short term	1. Promote diversification and integration of agricultural enterprises at all levels to spread climate risks
	2. Promote diversification of livelihoods through supporting of alternative off-farm and non-weather dependent enterprises and employment
	3. Invest in improved appropriate storage facilities (including those for bulk and long term storage) and technologies along the value chain
	4. Invest in improved post-harvest management to reduce spoilage and microbial risks.
	5. Rehabilitate existing warehouses and silos and establish public-private-partnerships management for long term food/grain storage and supply
	6. Strengthen the warehousing receipt system and link smallholder farmers to warehousing receipt system in the grain supply chain
	7. Train producers, processors and marketers in post-harvest management, preservation and long term storage of food and seed
Detailed sub-actions – medium to long term	1. Provide regular market information to improve distribution of agricultural commodities and food stuffs
	2. Develop and promote innovative micro-financing packages to facilitate food and cash crop farmers to access credit
	3. Facilitate establishment of marketing centres in rural areas, with the appropriate infrastructure
	4. Introduce and scale up technologies and practices for more efficient harvesting, drying and handling of crops
	5. Support private sector to invest in food processing as well as value addition, including packaging and branding
Budget	USD 19,688,406
Responsibility	MAAIF, MTIC, NARO, MoLG, LG, Civil Society and Private Sector
Action 5	Support community-based adaptation strategies through expanded and climate smart extension services
Ongoing Projects	<ul style="list-style-type: none"> • Regional Pastoral Livelihoods Resilience Project (RPLRP) • Agricultural Technology and Agribusiness Advisory Services (ATAAS) • Agriculture Advisory Services • Agriculture Cluster Development Project
Gaps	Awareness, capacity building and finance
Detailed actions - short to long term	1. Mainstream climate change into agricultural extension and community management

	2. Train and build the capacity of extension and community development workers to deliver climate smart agricultural technologies and practices.
	3. Strengthen platforms, through which small scale farmers can access agricultural information and extension services
	4. Promote innovation platforms that build on indigenous knowledge and partnerships along the commodity value chains
	5. Promote integrated crop-livestock systems to enhance community resilience to a changing climate
	6. Promoting pests and disease surveillance
	7. Empower communities to wisely use early warning information to enhance resilience
	8. Build capacity and equip extension service in delivery/ dissemination of climate smart agriculture technologies and practices.
Budget	USD 11,482,890
Responsibility	MAAIF, MWE, MoGLSD, MoLG, LG, Civil Society and Private Sector

5.4.2 Livestock Development

Objective:

Promote climate resilient livestock production systems and value chains.

Summary

Livestock production is a key component of the Ugandan economy, supporting pastoralists and agro pastoralists in the rangelands and semi-arid areas, and more especially in the cattle corridor, which occupies 51% of Uganda's total land area, is inhabited by 40% of the country's human population⁷² and accounts for almost 90% of the livestock herd in the country. Livestock rearing provides subsistence livelihoods, contributes to food security and generates some export earnings. The livestock sub-sector is very climate sensitive and is already experiencing negative impacts from current climate change challenges (e.g. drought, which leads to livestock morbidity and mortality). It is projected that conditions will worsen in some areas over time (e.g. where drought/flooding magnitude & frequency increases). However, conditions may improve in other areas where pastures adapt to the changes and humans take actions that enhance access to water for livestock.

⁷² Livestock Development Program, Preparation Report, Working papers 1 to 15. Agrisystems (Eastern Africa) Limited, Nairobi Kenya. MAAIF working Document dated 11 January 2002.

Action 1	Promote and encourage highly adaptive and productive livestock breeds
On-going projects	<ul style="list-style-type: none"> • Livestock Disease Control programme • Meat Export Support Services Project • Developing a Market Oriented Beef Industry Project • Rehabilitation and improvement of rangelands and grazing areas • Community mapping of land use in Karamoja • Global Climate Change Alliance Project II • Regional Pastoralism Livelihoods Resilience Project
Gaps	Financing, infrastructure, awareness, capacity building, regulation and enforcement
Detailed sub-actions - short term	1. Conduct climate change risk and vulnerability assessment for the livestock sector in all agro-ecological zones
	2. Increase awareness on climate change impacts on the livestock sub-sector and the need for highly adaptive livestock breeds
	3. Identify, pilot and introduce improved livestock and poultry breeds and management practices
	4. Expand community breeding schemes and artificial insemination services in various district centres
	5. Document and promote climate resilient indigenous livestock and poultry breeds and management practices
	6. Build local capacity in extension services related to breeding
	7. Mainstream gender in animal breeding interventions
Detailed sub-actions - Medium to long-term	1. Facilitate and support the acquisition of improved breeding stocks by men and women farmers
	2. Rehabilitate, restock and build capacity of livestock breeding centers to produce improved breeds of livestock for farmers
	3. Enhance selection and breeding of animals to increase adaptation to climate change
	4. Develop viable livestock breeding schemes
Budget	USD 32,900,993
Responsibility	MAAIF, NARO Research Institutes, Universities, Civil Society and Private Sector (Including UNFFE and UMPCU).
Action 2	Promote technologies for improved livestock feeds/ feeding and sustainable management of rangelands and pastures through integrated rangeland management
On-going projects	<ul style="list-style-type: none"> • Sustainable land Management (SLM) Project • Meat Export Support Services Project • Developing a Market Oriented Beef Industry Project • Climate Smart Agriculture Programme • Regional Pastoral Livelihoods Resilience Project (RPLRP) • Creation of Tsetse and Trypanosomiasis Free areas
Gaps	Financing, awareness, capacity building, technology, governance and infrastructure
Detailed short term sub-actions	1. Implement and popularise appropriate livestock feeding and rangeland management policies to enhance sustainable utilisation of rangelands.
	2. Develop and popularise appropriate livestock feeding technologies/strategies to sustainably utilize available feed resources through participatory approaches
	3. Develop and popularise appropriate strategies to sustainably utilize

	communally grazed land and rangelands, through participatory approaches
	4. Develop water resources including wetland systems through constructing appropriate infrastructure and promoting sustainable water resources management practices
	5. Developing rangeland resources governance systems including water committees.
	6. Conduct gender analysis of the livestock sector to bring on board vulnerable groups
	7. Promotion of integrate Crop-livestock production systems
	8. Build local capacity in extension services related to livestock feeding and rangeland management
	9. Enhance training in management skills and practices of farmers, pastoralists and herders in diseases, feeding, breeding and integration under intensive and extensive systems
Medium to long term actions	1. Identify, develop and disseminate indigenous best practices in range land management and drought coping mechanisms
	2. Conduct capacity building in indigenous knowledge, early warning systems, early action, stocking rates, vaccination campaigns, disease control
	3. Facilitate and support establishment of fodder banks and strategic reserves
	4. Develop and implement strategy for control of invasive weeds/species
	5. Develop adaptive research in sustainable rangeland resources management
Budget	USD 15,385,021
Responsibility	MAAIF, MWE, NEMA, NARO Research Institutes, LGs, Civil Society and Private Sector (Including UNFFE and UMPCU).
Action 3	Promote sustainable Animal health management systems
Gaps	Financing, awareness, inadequate capacity, technology and infrastructure
Short term	1. Build local capacity in extension services related to Animal health and vector control
	2. Review existing Lawson livestock disease control and enforcement
	3. Control of epidemics and zoonosis such as rabies
Medium term	4. Strengthen livestock disease surveillance and veterinary and entomological services to control pests and diseases
	5. Train farmers on livestock disease management and increase access to veterinary services (Vector management, disease control/management and livestock hygiene).
	6. Improvement of livestock infrastructure for disease control like cattle crushing and livestock holding grounds
	7. Conduct capacity building in indigenous knowledge, early warning systems, early action, stocking rates, vaccination campaigns, disease control
Budget	USD 6,593,580
Responsibility	MAAIF, MWE, NEMA, NARO Research Institutes, LGs, Civil Society and Private Sector (Including UNFFE and UMPCU).
Action 4	Promote and encourage diversification and improved livestock value chains
Ongoing projects	<ul style="list-style-type: none"> Regional Pastoral Livelihood Resilience Project (RPLRP) Uganda Meat Exports Development Project Agricultural Technology and Agribusiness Advisory Services (ATAAS)
Gaps	Finance, technology, infrastructure, capacity and awareness
Short to medium term	1. Promote livelihood diversification away from livestock (e.g. commercial crop and fodder production (irrigated agriculture), gums and resins production, productive entomology (apiary and sericulture), wood fuel farming and forestry

	2. Promote livelihood diversification in livestock farming (e.g. crop-livestock farming, silvo-pastoral farming, raising of camels, indigenous poultry, rabbits, emerging livestock - quails, guinea fowls and ostriches)
	3. Promote value addition for livestock and pastoral system products
	4. Develop trade and marketing systems for products from livestock, pastoral and rangeland systems
	5. Develop CC impact safety nets (including establishing price stabilization schemes and strategic livestock based food reserves).
	6. Mobilize and build capacity of livestock farmers for collective and cooperative effort to engage more efficient handling, storage, agro-processing and marketing
Budget	USD 19,688,406
Responsibility	MAAIF, MTIC, DDA, NARO Research Institutes, LGs, Civil Society and Private Sector (Including UNFFE and UMPCU).

