THE REPUBLIC OF UGANDA

NEBBI DISTRICT CLIMATE RISK AND VULNERABILITY ASSESSMENT (CRVA) FOR PRIORITY ADAPTATION SECTORS

FINANCIAL YEAR 2023/2024-2027/2028

May 2024

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Publication: The soft copy: www.nebbi.go.ug

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ACCRONYMS

AFARD	Agency For Accelerated Regional Development
AFOLU	Agriculture, Forestry and Other Land Uses
CAO	Chief Administrative Officer
CAM	Climate Action Model
CRVA	Climate Risk and Vulnerability Assessment
DCCAP	District Climate Change Action Plan
DCP	District Contingency Planning
DDP	District Development Plan
DRR	Disaster risk reduction
EWS	Early Warning Systems
GHGs	Green House Gases
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
LCLUC	Land Cover and Land Use Change
LEC	Local Environment Committee
LoCAL	Local Climate Adaptive Living Facility
MALGs	Ministries, Agencies and Local Governments
MSMEs	Micro Small and Medium Enterprises
MoLG	Ministry of Local Government
MoWE	Ministry of Water and Environment
NAPA	National Adaptation Program of Action
NCCAP	National Climate Change Action Plan
NCCAC	National Climate Change Advisory Committee
NDC	Nationally Determined Contributions
NDP	National Development Plan
NEA	National Environment Act
NEMA	National Environment Management Authority
NGO	Non-Governmental Organization
PDCC	Partnership for Development Capacity Consult Limited
PCE	Policy Committee on Environment
SACCOs	Saving and Credit Cooperative Organizations
SDGs	Sustainable Development Goals
SLCP	Short-Lived Climate Pollutants
UNMA	Uganda National Meteorological Authority
UNCDF	Natural Resource Department with support from United Nations Capital Development Fund
VSLAs	Village Savings and Loan Associations

DEFINITIONS OF THE KEY TERMS

Adaptive capacity refers to the ability of a system (human or natural) to adjust to climate change and its impacts and take advantage of any opportunities that arise. One of the primary reasons for climate action is to enhance adaptive capacity of human society and ecosystems.

Climate refers to the statistics (often mean or variability) of weather, usually over a 30-year interval. The key elements or variables measured over decades to determine the climate of an area include: temperature, humidity, atmospheric pressure, wind, precipitation, atmospheric particle count and other meteorological variables. Notably, climate differs from weather, in that weather only describes the short-term conditions of these variables in a given region, such as monthly or weekly or daily weather conditions.

Climate change means a change in the statistical distribution of weather patterns when that change lasts for an extended period of time like decades to millions of years. Climate change may refer to a change in average weather conditions, or in the time variation of weather around longer-term average conditions or more or fewer extreme weather events like droughts, rain, wind storms, among others. Climate change is caused by factors such as biotic processes, variations in solar radiation received by the earth, plate tectonics, and volcanic eruptions. Processes like human (anthropogenic) activities have also been identified as significant causes of recent climate change, often referred to as "global warming'' which refers to any warming of near-surface air during the past two centuries that can be traced to anthropogenic causes like burning of fossil fuels and ecosystem degradation such as deforestation.

Climate Risk is the potential for negative consequences for society or ecosystems from the impacts of climate change. There are two types of climate risks that include: *transition* risks that are related to the transition to a lower-carbon economy and *physical* risks which are related to the physical impacts of climate change. Climate risk results from a combination of local conditions, including climate hazards, exposure and vulnerability. Examples of climate risks include rising temperatures or heat intensity, rainfall intensity, wild dry season fires, windstorms, emergence of pests and diseases, among others.

Climate hazards refer to Climate hazards are situations or events that can cause adverse effects which are usually disasters. Examples of hazards include drought, floods and tropical storms. Hazards are caused by both natural and human-related factors which are mainly related to environmental degradation like deforestation, degradation of wetlands, lakeshores, riverbanks and mountainous/hilly areas.