5.4.3 Fisheries

Objective:

Promote climate resilient fisheries and integrated fisheries resource management.

Summary

The fisheries sub-sector contributes approximately 2.7% of Uganda's GDP and supports approximately 1.5 million people directly and indirectly. The sub-sector directly employs over 300,000 people, with up to 1.2 million more depending on fisheries as a source of income and livelihood. The fisheries sub-sector relies on freshwater bodies, particularly Lakes Victoria, Kyoga, Albert, George and Edward and is highly climate sensitive. For example, droughts lead to reduced inflow into the water bodies and high evaporation from lakes, which in turn reduces breeding and fishing grounds; leading to decline in fish stocks. While research has been limited on climate change impacts on fishing in Uganda, initial findings indicate that the projected changes in climate will be detrimental to many fish stocks. The fishing sub-sector remains at risk from climate impacts and thus further actions are required.

Action 1	Promote climate resilient fisheries sector and integrated fisheries resource management
On-going projects and interventions	<ul style="list-style-type: none"> • Support to Fisheries Development Programme • Support to Fisheries Mechanization and weed control • Lake Victoria Environment Management Programme (LVEMP) - Restocking Fish in Water Bodies • IOC-SmartFish Project • Lakes Edward, Albert fisheries project (LEAF) • Operation wealth creation (OWC) program
Gaps	Community awareness and mobilisation, capacity building, financing
Short Term Sub-actions	1. Undertake risk and vulnerability assessment of the fisheries sub-sector and value chains
	2. Enhance capacity of the fisheries sub-sector to address the impacts of climate change on fisheries (training, avail appropriated fishing technologies, aquaculture inputs and value addition technology)
	3. Promotion of zonation and protection of fish breeding grounds along shoreline
	4. Promotion of renewable energy/ energy-saving technologies for post-harvest fish handling, environmental friendly artisanal processing of small

	pelagic fish species
	5. Enhance capacity of fish quality assurance (cold chain, post-harvest handling infrastructure); initiate development of standards and their enforcement
	6. Strengthen operation and maintenance of existing infrastructure
	7. Strengthen management and control of invasive water weeds
Medium Term Sub-actions	1. Put in place economic incentives to diversify livelihood options and reduce dependence on climate-sensitive fisheries resources
	2. Strengthen monitoring capacity and the capability to prevent over fishing and unauthorized exploitation of water bodies
	3. Up-scale climate resilient strategies/technologies in fisheries and climate resilient fish varieties
	4. Establish, restore and maintain the bio-physical health of water bodies
	5. Strengthen capacity of aquaculture infrastructures/structures (hatcheries, feed production and farmer organisations)
Budget	USD 53,862,654
Responsibility	MAAIF, MWE, NAFIRI, LVFO, Universities and Research Institutes, LGs, Civil society and Private Sector.
Action 2	Promote Aquaculture in order to ensure climate resilient fisheries resources
Short Term Sub-actions	1. Enhance capacity of the aquaculture sub-sector to address the impacts of climate change
	2. Strengthen both pond or cage culture
	3. Identify suitable sites for setup of aquaculture parks
	4. Encourage climate change resilient practices, including commercial fish farming, training in building fish ponds and making fish fodder
	5. Address challenges of quality and quantity of fish seed and feed
	6. Promote the breeding of climate resilient fish breeds/species, appropriate to particular ecosystems and communities
	7. Train farmers/ household members in semi-intensive and intensive aquaculture farming
	8. Enhance capacity for integrated Agriculture-Aquaculture mixed farming systems to increase efficient use of water resources and adaptability to changing climate
	9. Amplification of incentives available in Gov't for private sector investment in climate-change suitable farming systems
	10. Train extension workers on aquaculture production technologies in the face of changing climatic conditions
Medium Term Sub-actions	1. Undertake comprehensive management needs assessment of existing large-scale farms
	2. Promotion of aquaculture in wetlands, small lakes and reservoirs and dams through stocking and restocking programs
	3. Undertake studies of viability of climate-smart aquaculture enterprises
Budget	USD 17,954,218
Responsibility	MAAIF, MWE, NAFIRRI, LVFO, Universities and Research Institutes, LGs, Civil society and Private Sector.

5.4.4 Climate Information, Early Warning and Disaster Preparedness Systems

Objective:

Improve and strengthen climate information, early warning and disaster preparedness mechanism for a better-informed agricultural planning and decision-making.

Summary

Climate information and early warning systems provide useful inputs into the agricultural sector and assists farmers in making decisions about where, what and when to plant. Weather-related factors already form the biggest risk to agricultural productivity in Uganda now, but projecting this into an uncertain future is complex. At country level, climate predictions are affected by inadequate data and which in turn affects the accuracy of seasonal forecasts by UNMA. Thus climate projections and crop models are uncertain and make long-term decisions risky. In addition, there are challenges of inadequate capacity to down scale weather information; fragmented early warning systems; insufficient weather information flow networks and inadequate systems; and limited knowledge and capacity at household, community, district and national levels, to respond to emergencies. The need for appropriate climate information and early warning to support agriculture is thus pressing. Additionally, there is a need for innovative safety nets and insurance schemes; to assist farmers deal with climate change related risks and disasters.

Action 1	Strengthen climate information, and early warning and disaster preparedness systems to support sustainable agriculture
Ongoing Projects	<ul style="list-style-type: none"> • Development of National Early Warning Systems Project • Plan for National Agriculture Statistics • Climate Change Research programme • Programme on Increasing Drought Resilience • Forest information system (GHG emission, deforestation rate)
Gaps	Capacity, Financing and awareness, use of Agricultural Information Technology (e.g GIS)
Detailed short term sub-actions	1. Increase coverage of automated weather monitoring stations country-wide and integrate use of indigenous knowledge into community early warning systems
	2. Strengthen and widen weather forecasting systems to inform better farmer decision
	3. Put in place community information platforms, to facilitate and disseminate climate information early warnings
	4. Produce and disseminate early warning messages, that include risk information that are easily understood by authorities and end users
Detailed medium to long term sub-actions	1. Facilitate specialized training; to increase capacity, knowledge and improved accuracy of models for predicting weather and climate
	2. Build capacity to downscale global and regional climate change models and information to national and local levels to support agricultural planning and decision-making
	3. Scale up countrywide vulnerability mapping to support agricultural production, food security and disaster preparedness interventions
	4. Establish a National Seed Disaster stock and establish capacity for a six-month of food strategic stocks (maize, rice, sorghum, millet)
Budget	USD 6,216,166
Responsibility	UNMA, MAAIF, OPM, NARO, CCD, LGs, Civil Society, Private Sector
Action 2	Support innovative insurance schemes to protect farmers against climate risk related crop and livestock losses
Ongoing Projects	None
Gaps	Awareness and Financing
Detailed sub-actions - short to	1. Develop and implement varied innovative crop and livestock weather-indexed

long-term	insurance packages
	2. Invest in the agro-meteorological infrastructure to support weather-indexed insurance
	3. Enhance the capacity of micro-finance institutions to act as agents to deliver innovative crop and livestock weather-indexed insurance packages
	4. Raise awareness within the insurance industry of extreme weather and climate risks and communicate actions and opportunities
	5. Undertake farmer education and address barriers to uptake of weather-indexed insurance products with a view to gain their trust
	6. Explore ways of using other safety nets and alternative risk transfer instruments
Budget	USD 105,442,110
Responsibility	MAAIF, OPM, MoFPED, Insurance and Microfinance Institutions, Civil Society and Private Sector

5.4.5 Forestry, Land and Natural Resources Management

Objective:

Promote sustainable forestry, land use and water management that enhances the resilience of agriculture and agrarian communities to a changing climate.