Climate Vulnerability is the potential of a system to be harmed by an external stresses and shocks (threats). It is a function of exposure, sensitivity to impacts and the ability or lack of ability to cope or adapt the stresses and shocks like drought and floods. Climate change vulnerability is a concept that describes how strongly people or ecosystems are likely to be affected by climate change and its impacts.

Climate change Adaptation is the ability for a human community or an ecosystem to cope with the impacts of climate change in order to survive. It is about building resilience to climate change; capacitated societies, healthy well-functioning ecosystems; enhanced resilience to climate

change. We have a positive (proactive) adaptation strategy which is the action or process that reduces climate stresses and shocks by anticipating what it will be and preparing for how to cope with it; getting to the root causes; and a negative (maladaptation) strategy or technique that addresses symptoms of the stress without any coping mechanism. Notably, an adaptation strategy deals with local situations; addresses effects; and reduces risks and increases the ability to prepare, absorb and recover from the adverse climate events. Examples of adaptation strategies include: disaster management, flood protection, infrastructure upgrades or climate-proofing; and provision of alternative livelihoods like food and nutrition security, enhancement of household income, provision of safe water and sanitation, among others.

Climate change mitigation refers to action/process aimed at reducing emissions from greenhouse gases (GHGs) like carbon dioxide, methane and nitrous oxide that are responsible for global warming that causes climate change. A mitigation strategy addresses the root causes of climate change by reducing green gas emissions; it is global in nature and practice; and it aims at avoiding the negative impacts of climate change that are usually addressed by adaptation measures. Examples of mitigation measures or strategies include promotion of: clean energy, sustainable transport, energy efficiency, and forest conservation for carbon sinks and sequestration.

Disaster risk reduction is a management strategy and processes which analyse specific potential events or emerging situations that might threaten society or the environment and establishes arrangements in advance to enable timely, effective and appropriate responses to such events and situations. Disaster risk reduction (DRR) process includes: prevention and mitigation, preparedness, response, and rehabilitation and recovery. Disaster risk reduction aims at preventing new and reducing existing disaster risk and managing residual risks, all of which contribute to strengthening resilience and therefore to achieve sustainable development.

Exposure is the extent to which a system or a person or something subject to a stressor (climate or non-climate stressor); either directly or indirectly exposed. It is the amount and rate of change that a person, a species or system experiences from the direct (like temperature, precipitation changes) or indirect (such as habitat shifts due to changing vegetation composition) impacts of climate change

Resilience is the capacity to absorb stresses/shocks and maintain function in the face of external stresses due to climate change; it is the capacity to adapt, re-organize and evolve for sustainability. Climate resilience is the capacity to cope, adapt, recover capacity and transform amidst climate change stresses and shocks like drought, floods, landslides and windstorms.

Sensitivity refers to the extent to which something will be positively or negatively affected if it is exposed to a stressor, this could also be directly or indirectly sensitive. It also refers to characteristics of a person, a species or system that are dependent on specific environmental conditions, and the degree to which they will likely be affected by climate change (for example; temperature or hydrological requirements)

Weather is state of the atmosphere at a particular place during a short period of time. It involves atmospheric phenomena or conditions like temperature, humidity, precipitation, air pressure, wind, and cloud cover. The time period could be monthly, weekly or daily.

FORWARD

The myriad and uncertain effects of the changing climate normally pose significant risks for Development and realisation of planned District, National and Global Development Goals as well as Local Government Development aspirations. Increasingly, Local Governments and Countries are coming to realise that, in the long term, Climate Change mitigation and adaptation interventions need to be implemented through an integrated and cross- cutting policy approach. The National Vision 2040 recognises the need to develop appropriate adaptation and mitigation strategies on Climate Change over the Vision period 2040, in order to ensure that the District is cushioned from the associated adverse impacts. In order to achieve the above, it is imperative that Sectors mainstream Climate Change into their Sectoral Policies, Plans, programmes and Budgets.

The Climate Risk and Vulnerability Assessment (CRVA) was therefore prioritised by the District and it was the collaborative efforts of the Office of the District Chairperson, the Chief Administrative Officer (CAO) and the Natural Resource Department with support from United Nations Capital Development Fund (UNCDF) under Local Climate Adaptive Living Facility (LoCAL), coordinated by Ministry of Local Government (MoLG) and Ministry of Water and Environment (MoWE). This CRVA has further been conducted in response to the growing concern of the negative impacts of climate change risks and vulnerability on the human beings, socio-economic and physical environment of Nebbi District. Its overall aim is to enhance the technical, institutional and individual capacity of the district to address the impacts of climate change. The CRVA covers Climate change trend analysis, risks and vulnerabilities and proposes strategic actions to address adaptation, mitigation and cross-cutting interventions that will enable the district to benefit from opportunities available to developing countries in the efforts to tackle climate change.

It is of critical importance to note that the pathway to a green, low-emission and Climate resilient economy will require not only raising Climate Change awareness, but also to significantly mobilise new financial resources from public and private sources. It also implies having a CRVA that realigns Climate Change Actions into Sector Budgets, plans, policy Goals and Priorities.

The CRVA responds to the above needs by ensuring that there is more coordination and complementarity between key economic sectors in implementing climate change interventions. Moreover this CRVA makes it easier for the district to benefit from national climate change mitigation and adaptation opportunities while contributing significantly to Nationally Determined Contributions (NDC) and the international community efforts to address climate change.

Finally I call upon all stakeholders, including Civil Society, Media, private Sectors and all our Development Partners to fully embrace the key issues and recommended strategies to address climate change as identified in the CRVA and support its implementation in all practical ways for the full realisation of the Nebbi District and National Development Objectives to address climate change.

For God and my Country

Hon. Urombi Emmanuel
DISTRICT CHAIRPERSON

ACKNOWLEDGEMENT

This Climate Risk and Vulnerability Assessment (CRVA) has been conducted in response to the growing concern of the negative impacts of climate change risks and vulnerability on the human beings, socio-economic and physical environment of Nebbi District.

Its overall aim is to enhance the technical, institutional and individual capacity of the district to address the impacts of climate change. The CRVA presents Climate change trend analysis, risks and vulnerabilities and proposes strategic actions to address adaptation, mitigation and cross-cutting interventions that will enable the district to benefit from opportunities available to developing countries in the efforts to tackle climate change.

The path to conducting the CRVA has been paved through the Natural Resource Department and my Office with support from United Nations Capital Development Fund (UNCDF) under Local Climate Adaptive Living Facility (LoCAL), coordinated by Ministry of Local Government (MoLG) and Ministry of Water and Environment (MoWE). As you may be aware, any efforts to mitigate climate change impacts require thorough assessment of the climatic condition in period of over 30 years and that's why as Nebbi District Local Government, we decided to conduct CRVA to guide our planning, budgeting and implementation of climate adaptation and mitigation interventions.

I would like to acknowledge the good work and commitment of Partnership for Development Capacity Consult (PDCC) Limited whom the district procured to conduct the CRVA, I also thank the Lower Local Government technical and political leadership for their inputs during consultation and validation of the CRVA and the District Technical Committee for their technical input in to this document.

I sincerely appreciate the Office of the Resident District Commissioner and the District Chairperson, District Executive Committee, the Office of the Speaker, the Sectoral Committee for Production, Marketing, Environment and Natural Resources and Works and the representatives of the Civil Society Organisations (Plan International, Action Aid-Uganda, AFARD and Nebbi District NGO-Forum) for their contribution in validating this document.

In a special way, gratitude goes to the technical team from Ministry of Water and Environment, Ministry of Local Government, UNCDF and Uganda National Meteorological Authority (UNMA) for the technical support provided to the District to improve the CRVA Report.

It is my belief therefore that the development and publication of this document shall benefit the various sectors and organisations as they respond to the negative impacts of Climate Change and enables them work towards achieving a climate resilient development path through adaptation and mitigation as enshrined in our National/ District Development Plans and Vision 2040.