Summary

Uganda's agricultural policies and plans emphasize that appropriate use of natural resources; including land, water, forests and wetlands, can enhance productivity and profitability in the agricultural sector as well as conserve the environment. However, to date, agricultural productivity gains in Uganda have been based more on the expansion of cultivated land, rather than increased yield, and this expansion of land for cultivation and livestock rearing is one of the major drivers of deforestation and land degradation in the country. The changing climate will place additional stresses on natural resources. To that end, the current natural resource management by the agriculture sector paints a worrying picture. With droughts leading to increasing scarcity of water, especially in the cattle corridor, and with the wide spread land degradation across the country, Uganda requires adequate land management strategies that take into account agriculture and natural resources' vulnerability to the impacts of climate change. In particular, focus will be made on the future availability of water for agriculture and other uses.

The water sector requires an identification of the current and future vulnerabilities, in order to develop strategies and plans to manage water sources, basins and water supply. As the country embarks on small irrigation and scaling up large scale irrigation projects, irrigation needs to be planned appropriately as an adaptation measure. In all, climate adaptation interventions for land and natural resource management are no-regrets measures for increasing crop productivity. In this NAP, improvement of land and natural management has been identified as a top priority both for the agricultural sector and for building resilience to climate change. Improved land use systems, which integrate agriculture and forestry, have the potential to mitigate extensive forest, soil and environmental degradation; while providing for essential household needs and services such as food, fuel wood and soil fertility improvement. The approach should provide an enabling framework for integrating gender and the needs of the youth and vulnerable groups.

Action 1	Increase water use efficiency and water storage
On-going projects	<ul style="list-style-type: none"> • Framework for Integrated Catchment-based Water Resources Management • Adaptation Strategy and Action Plan for the Water Resources Sector • Construction/rehabilitation of boreholes, shallow wells, valley dams and water tanks for animal watering and for micro-irrigation systems • Construction of strategic dams for multi-purpose use (e.g. domestic, agriculture, rural industries); • promoting water harvesting technologies(technology being used among others is solar water pumping), • Climate Smart Agriculture Programme • Sustainable Land Management Programme • Labour Saving technologies and mechanization for agricultural production enhancement
Gaps	Awareness, capacity building, financing, Technology
Detailed sub-actions - short term	1. Promote awareness on how climate change impacts on water and affects the agriculture sectors
	2. Enhance public awareness on water conservation and efficient water use for agricultural production
	3. Develop guidelines to ensure that irrigation plans and designs consider water availability, climate variability and climate change
	4. Develop policy briefs to advocate for updating policies to emphasize water use efficiency improvements in response to climate change
	5. Mainstream disaster risk reduction measures in water sector planning and service delivery, particularly in vulnerable agrarian communities
	4. Construction of multi- purpose dams and water harvesting infrastructure for medium and large scale irrigation, livestock and fisheries
	6. Support on farm water storage facilities for storing harvested rainwater, during periods of water scarcity, for farming activities
Detailed medium to long term sub actions	1. Conduct a stocktaking on water use efficiency, water lifting technologies, rainwater harvesting and water storage technique
	2. Use environmental assessment and enforcement to strategically integrate water availability and climate change into irrigation projects and planning
	3. Promote the sustainable use of groundwater resources for irrigation purposes
	4. Support traditional and improved/modern rainwater harvesting techniques
Budget	USD 11,580,711
Responsibility	MWE, MAAIF, NEMA, LGs, Civil Society, Private Sector, Communities
Action 2	Strengthen catchment management in agricultural planning
	<ul style="list-style-type: none"> • Framework for Integrated Catchment-based Water Resources Management • Integrated water resources management and watershed level planning taking place through NGOs and Local Government in Karamoja. • East African Agricultural Productivity Project (EAAPP) • Farm Income Enhancement and Forest Conservation (FEFOC) Project • Climate Smart Agriculture Program • Sustainable Land Management Program • GREEN CHARCOAL PROJECT

	<ul style="list-style-type: none"> • National REDD+ program • East African Project on REDD. • Pilot Program on Climate Resilience (PPCR)
Gaps	Awareness, capacity building, financing, TECHNOLOG ⁷³ Y
Detailed short term sub-actions	Develop an agricultural, forest, land and water catchment level coordination mechanism
	1. Develop conservation management plans upstream and downstream of catchment areas with irrigation schemes and other water for production infrastructures
	2. Develop a stakeholder engagement strengthening program to protect water catchment areas in areas planned for agricultural intensification
	3. Increase community awareness on sustainable land and water management on farm lands
Detailed medium to long term sub-actions	1. Protect water catchment areas through integrated watershed management
	2. Promote upstream water catchments conservation to reduce sediment yields into the river and lake systems
	3. Promote appropriate forestry and agroforestry technologies to improve the environment and livelihoods
	4. Identify and promote sustainable traditional farming systems, indigenous technologies, and farmer initiatives under similar agro-ecological/agro economic conditions
Budget	USD 75,892,113
Responsibility	MWE, MAAIF, NFA, NEMA, LGs, Civil Society, Private Sector, Communities
Action 3	Adopt sustainable agricultural land, forest land and water management to reduce degradation,
Ongoing projects	<ul style="list-style-type: none"> • Climate Smart Agriculture Programme • Framework for Integrated Catchment-based Water Resources Management • Farm Income Enhancement and Forest Conservation (FEFOC) Project • Kagera Trans-boundary Agro-Ecosystem Management Project [TAMP] • Sustainable Land Management Programme
Gaps	Awareness, capacity building, financing, Innovations and technology
Detailed sub-actions - short term	1. Develop guidelines and principles on sustainable land and water management
	2. Build capacity of local governments and other stakeholders to plan, implement and monitor sustainable land management practices that involve local communities
	3. Increase community awareness of sustainable land and water management on farmlands
	4. Support initiatives for community action to control soil erosion, reforest, protect and conserve degraded agricultural landscapes and watersheds
Detailed sub actions - medium to long term	1. Support land use planning at district and local levels, to guide sustainable land use and management and monitoring of both subsistence and commercial farming activities
	2. Support preparation of agricultural land management plans at village level to

	guide sustainable land use, which should include both subsistence and commercial farming and look at upstream and downstream water users and uses
	3. Promote appropriate agroforestry and clean energy technologies to improve livelihoods and the environment
	4. Implement all or some of the land use plans prepared for the districts on sustainable land management.
	5. Training and research in appropriate technology development
Budget	USD 16,469,996
Responsibility	MAAIF, MWE, NEMA, NARO, LGs, Civil Society, Private Sector, Communities, MEMD, RESEARCH INSTITUTIONS
Action 4	Promote appropriate forest and ecosystem management practices to increase the resilience of agrarian communities to the impacts of a changing climate
Ongoing projects	<ul style="list-style-type: none"> • Farm Income Enhancement and Forest Conservation Project (FIEFOC) • East African Agricultural Productivity Project (EAAPP) • EU- Sawlog Production Grants Scheme (SPGS) • NFA Community Tree Planting Project. • REDD + • IUCN- ECOSYSTEM CATCHMENTMANAGEMENT PROJECTIN ELGON • GREEN CHARCOAL PROJECT • Pilot Programme on Climate Resilience (PPCR)
Gaps	Awareness, capacity building and financing
Detailed sub-actions - short to long term	1. Develop and implement management plans for ecosystems in order to encourage sustainable use
	2. Support the establishment of tree nurseries and distribution of tree seedlings.
	3. Provide incentives to farmers to increase tree cover on their land
	4. Develop a business model for ecosystem management in order to facilitate Payment for Ecosystem Services/ PES (e.g. use of tourism revenue to motivate farmers to conserve wildlife and use of revenue from payment for water in urban areas to pay farmers for conservation of water catchments)
	5. Promote best management practices for forest and ecosystem management, to improve and maximize net benefits for the farmers
	6. Document biodiversity in the ecosystems, including below ground biodiversity and develop eco-tourism opportunities in such areas
	7. Support Local Governments at District and Sub-county levels to undertake afforestation and reforestation through Public-Private Partnerships
	8. Scale up and strengthen wetland conservation and restoration of degraded wetlands, lakeshores, riverbanks, hilly and mountainous areas and rangelands.
	9. Support the planting of woodlots to ensure a steady supply of wood fuel in transition to renewable energy use
Budget	USD 11,821,936
Responsibility	MWE, MAAIF, NFA, UWA, NWSC, LGs, Civil Society, Private Sector, Communities.