For God and my Country

Dorothy Ajwang

CHIEF ADMINISTRATIVE OFFICER

1 BACKGROUND

1.1 The national perspective

Weather is the short-term conditions of the state of the atmosphere at a particular place and time that includes; temperature, sunshine, wind, rain, among others, while climate refers to long term weather conditions. Extreme changes in climatic conditions like rain, temperatures, winds and others, usually over 30 years, are referred to as climate change. Climate change is usually caused by global warming due to excess heat in the atmosphere caused by increased emissions of greenhouse gases (GHGs) like carbon dioxide, nitrous oxide, methane, and short-lived climate pollutants (SLCPs) such as black carbon, tropospheric ozone and hydrofluorocarbons. It is important to note that, increase in the concentration of GHGs and SLCPs in the atmosphere is majorly a contribution from human activities like unplanned tree harvesting/cutting, deforestation, uncontrolled bush burning, poor farming methods that degrade water and soils, encroachment and degradation of wetlands and pollution by industries, among others. However, notably some of the climate change factors are natural phenomena which contribute to increase in the concentration of GHGs and SLCPs in the atmosphere and the biosphere, such natural phenomena include earthquakes and volcano eruptions.

Climate change is manifested through extreme weather events like high precipitation (heavy and torrential rains) that contribute to flash/riverine floods, rainstorms and landslides, and high/rising temperatures that contribute to prolonged draughts. According the UNCDF CRVA, 2023 and the National Risk Atlas, 2021, flooding has become more frequent, largely due to more intense rainfall where over the past two decades, an average of 200,000 Ugandans are affected each year by disasters. This is due to increased intensity of heavy rainfall, worse to that, the climate change vulnerability assessment report of 2013 shows more rainfall during traditional dry season and 2°C temperatures rise by 2030. This information implies that Uganda should expect increasing and more intensified floods and draught over years to come.

More importantly, the impacts of climate change will not only affect ecosystems and other production sectors but will have counter- productive effects across sectors and the entire economy. For examples, water scarcity leading to health and food insecurity and conflicts; unmet water demand that will cost economic loss of US$5.5 billion per year; declining agricultural exports and losses worth US$641–938m by 2050; food shortage and food inflation; 26% reduction in hydropower development due to a reduction in rainfall and water availability thus contributing to loss of 967kha of tree cover used as biomass energy; 12% decrease in tree cover, and 438Mt of CO_2e emissions (Global Forest Watch, 2022) in addition to a loss of 5 to 10% of domestic wood by 2050 worth US$130-136 billion. Likewise, damages to infrastructure damages like roads/bridges and schools, life and injury. More costs due to climate change include disaster relief that is estimated at US$938 m–3,2 billion by 2050 yet climate-proofing costs are limited amounts to US$347–621 million in 2050. Significantly, biodiversity that provides ecosystem services for human survival and natural capital in Uganda's economy is not spared by the impacts of climate change. Notably, nature is the chief source of food and industrial raw materials and natural capital provides over 70% of the total wealth, 68% of the population derives its livelihoods directly from the environment and natural resources, 89.4% of energy comes from the biomass, tourism contributes about USD1.6 billion to the annual national revenue, and 71% of foreign exchange earnings (exports) come from the nature-based sectors of the economy.

Worth noting, the National Climate Change Act of 2021 Section 6 provides for the National Climate Change Action Plan that should have actions which should be taken to assess and manage climate risks and vulnerability to climate change, responses and actions for achieving adaptation

and mitigation of climate change, actions for the conservation and enhance sinks and reservoirs of greenhouse gases (conservation of ecosystems), and actions for gender issues, and other marginalized and climate-vulnerable communities.

1.2 The local governments perspective

The key laws that enhance decentralized environment management, are the Local Government Act (1997) (as amended), the National Environment Act (2019) and the Climate Change Act (2021) which mandate local governments to plan and budget for such decentralized environment management services that include climate action (mitigation and adaptation). Besides, local governments are mandated to formulate and enforce ordinances (for district and city local governments) and bye-laws (for the lower local governments) to ensure effective environment protection for ecosystems' integrity, sustainability, climate resilience and human wellbeing. Accordingly, Section 8 of the Act has provided for District Climate Change Action Plan (DCCAP) that among others address climate vulnerability and risk assessment, mitigation and adaptation measures, technology, capacity and finance within the jurisdictions of the respective districts.