5.4.6 Research for climate resilient agricultural development

Objective:

Promote climate smart agricultural research and innovations.

Summary

The NCCP observes that effective climate change response needs reliable data. More research is thus needed, to establish climate change patterns, vulnerability, adaptive capacity and options and to develop technologies that will ensure sustainable response systems and minimize impacts and risks associated with climate change. The National Agricultural Research Organization (NARO) System (NARS) is well established but its performance needs to be enhanced to take on the climate change challenge. There are few climate change relevant action research projects, and most of the studies that have been documented have limited sample size and small spatial representation, which make extrapolation to other areas difficult. This NAP prioritizes filling key research gaps to better integrate climate change into agricultural policy. Strategic research will be especially critical, not only to fill the knowledge gaps on the potential impacts of climate change on the agriculture sector, but also to guide on the application of this research to target interventions to vulnerable areas. The research and innovations programmes should take a gendered approach; taking particular attention the needs of women, youth and other vulnerable groups.

Action 1	Mainstream climate change in agricultural research and innovations
Ongoing projects	Climate Smart Research initiatives at NARO and Makerere University
Gaps	Awareness, capacity building, financing
Detailed short to long term sub-actions	1. Develop and implement a climate change and agriculture research program
	2. Establish and operationalize a climate smart agricultural research fund
	3. Strengthen the infrastructural and technical capacities of the agricultural research centres to enable them undertake climate smart agricultural research and innovations
	4. Conduct participatory research work on improved technologies and practices, informed by needs of users and agro-ecological zones along the value chain
	5. Enhance adaptive research on climate resilient and productivity enhancing technologies, including indigenous knowledge and local innovations, on-farm and on-station demos/trials
	6. Strengthen platforms through which researchers will have regular contacts with stakeholders and other users at the national, Zonal, District and farm levels.
	7. Develop a framework to target climate adaptation projects in vulnerable areas
	8. Develop a framework to advocate for increased public sector funding in research and development and innovations
	9. Incentivize private sector and civil society investments in climate smart agricultural research and development, and innovations
Budget	USD 10,565,090
Responsibility	MAAIF, MWE, NARO, MoEST, NCST, Research Institutes and Universities, Civil Society and Private Sector

5.4.7 Knowledge Management and Partnerships for climate action

Objective:

To enhance knowledge on good practices and partnerships to reduce vulnerability of the agricultural sector to the impacts of climate change

Summary

National networks and collective knowledge on coping strategies are poor in Uganda, which renders transfer, retention and replication of good practices difficult. Information sharing is a particular challenge, because of the multispectral nature of key agricultural and climate change stakeholders. As for partnerships and networks, there is lack of a structured framework for private sector and civil society to engage national and local governments on climate smart agriculture issues. In addition, incentives for private sector to invest in climate smart agriculture are inadequate. Implementation of the agricultural sector NAP investments will need evidence upon which to make climate-smart decisions, strategies to communicate key messages, and the ability to target specific stakeholders to ensure actions have maximum reach. To that end, the NAP prioritizes to develop partnerships and national and local knowledge on adaptation.

The adaptation intervention proposed under this action consists of an efficient and systematic dissemination and communication of all sector NAP activities and outputs and to all stakeholders, as well as documenting and communicating the lessons learned, informing stakeholders at all levels about climate change risk management and adaptation options in the agricultural sector, and the costs and benefits of implementing such measures. This will be designed to ensure that the achievements and lessons learned from implementation of the other actions in this NAP will appropriately inform the policy decision making processes and leave impacts at the policy level.

Action 1	Develop knowledge management and communication systems to support climate resilient agriculture
Ongoing projects	<ul style="list-style-type: none"> • FAO supported Climate Change Knowledge Management System in the Cattle Corridor (under development) • TACC supported ITCP for Mbale Region Climate Change Platform
Gaps	Awareness, capacity building, financing
Detailed short term sub-actions	1. Support the development of a climate smart agriculture communication and awareness strategy as well as communication tools
	2. Undertake a climate smart agriculture knowledge mapping, audit and analysis
	3. Establish stakeholder engagement and communication networks
	4. Develop, operationalize and regularly maintain a Knowledge Management System and web portal for climate smart agriculture
Detailed long term sub-actions	1. Develop and coordinate a campaign using ICT to raise awareness and disseminate targeted information on climate smart agriculture
	2. Build a climate smart agriculture knowledge warehouse
	3. Develop and implement a training plan for relevant stakeholders for uptake of lessons learned and engagement
	4. Develop and disseminate documentation for lessons learned to policy makers and implementers, researchers, communities and other stakeholders; throughout the project
Budget	USD 3,668,456
Responsibility	MWE, MAAIF, NARO, MoICT, Universities and Research Institutes, MoLG, LG, Civil Society and Private Sector, UNFFE

Action 2	Strengthen partnerships and networks to enhance a common approach to climate resilient agriculture
Ongoing projects	None
Gaps	Awareness, capacity building, financing
Detailed sub-actions - short to long term	1. Develop a network of institutions (government, civil society, private sectors, DPs) active in climate smart agriculture
	2. Establish and strengthen forums and platforms for engagement between national and local governments, the private sector and civil society on climate change and agriculture
	3. Enhance programmatic coordination on climate smart agriculture between GoU and Development Partners
	4. Enhance a science-policy dialogue by establishing and strengthening platforms and networks between the academia, researchers, policy makers and decision makers
Budget	USD 4,569,989
Responsibility	MAAIF, MWE, MoLG, LG, Universities and Research Institutes, DPs, Civil Society and Private Sector

5.4.8 Gendered Approach to climate change adaptation

Objective:

Promote a gendered climate smart agriculture programme to reduce the vulnerability of women, youth and other disadvantaged groups

Summary

Although the Ugandan society has an encouraging attitude towards gender equality, and there have been positive steps taken towards inclusion of women in public affairs and the workplace, challenges still remain. For instance, *Uganda* ranks as number 73 out of 102 countries on the Social Institutions and Gender Index (SIGI) devised by the OECD⁷⁴. The country is still male dominated and women have limited ownership, access and control over resources, especially land. Although climate change impacts affect all members of the society, existing gender inequalities make women more vulnerable than any other marginal groups. There are marked climate change related gender disparities that place exceptional burdens for women, as many women use resources (especially land for agriculture) without owning them and without adequate knowledge on climate change responsiveness. Women and youth in Uganda also contribute a lot to the family labour and are affected by some climate change challenges, such as moving longer distances during times of water scarcity. This calls for mainstreaming gender in climate smart agriculture.

Action 1	Mainstream gender in climate smart agriculture
Ongoing projects	None
Gaps	Awareness, capacity building, financing
Detailed short to long term sub-actions	Conduct a comprehensive gender specific assessment on climate change impacts on agriculture
	Develop and implement a targeted and gender capacity support programme

⁷⁴ <http://www.genderindex.org/country/uganda>

	Develop a gender and agriculture coordination mechanism
	Develop and apply a tool for gender-sensitive climate smart agriculture budgeting and planning
	Develop a framework to address/mainstream gender and vulnerable groups issues in agriculture and climate change policies, plans, programmes and projects
	Assess and document gender sensitive technologies based on locations
	Creation of gender-climate change platforms
Budget	USD 2,300,000
Responsibility	MAAIF, MoGLSD, MoLG, LGs, Civil Society

6 Coordination and Implementation Arrangements

To foster implementation of the NAP and other climate smart agriculture programmes, it will be critical for MAAIF to create an institutional arrangement that allows for transparent and effective coordination, flow of information, knowledge and financial resources. While it is efficient to build upon existing institutional structures, the cross-cutting nature and emerging nature of climate change necessitates some new organizational structures for effective climate change coordination and management.

6.1 Climate Change Department (CCD), Ministry of Water and Environment

The institutional arrangement for implementation of the agricultural sector NAP follows that described in the National Climate Change Policy (NCCP), with overall coordination by the Climate Change Department (CCD) which is also the National Climate Change Focal Point (NCCFP) in the Ministry of Water and Environment and the Focal Point for UNFCCC. As provided for in the NCCP, the CCD is tasked with coordination of climate change issues between sectors/ministries such as works, energy, water, environment and agriculture. For the sector-specific NAPs, CCD can delegate its coordination role to the relevant sectors. The agriculture sector NAP will therefore be coordinated by MAAIF, given its mandate over the crops, livestock and fisheries sub-sectors; which form a big component of the agricultural sector. CCD will provide oversight and guidance to implementation of the agricultural sector NAP and the Climate Smart Agriculture Programmes.

6.2 Agriculture Climate Change Coordination Unit (ACCU)

MAAIF will put in place an Agriculture Climate Change Coordination Unit (ACCU), which will serve as the Sector Focal Point to implement the NAP and the Climate Smart Agriculture Programme. Climate Change cuts across the MAAIF sub-sectors/Directorates - Crop Resources, Animal Resources, Fisheries Resources and Agricultural Extension Services. In that case ACCU will be responsible and accountable for ensuring the smooth implementation of the NAP. The main constraint is that ACCU is not yet in place and does not currently have a budget allocation for climate change activities. However, as part of implementation of this NAP, a process will be initiated to strengthen and formalize the existing MAAIF climate change task force into an ACCU. The roles and responsibilities of the ACCU are to:

- Develop coordination mechanisms in key sub-sectors will work with MAAIF in the NAPs process such as water, environment, land use and gender;
- Coordinate quarterly agriculture and climate change Technical Working Group meetings;
- Ensure that MAAIF representatives on the National Climate Change Policy Committee and other National Climate Change Committees are informed of climate change issues and status of NAP and Climate Smart agriculture implementation;
- Coordinate with key implementation stakeholders across the GoU, including within MAAIF and MDAs;
- Coordinate with key implementation stakeholders at the sub-national/district level, including lower LGs;
- Build partnerships with non-state actors, including NGOs, research institutions, academia, the private sector, and Development Partners;

- Identify Development Partners, NGOs, Foundations, private sector and other potential sources of finance for the NAP;
- Coordinate with and report to CCD and the National Climate Change Policy Committee;
- Develop and implement the M&E framework;
- Coordinate regional workshops to promote awareness on the NAP and ensure buy-in by stakeholder groups;
- Ensure capacity building at national and district levels; and
- Ensure that MAAIF policies, plans, and programmes have considered climate change and identify linkages with the NAP.

6.3 Climate Smart Agriculture Task Force

MAAIF formed a Climate Change Task Force in 2012. The Task Force draws representation from relevant ministries departments and agencies (MDAs), civil society, NGOs, private sector, researchers, academia and individuals. The Permanent Secretary MAAIF charged the Task Force with initiating and coordinating, in collaboration with the national Climate Change Unit, the development, implementation and review of policies, strategies, laws and programmes meant to mitigate effects of climate change in the agriculture sector. Currently, the Task Force is chaired by the Commissioner Farm Development, MAAIF. Given the importance and cross cutting nature of climate change in agriculture, it is crucial that this Task Force is chaired by the Permanent Secretary; who can delegate some roles to the Deputy Chairperson (a Commissioner).

The Agriculture Task Force will monitor implementation of the NAP, serve a vital coordination function between MAAIF, MDAs, LGs, and regional entities such as the EAC, and issue directives to all relevant MAAIF departments and units for mainstreaming the NAP in their operations. The Task Force Secretariat will be set up in the ACCU, which will work closely with CCD.

The Task Force will consist of representatives from:

1. MAAIF departments and agencies, including institutions representing:
 - Crop Resources Directorate.
 - Fisheries Resources Directorate.
 - Animal Resources Directorate.
 - Agencies: NARO, NAADS, UCDA, NAGRIC/DB, DDA, CDO and the Agricultural institute.
2. Other Ministries Departments and Agencies
 - MWE: CCD, Directorate of Water for Production, Directorate for environmental Affairs.
 - Ministry of Local Government.
 - National Planning Authority.
 - National Environment Management Authority.
 - Uganda National Meteorological Authority.
 - Ministry of Lands Housing and Urban Development.
 - Ministry of Gender, Labour and Social Development.
 - Office of the Prime Minister.
 - Ministry of Finance Planning and Economic Development.
 - Ministry of Trade, Industry and Cooperative.
3. Civil Society, Private Sector and Development Partners.

6.4 Implementing entities

The implementing institutions will be in five main categories (see Table 5)

- National Government Ministries
- Government agencies and Parastatals
- Local Governments
- Civil society and NGOs
- Private Sector

Table 5: Implementers of the NAP

	Level/Institution	Details	Roles and responsibilities
1	National Government	Government ministries: MAAIF and MWE	Policy implementation, Coordination of NAPs implementation, Resource mobilization. Extension services, Regulation, Standards, Early warning information, Human Resource Management Prioritize, Plan and budget for climate change adaptation in the agriculture sector at central government level
		MoLHUD, MTIC, MoFPED, MoLG, NPA, OPM, MoGLSD	Participate as members of Climate Change Taskforce and other committees and platforms, participate in implementation
		NARO	Research and development
		UNMA	Climate Information and Early Warning Systems
2	Local Governments	District and Sub-County Local Councils District and Sub-county Technical Departments	Mobilize farmers' participation in climate change programs; Prioritize, Plan and budget for climate change adaptation in the agriculture sector at LGs
3	Private Sector	Financial Institutions	Provision of financial products that support CCA including credit and banking services and guarantees to farmers and the private sector
		Insurance Companies	Provision of crop, fisheries and livestock insurance services
		Suppliers, Produce buyers, Service Providers	Provision of goods and services for Market information, provision of credit, provision of market for produce, implementation of CSA
4	Farmers Institutions	Uganda National Farmers Federation, Farmer Cooperatives, Farmers Associations	Facilitation of group formation/SACCOs, awareness, mobilization, advocacy and coordination of partnerships for CCA, implementation of CSA activities; promotion of group marketing and warehouse receipt systems
5	Civil Society	NGOs, CBOs, Faith Based Organizations Cultural Institutions	Advocacy, capacity building and support to implementation of CSA interventions
6	Development Partners	Multi-lateral Development Partners Bilateral Development Partners	Contribution towards policy development and implementation; financial support for development
	Media		provide vital information at times of emergency — e.g. warnings on imminent floods and landslides; explaining how to deal with disease outbreaks, and dissemination of the NAP

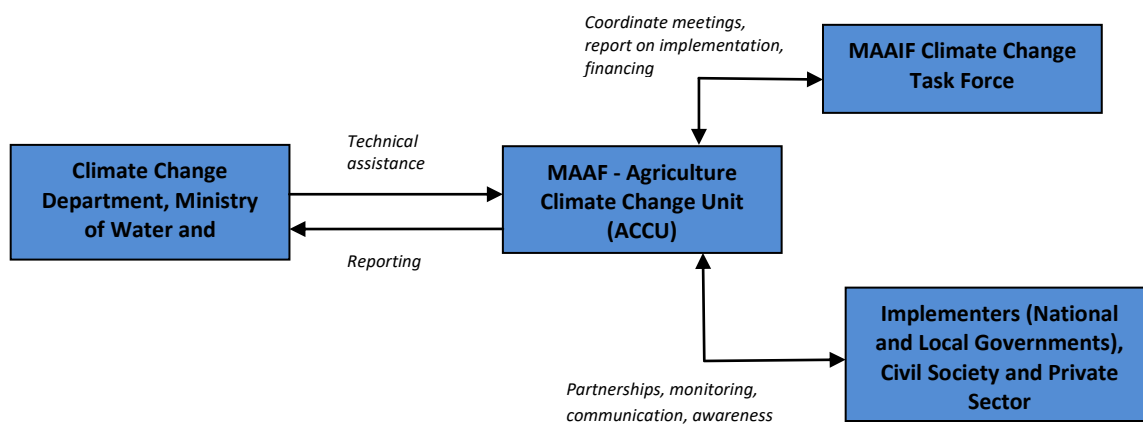


Figure 8: Agriculture sector NAP Implementation Framework

7 Monitoring, Reporting and Evaluation

Adaptation monitoring, reporting and evaluation (M&E) is an essential part of ensuring that the prospective benefits of adaptation interventions aimed at building adaptive capacities and enhancing resilience in the agricultural sector are being realised and lessons learnt assist in the improvement of the GoU and MAAIF's sector plans and programmes. The M&E system for this agricultural sector NAPs will have a feedback mechanism, which will ensure the continued building of resilience and reduction of vulnerabilities to climate change in the longer term.