Within the principles of decentralization, the districts are expected to further include all stakeholders within their areas of jurisdictions in the process, the implementation and the review of the DCCAPs. Besides, the development partners like the Non-Governmental Organizations (NGOs) within the districts are expected to provide support in forms of resource mobilization and financing, capacity building, lobbying and advocacy for the effective implementation of the DCCAPs and other interventions that focus on actions for the enhancement of climate resilience and increasing community adaptive capacity. This is exactly what AFARD and AWO International are doing through the Climate Action Model (CAM) Project in Nebbi and Pakwach Districts with a number of climate-smart interventions that, among others include promotion of tree planting through the establishment of food forests, community and school woodlots, boundary tree planting; household energy saving cook-stoves; school health and environment clubs; household sanitation; family planning; intensified agriculture; and diversified livelihoods including enhancement of household income through Village Savings and Loan Associations (VSLAs).

Notably, based on the frequent occurrences of the extreme weather events that are associated with climate risks and their impacts, and the existing national policies, planning frameworks and legislation, Nebbi District, with support from the Local Climate Adaptive Living Facility (LoCAL)–Uganda mechanism, with funding from the United Nations Capital Development Fund (UNCDF), commissioned and facilitated the Climate Analytical Study in the District to improve understanding of the impact of climate change on rural livelihoods in Nebbi district local government.

2 INTRODUCTION

Nebbi district is already experiencing the impacts of climate change exhibited in increase in temperatures, reduced precipitation or at times precipitation intensity, increase in the frequency and intensity of drought and floods among other related calamities. Climate change is affecting agriculture, water resources, forestry resources, land and ultimately the community livelihoods. Nebbi district too is very vulnerable to climate change and its effects due to the low adaptive capacity of smallholder farmers who form majority of the population thus further compounding household poverty, food insecurity and poor health among other challenges.

2.1 Policy, Legal and Institutional Context

2.1.1 The National Climate Change Policy

That National Climate Change Policy of 2015 provides direction to all sectors that are affected by climate change to facilitate adaptation and mitigation, and to strengthen coordination of efforts amongst all sectors to build an overarching national development process that is more resilient. The policy provides guidance for how Uganda can develop sustainably while also producing less greenhouse gases that cause climate change. Likewise, the policy has provided for an institutional arrangement to ensure that Uganda can adequately respond to climate change.

The policy goal is to ensure a harmonized approach towards a climate-resilient and low-carbon development path for sustainable development in Uganda with the main objective of ensuring that all stakeholders address climate change impacts and their causes through actions that promote a green economy and sustainable development. Similarly, the policy specific objectives include: identifying and promoting collective policy priorities to address climate change; actions to enable stakeholders adapt to climate change; control measures to climate change; monitoring, detection, attribution and prediction policy responses; integration of climate change concerns into planning, decision making and investments in all sectors and at all levels; and mobilization of financial resources to address climate change. These objectives are expected to be realized through the policy strategies.

The policy is expected to reduce the country's vulnerability to climate change impacts by adjusting to and managing the projected impacts of climate change on the nation; address the challenges brought about by extreme weather events such as increased warming, drought, unpredictable rainfall patterns, floods and storms; and increase the resilience of the economy and allow the economy benefit from some opportunities brought about by climate change. Notably, one of the key modalities of the implementation of the policy is the inclusion of the government ministries, agencies and local governments (MALGs) within the principle of mainstreaming climate change issues in sector policies, national and local government plans and budgets.

2.1.2 The National Adaptation Program of Action (NAPA)

There are efforts and strategies in place to improve on Uganda's climate change adaptive capacity as seen by the priorities set by the National Adaptation Program of Action (NAPA) to respond to communities' needs to adapt to climate risks and their impacts. These priorities include: community tree growing; degradation management; strengthening meteorological services; community water and sanitation; water for production; drought adaptation; vectors, pests and disease control; indigenous knowledge and natural resource management; and climate change and development planning.

2.1.3 The updated Nationally Determined Contribution (NDC)

The Uganda's updated NDC is an articulation of the country's mitigation and adaptation contributions towards the objectives of the Paris Agreement by 2030. It sets out targets and

describes measures and actions (mitigation and adaptation) across sectors, society and the economy to be pursued towards the achievement of the targets.

The updated NDC (2022) has revised ambitious progress from the target of 24.7% GHG emission reduction below the BAU level by 2030 from 22% in the 2015 NDC. This target will be realized through mitigation measures across the NDC priority sectors that include Agriculture, forestry and other land uses (AFOLU), energy, transport, waste, and industrial processes and product use (IPPU). Besides, the NDC has adaptation priorities and targets across sectors that include; water and environment, agriculture, forestry, fisheries, energy, health, and transport, cities and the built environment. The updated NDC is expected to be implemented by: the Government of Uganda through the National Development Plan (NDP), the sector and local government development plans and budgets; civil society; and the private sector.

2.1.4 National Development Plan III 2020-2025

The government has articulated within the National Development Plan (NDP III) 2020-2025 the vision for development as *"A Transformed Ugandan Society from a Peasant to a Modern and Prosperous Country within 30 years*", or more simply, "harness and sustainably use the country's natural resources for socio-economic development for the benefit of the current and future generations of Ugandans."

One of the 18 programs of the NDPIII is natural resources, environment, climate change, land and water management with one of its objectives that focuses on the promotion of inclusive climate resilient and low emissions development at all levels. The objective is expected to be effected through building capacity for climate change mitigation and adaptation including hazards/disaster risk reduction; promotion of natural resources accounting to improve on national income measurement; mainstreaming climate change resilience in programs and budgets with clear budget lines and performance indicators; implementation of the resolutions of negotiations from carbon projects and develop bankable projects; development of local finance solutions for micro, small and medium enterprises engaged in sustainable production and generation climate change responsive technologies; and building partnerships with stakeholders to formulate instruments such climate and green bonds.

In addition to NDPIII, the Uganda NAP-Ag framework, is a partnership among UN agencies, government institutions, non-State actors, academia and research agencies, that presents adaptation actions for different agro-ecological zones, and aims to guide farmers, technical officers and decision makers on investments aimed at increasing the resilience of communities, systems and institutions. It provides 21 priority adaptation options in the areas of: crop production; livestock production; fisheries management; climate information, early warning and disaster preparedness; forestry, land and natural resources management; and research and knowledge management. It also links to government commitments under the Paris Agreement on climate change and the SDGs. Under its Vision 2040 Uganda seeks to: Integrate climate change issues (mitigation and adaptation) in all government plans and programs as a key development factor.

2.1.5 The National Environment Act (NEA) No.5 of 2019

Section 69 of the NEA (2019) provided for the management of climate change impacts on ecosystems with focus on the function of the lead agencies, including local governments, to address the impacts of climate change, among others, to improve on the resilience of ecosystems, promotion of low carbon development and reducing emissions from deforestation and forest degradation, sustainable management of forests and conservation of forest carbon stock. Accordingly, the lead agencies are expected to develop and operationalize strategies and action plans to address climate change and its impacts.

2.1.6 The Climate Change Act of 2021

The Government of formulated and adopted the Climate Change Act in 2021 to give the Convention" its Protocol and the Agreement the force of law in Uganda; provide a regulatory framework for monitoring, reporting and verifying the impact of climate change and the implementation of programmes on climate change; enhance the country's ability to adapt to the adverse impacts of climate change, build climate resilience and develop a mechanism for enhancing low greenhouse gas emissions; provide for the institutional framework to coordinate, supervise, regulate and manage all activities related to climate change; and provide for climate change financing.