The NCCP requires MDAs such as MAAIF to monitor their implementation of the NCCP Implementation Strategy Interventions and report on results. However, Uganda does not have an established national system for monitoring and reporting on climate change and implementation of the NCCP. Regardless, establishing a monitoring and reporting system for the NAP will be key for MAAIF to demonstrate and quantify results from the NAPs process, as well as systematically identifying and tracking climate change activities in the sector. Currently a national Performance Monitoring Framework (PMF) for the NCCP is being finalized. The MAAIF monitoring and reporting system will be sector-specific while still meeting the basic requirements outlined in the NCCP and the national climate change PMF.

7.1 Agriculture Adaptation Theory of Change

The Uganda Agricultural sector NAP M&E framework is anchored on a theory of change. The theory of change has been constructed to track progress in building adaptive capacity of the agricultural sector. Indicators have been proposed against the major changes expected in resilience until 2030. The proposed adaptation indicators will be useful for:

- Attracting international climate finance;
- Evaluating adaptation policy, programme and project interventions (i.e. the intended objectives and outcomes of the adaptation activities);
- Informing future adaptation policy development;
- Mainstreaming adaptation in development, through links with related indicators;
- Comparing adaptation achievements across sub-sectors and local governments;
- Communicating adaptation progress to stakeholders and the general public;
- Informing climate change debate and negotiations in the international arena; and
- Targeting, justifying and monitoring adaptation funding and programmes.

The theory of change in Figure 9 represents the short, medium and long term changes expected from the implementation of the sector NAP.

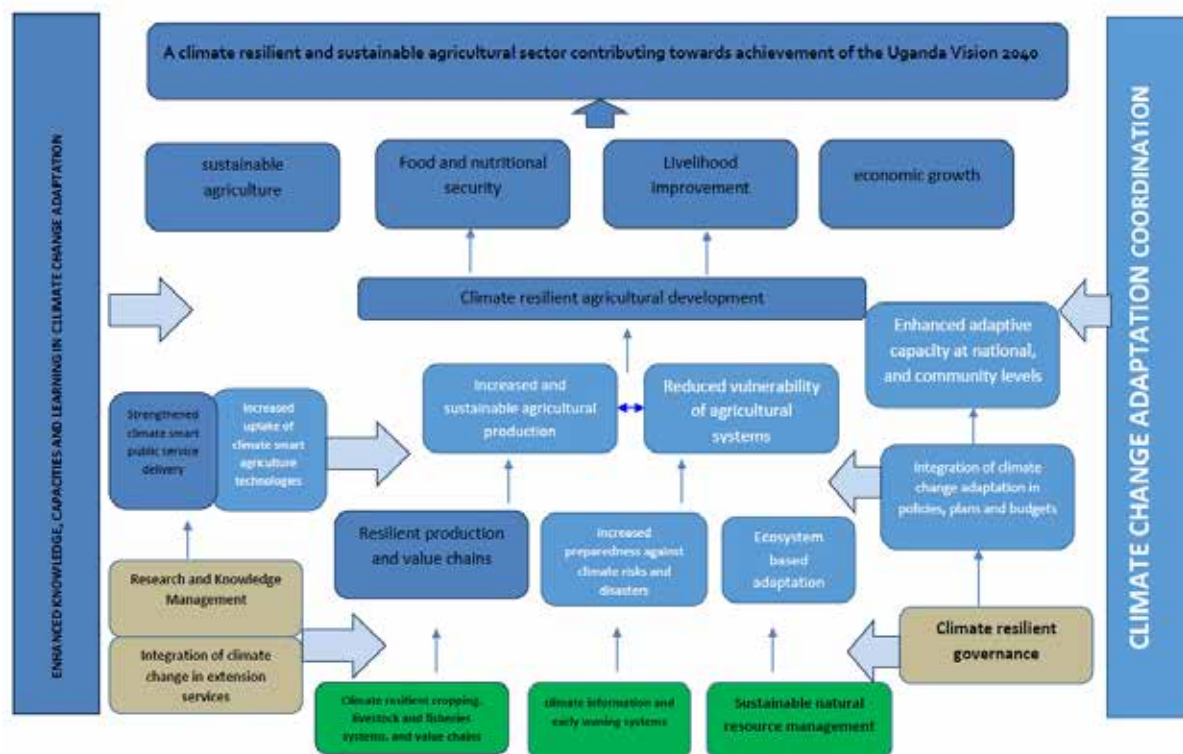


Figure 9: Adaptation Theory of Change

The goal of the agriculture NAP is "to increase the resilience of Uganda's agricultural sector to the impacts of climate change, through coordinated interventions that enhance sustainable agriculture, food and nutritional security, livelihood improvement and sustainable development". Thus the main NAP Outcome is: "increased resilience of Uganda's agricultural sector to the impacts of climate change, through coordinated interventions that enhance sustainable agriculture, food and nutritional security, livelihood improvement and sustainable development". Achievement of this outcome contributes to increasing the resilience of Uganda's agricultural sector to the impacts of climate change. The NAPs actions have been designed to deliver certain outputs, which in turn aim to make a significant contribution to the achievement of a set of direct (or immediate) outcomes that, as a whole, represent the main NAP outcome (see Figure 9).

Implementation of the NAP actions will deliver: (i) climate resilient cropping, livestock and fisheries systems and value chains, (ii) appropriate climate information and early warning systems, and, (iii) sustainable natural resources management. These will be achieved through, among others; (i) integration of climate change adaptation in development policies, plans and budgets, (ii) integration of climate change in agricultural extension services, (iii) strengthened climate change research and knowledge management, (iv) technical and institutional capacity building, (v) appropriate climate change governance that will improve service delivery.

Achievement of the above will enhance the uptake of climate smart agriculture practices resulting into increased and sustainable agricultural production and reduced vulnerability of agricultural systems to a changing climate. This would ultimately result into 'climate resilient agricultural development'.

The ultimate impact that this agriculture sector NAP is intended to achieve is “a climate resilient agricultural sector that is contributing to the achievement of the Uganda Vision 2040”. The pathway from the main outcome (climate resilient agricultural development) to the intended impact is not a straightforward process i.e. intermediate states, the transitional conditions between the NAP’s immediate outcomes and the intended impact, are necessary conditions for the achievement of the intended impacts. The intermediate states that have to be achieved (as shown in Figure 9), to lead to the achievement of the intended impacts are attainment of (i) sustainable agriculture, (ii) food and nutritional security, (iii) livelihood improvement, and (iv) economic growth.

7.2 Monitoring Framework

Within two months of implementation of the NAP, MAAIF will establish a simple climate change monitoring framework; that includes relevant activities in Table 6. Implementation of the activities will be coordinated by MAAIF - ACCU and discussed with technical support from the Climate Change Task Force, which could be done in house, or contracted through an outside consultant, if sufficient capacity is not yet available.

A consultant would be expected to conduct capacity building activities for implementation of the framework. This will include the development and operationalization of a Knowledge Management System for climate change and agriculture; including a monitoring framework.

Table 6: Steps to Develop Monitoring and Reporting System

	Step	Detailed Activities
1	Define and agree on monitoring and reporting procedures	Consult with the CCD/MWE to define expectations for annual reports according to the requirement in the NCCP and UNFCCC guidelines
		Discuss and agree with Climate Change Task Force on reporting
		Develop a reporting mechanism on gender mainstreaming into climate change adaptation-related policies, strategies, programs and budgets
2	Set Targets and Milestones	Work with the Climate Change Task Force to establish targets for what MAAIF can achieve in implementing the NAP in the first year and each subsequent year
		Set annual milestones toward achieving the targets
3	Define Indicators	Identify climate relevant indicators within the Agriculture Sector that can be monitored
		Identify indicators to develop a monitoring framework for all identified NAP activities, based on the targets and milestones
4	Draft a reporting plan	MAAIF - ACCU drafts a reporting plan including all reporting deadlines, reporting templates, and responsibilities for the implementation period of the NAP
		Define stakeholder channels for dissemination of reports, including publication on the website
		Discuss and agree on reporting plan with the CCD and MAAIF Climate Change Task Force and relevant partners

7.3 Reporting Requirements

After the initial six-month mobilization phase, MAAIF will undertake regular reporting within the Ministry and with outside stakeholders, according to the schedule outlined in Table 7. The Results Based Management Platform will be used.

Table 7: Agricultural Sector NAP Reporting Schedule

	Period	Reporting requirements	Content
1	Quarterly	Presentation to MAAIF Climate Change task force	Status of NAP implementation, including new activities, mainstreaming, coordination, finance and partnership opportunities, and challenges.
		Publish quarterly status newsletter on MAAIF climate change website and distribute to stakeholders	
2	Annually	Submit Annual Progress Report at the onset of years to CCD - MWE per NCCP requirement	Summarize implementation status of all actions and activities
		Submit annual progress report on gender, climate change and agriculture sent to MoGLSD and CCD/MWE	Summarize climate change screening of new major initiatives, projects and programmes and describe implications/updates to NAP
		Publish approved annual reports on MAAIF Climate Change website	Financial reporting should include information on any financial resources allocated for the climate change issues according to the NCCP (and therefore NAP)
			Summarize successes, challenges and lessons learned
3	After every five years	Conduct a review of NAP implementation	Assess likelihood of impacts of the NAP to measure achieved vs. planned results and provide recommendations for improvement in next stages of the NAP.
		Publish review reports on MAAIF climate change website and distribute to stakeholders	
4	At end of NAP period	Conduct a final evaluation of NAP implementation	Assess impacts of the NAP to measure achieved vs. planned results and provide recommendations for next NAP.
		Publish evaluation report on MAAIF climate change website and distribute to stakeholders	

7.4 First Year Launch

NAP start/Launch:

An Inception Workshop will be held within the first 2 months of NAP start. The Inception Workshop is crucial to building ownership for the NAP results and to plan the first year annual work plan.

The Inception Workshop will address a number of key issues, including:

- Assisting all partners to fully understand and take ownership of the NAP.
- Defining support services and complementary roles and responsibilities of all stakeholders.
- Discussing the roles, functions, and responsibilities within the decision-making structures, including reporting and communication lines, and conflict resolution mechanisms.
- Reviewing the NAPs Results Framework and agreeing on the indicators, targets and their means of verification, and validating assumptions and risks.
- Providing a detailed overview of reporting, monitoring and evaluation (M&E) requirements. The Monitoring and Evaluation work plan and budget should be agreed and scheduled.
- Discussing financial reporting procedures and obligations, and arrangements for annual audit.
- Planning and scheduling meetings.

The Inception Workshop report will be a key reference document and shall be prepared and shared with participants to formalize various agreements and plans decided during the meeting.

The first year of NAP implementation will be critical to set the foundation for implementing the Plan. The actions and cost estimates in the Plan will need to be further refined and aligned to activities within MAAIF as well as those implemented by other stakeholders to improve mainstreaming the NAP activities in current and planned activities in the Ministry, GoU, and with outside stakeholders. Gaps and areas requiring additional investments will also be identified. Given the prominent role of Development Partners and other potential funders for financing the NAP, more sensitisation will need to be done at an early stage to engage and bring awareness about the Plan and MAAIF's priorities on climate change adaptation.

The following five steps outlined in Table 8 will guide the initial stages of implementing the NAP, and are key areas where donors and Development Partners can target support and technical assistance in the initial stages. The cost estimates for initial activities to launch the NAP are provided in Table 9, which are additional to the overall costs for the NAP investments. Estimates are based on the contracting of a climate smart agriculture (adaptation) specialist to be placed in MAAIF for at least six months, in order to build capacity and facilitate initial activities. Estimates also include expert consulting fees and event costs.

Table 8: Steps for Launching the NAP

Step	Task	Details	Cost - USD
1	Put in place ACCU and strengthening the MAAIF Climate Change Task Force	Broadening membership and invite members from key implementation stakeholders	30,000
		Review TORs and operating guidelines for the Task Force	
		Put in place ACCU and CC Task force Secretariat	
		Develop targets and milestones for Year 1 of the NAP	
		Hold quarterly Task Force meetings	
2	Sensitize key implementers and stakeholders	Conduct a sensitization meeting with all MAAIF Directorates, Departments, Units and Agencies to generate awareness of the NAP activities	20,000
		Initiate set up of climate change Knowledge Management System, including coordination for monitoring climate-related activities across MAAIF, MDAs and other stakeholders	
		Hold a launch/inception workshop to establish relationships with Development Partners, foundations, universities, private sector, and promote awareness about the NAP	
3	Internalizing the agriculture sector NAP	Hold regional/zonal workshops (one in each reach and or agro-ecological zones)	16,000
		Building on the NAP policy review, internalize the NAP in all policies, plans, and programmes	
		Design a simple climate change screening tool for all MAAIF projects and programmes to identify where activities are linked with the actions in the NAP and flag areas for monitoring	
		Conduct a detailed stocktaking of MAAIF activities to identify all ongoing activities that align with the NAP, where actions and investments can be mainstreamed, and where there are gaps that require additional resources	
		Define how screening will be done for all new projects and	

		programmes	
4	Develop a framework for bankable investments/projects	Identify “big win” investments for Year 1 of the NAP	35,000
		Indicate NAP activities that require mainstreaming and where new investments are required	
		Secure budget resources and fundraise where there are gaps	
		Conduct at least three pre-feasibility studies of transformative projects per the NAP priorities	
5	Mobilize financial resources	Draft a detailed financing strategy for the NAP, including MAAIF resources and outside sources	31,000
		Identify potential projects to be financed by the Green Climate Fund (GCF), AF, and identify steps for GCF readiness (including within MAAIF, MWE, and partners and how finances will flow between them)	
		Coordinate with Development Partners to identify entry points for financing with existing and pipeline programmes	
		Total First Year Launch Cost Estimate	132,000

8 Financing and Resource Mobilization

8.1 Introduction

Adaptation has been financed through various mechanisms in Uganda and even if the actions have not been termed adaptation, their objective has been to enhance resilience due to the impacts of climate change. The GoU and Development Partners (more especially FAO, UNDP, DFID, WB, EU, and USAID) are already financing a number of Climate Smart Agriculture interventions. The challenge has been that there has been no centralised system for tracking climate finance and thus the amount of finance that has gone into adaptation can only be estimated.

With the Green Climate Fund becoming operational soon (and existence of other sources of Climate Finance for example the Adaptation Fund) Uganda needs to establish a mechanism through which Development Partners can channel climate resources for easier tracking. The Ministry of Finance Planning and Economic Development has been designated as the GCF Focal Point and is charged with mobilising climate finance and tracking its utilisation. Moreover, climate financing has been integrated in the NDP II. It is hoped that through these arrangements, adaptation financing from the Uganda government, development partners and other actors can be appropriately allocated to priority sectors, including agriculture sector, in order to achieve greater impacts in enhancing resilience. This NAP envisages that adaptation actions that are not yet financed by government will attract financing from development partners and the private sector.

The estimated cost of implementation of NAP is provided in section 8.1.

8.1 Implementation cost estimates

Implementation of this agriculture sector NAP will require approximately USD 522 million over the next 15 years, up to 2030 (about USD 35 million per annum). The estimated cost is derived from the estimated cost contained in the NCCP and its Costed Implementation Strategy. A breakdown of the costs by action is included Table 9. It is important to recognize that the most costly actions also double as high priority interventions based on criteria such as fostering adaptation, urgency, and dependency of other interventions. Water use efficiency, water storage and risk management for climate shocks, for example, tend to be costly due to the scale of investments in climate-proofing infrastructure and other investments, yet urgent given the pressure on water resources and the linkages with natural disasters.

MAAIF and the concerned sub-sectors will need to refine the cost estimates on an annual basis to better reflect alignment with existing programming. The estimates here provide a general idea of the funding needs to implement the sector NAP, but early in implementation of the NAP an assessment will need to be done to further identify (i) existing activities that align with the NAP investments and would be appropriate for mainstreaming (incurring moderate to minimal cost), (ii) where there are gaps that require more substantial additional resources.

Leveraging external funding sources will be critical to implementation of the agricultural sector NAP, with about 70% of resources expected to come from outside of the GoU's own sources. This likely allocation between GoU and external funding sources is set out in the NCCP and Implementation Strategy and confirmed in the INDC, though this may prove challenging in the short term based on the finding that Uganda has been spending on average about 1% of its annual budget on climate change related activities

in the period between 2008-2012⁷⁵. The GOU will need to increase to provide at least 30% of the estimated cost of implementing the NAP from the national budget.

Table 9: Agriculture NAP Total Cost Estimates

	Action(s)	Appraisal		Cost (USD)
		Cost	Priority	
A	Agriculture - Crops			
	1. Promote and encourage highly adaptive and productive crop varieties and cultivars in drought-prone, flood-prone and rain-fed crop farming systems	Medium	High	28,089,981
	2. Promote and encourage conservation agriculture and ecologically compatible cropping systems to increase resilience to the impacts of climate change	Low	High	13,014,701
	3. Strengthen water harvesting and irrigation farming to build resilience to droughts	High	High	54,652,627
	4. Promote and encourage agricultural diversification and improved post-harvest handling, storage and value addition	Medium	High	19,688,406
	5. Support community-based adaptation strategies through expanded and climate smart extension services	Low	Medium	11,482,890
	Subtotal			126,928,605
B	Agriculture - Livestock Development			
	1. Promote and encourage highly adaptive and productive livestock breeds	High	High	32,900,993
	2. Promote technologies for improved livestock feeds/ feeding and sustainable management of rangelands and pastures through integrated rangeland management	Medium	High	15,385,021
	3. Promote sustainable Animal health management systems	Low	High	6,593,580
	4. Promote and encourage diversification and improved livestock value chains	Medium	High	19,688,406
	Subtotal			74,568,000
C	Fisheries			
	1. Promote climate resilient fisheries sector and integrated fisheries resource management	High	High	53,862,654
	2. Promote Aquaculture in order to ensure climate resilient fisheries resources	Medium	High	17,954,218
	Subtotal			71,816,872
D	Climate Information, Early Warning and Disaster Preparedness Systems			
	1. Strengthen climate information, and early warning and disaster preparedness systems to support sustainable	Low	High	6,216,166

⁷⁵ Tumushabe G., Muhumuza T et al., (2013). Uganda national climate change finance analysis. ACODE and ODI study report.

	Action(s)	Appraisal		Cost (USD)
		Cost	Priority	
	agriculture			
	2. Support innovative insurance schemes to protect farmers against climate risk related crop and livestock losses	High	High	105,442,110
	Subtotal			111,658,276
E	Forestry, Land and Natural Resources Management			
	1. Increase water use efficiency and water storage	Low	Medium	11,580,711
	2. Strengthen catchment management in agricultural planning	High	Medium	75,892,113
	3. Adopt sustainable agricultural land and water management to reduce degradation	Medium	Medium	16,469,996
	4. Promote appropriate forest and ecosystem management practices to increase the resilience of agrarian communities to the impacts of a changing climate	Low	Medium	11,821,936
	Subtotal			115,764,756
F	Research for climate resilient agricultural development			
	1. Mainstream climate change in agricultural research and innovations	Low	High	10,565,090
	Subtotal			10,565,090
G	Knowledge Management and Partnerships for climate action			
	1. Develop knowledge management and communication systems to support climate resilient agriculture	Low	High	3,668,456
	2. Strengthen partnerships and networks to enhance a common approach to climate resilient agriculture	Low	Medium	4,569,989
	Subtotal			8,238,445
H	Gendered Approach to climate change adaptation			
	1. Mainstream gender in climate smart agriculture	Low	High	2,300,000
	Subtotal			2,300,000
	First Year Launch	Low	High	132,000
	Grand total			521,972,044

The GoU needs to not only secure additional funds for climate change in the agriculture sector, but more specifically address climate resilience. A screening of expenditures on climate change activities in the agriculture sector (including MAAIF, MWE and other MDAs) showed that funds are already allocated to climate change activities, yet these most climate-related expenditures are (i) primarily financing irrigation, (ii) water for production, and (iii) only marginally linked with climate resilience. Therefore, MAAIF and other line sector ministries that are linked with agriculture will need to not only increase the amount of budget resources, but also improve overall planning for resilience activities, which in the past have been mostly limited to irrigation activities that may not sufficiently incorporate climate risk.

8.3 Sources of Funding

1. **MAAIF budget resources** for implementation of the NAP will need to be committed as soon as possible, especially to set up institutional structures as well as capacity building.
2. **Mainstreaming NAP priority actions in MAIF projects and programmes.** This will require close coordination between the implementing entities for those programmes.
3. **National Budget resources:** The GoU is currently exploring options for financing climate change within the Medium Term Expenditure Framework. To support the implementation of the National Climate Change Policy. MAAIF could coordinate with MoFPED and NPA to ensure that the funding is allocated for climate-resilient agriculture.
4. **Global Environment Facility** resources could be requested by Uganda to support building resilience in the agriculture sector.
5. **Development Partners** contribute the largest proportion of climate finance in Uganda and would be a likely source of initial funding to begin implementation of the NAP. MAAIF can also leverage relationships with DPs for technical assistance on climate change and integrate NAP activities into DP projects and programmes. DPs can also assist with international funding sources such as the Global Environment Facility, Green Climate Fund, Adaptation Fund, LDCF, IFAD, UN-REDD, Climate Investment Funds (CIFs) of the World Bank.
6. **Grant funding** from sources such as international NGOs.
7. **Green Climate Fund:** Resources from the GCF are still uncertain, as Uganda is not yet accredited to the GCF but could be accessed in the coming years. Technical assistance is needed to determine readiness for these funds and institutional arrangements between sector ministries and the National Implementing Entity as well as developing pipeline of transformational activities.
8. **Insurance:** Insurance can reduce the risk financial institutions associate with the agricultural sector, making commercial loan facilities more accessible to farmers and small entrepreneurs. Micro-insurance and weather-index based insurance are tools that can reduce the traditionally high operating costs that often hinder small-scale farmers' access to agricultural insurance. However, insurance schemes like these need to be well designed and adapted to local circumstances in order to be successful and, thus require initial public investment. To date no agricultural insurance schemes exist in Uganda and ECOTRUST Project is piloting integrating initial trials in some of its climate change interventions.

Table 10: Institutional Roles for Leveraging Financing for NAP Implementation

Institution	Role for leveraging financing
MAAIF	Obtain sector budget allocation and integrate in MTEF (with MoFPED)
	Coordinate with relevant entities to leverage private sector contributions to promote climate resilience
	Build capacity to develop proposals for international climate finance
	Coordinate with CCD, NPA and MoFPED on mainstreaming and supporting recurrent costs of NAP plan implementation
MoFPED	Integrate NAP Actions in the MTEF
Climate Change Department, MWE	Play a role by developing a financing framework for climate change action
	Provide capacity building to MAAIF on accessing international climate finance
	Ensure that funds flow to sectors from projects on climate change mainstreaming and eventual funding for implementation of NAPs
Universities and Research Institutions	MAAIF can partner with key institutions such universities and research institutions to coordinate on climate change projects
	Seek opportunities for co-financing of climate-related projects and programmes
Development Partners	Potential source of initial financing for NAP actions and activities
	MAIF to ensure that DP-funded agriculture projects are aware of and consider financing NAP actions and activities
	Provide technical assistance to MAAIF for implementation of the NAP, including climate finance readiness, project feasibility studies, and institutional strengthening.
	Financing implementation of linked activities such as the NDC, Green growth strategy, REDD+ Strategy, NAPs and NAMAs
Other Funding Sources	Increased private sector investment in Uganda brings opportunity to leverage PPPs that could finance resilience actions
	NGOs, foundations and research institutions are heavily engaged in areas such as climate smart agriculture and natural resources management. These relationships could be leveraged to harmonize with the NAP.

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