Accordingly, Section 6 of the Act has provided for the formulation of the National Climate Change Action Plan (NCCAP) that is to be reviewed every five years or earlier as deemed necessary. The NCCAP provides for the actions to be undertaken to assess and manage the impacts, risks, risk tends and vulnerability to climate change; the responses, measures and actions to be undertaken for achieving adaptation to and mitigation of climate change; the measures' and actions to be undertaken to conserve and enhance sinks and reservoirs of greenhouse gases; the specific resilience, mitigation and adaptation measures, responses and actions to be adopted for ecosystems, gender matters related to climate change , among others; and the actions for building resilience to climate change.

Equally, Section 7 of the Act instituted the formulation of Lead Agency Climate Change Action Plan in conformity to the NCCAP, as the Lead Agency Action Plan provides for actions to assess and manage risks and vulnerability, identification of greenhouse gas mitigation potentials, and prioritization of appropriate adaptation measures for joint projects of national and local governments. In addition, Section 8 of the Act establishes District Climate Change Action Plan, which, within the areas of jurisdictions of the respective districts, will include: an assessment of the current and predicted impact of climate change; an assessment of the vulnerability impact and the risk of climate change; a statement of the strategies; policies and actions to build resilience; and capacity building for the districts and other stakeholders.

Moreover, Section 8 of the Act has provided for District Climate Change Action Plan (DCCAP) that focuses on an assessment of the current and predicted impact of climate change on the area under the jurisdiction of the district; an assessment of the vulnerability impact and the risk of climate change in the district; a statement of the strategies, policies and actions for adaptation to and mitigation of climate change; the actions to be undertaken by the district to build resilience to climate change; and the strategy to be adopted to undertake capacity building for the staff of the district and other stakeholders engaged in climate change related activities.

2.1.7 The Local Governments Act of 1997 (CAP 243 as amended)

The Local Government Act of 1997 decentralized powers to local governments, including management of natural resources, making management of natural resources a responsibility of local governments as a decentralized function. The Local Governments Act decentralizes environment management and empowers local governments to plan for environment protection, implement and report on environment management activities that include climate action or measures like adaptation and mitigation of climate change and its impacts.

2.2 Institutional Context

Section 14 of the National Climate Change Act established the Climate Change Department that is strategically responsible for realization of the objectives of the United Nations Framework Convention on Climate Change, its Protocol, and the Paris Agreement; and the coordination, monitoring and evaluation of Government programmes and actions on climate change. In performing its strategic functions, the Department is expected, among others to: assess adaptation and mitigation actions of lead agencies, individuals and private entities to identify potential

synergies and develop co-benefits to guide national prioritization of climate change actions; promote the development, application and diffusion including transfer of technologies, practices and processes that control, reduce or prevent anthropogenic emissions of greenhouse gases in all relevant sectors; serve as the national knowledge and information management centre for collating, verifying, refining, and disseminating knowledge and information on climate change; promote multi stakeholder participation and public participation in developing adequate responses to climate change and its adverse effects; and provide districts with technical assistance and information in support of District Climate Change Action Plans.

In addition, Section 15 of the Act adopted the Policy Committee on Environment (PCE) as established in Section 6 of the National Environment Act (NEA) of 2019. The Climate Change Act mandates PCE to advise the Department and lead agencies on the implementation of this Act and the National Climate Change Policy; make policies and decisions for implementation by the Department as provided for in the Act; receive and review the biennial report on climate change prepared by the Department and, where necessary, make recommendations to the Department; and review the reports referred to in section 12 of the Act for purposes of compliance with international obligations.

Besides, the National Climate Change Act has established the National Climate Change Advisory Committee (NCCAC) under Section 16. The NCCAC is responsible for the provision of independent technical advice on climate change science, technologies, interventional programs on climate change and best practices for risk assessment, enhancement of the adaptive capacity to potential impacts of climate change and establishment and achievement of the set targets.

Section 17 of the Act provides Lead Agencies that are responsible for mitigation, adaptation and compatibility standards, measures and performance levels for responding to the climate change matters which relate to the mandate of the respective lead agencies. In performing their functions, the Lead Agencies are mandated to: reduce the vulnerability of the fragile ecosystems, communities and concerned persons to the adverse effects of climate change; build economic and social resilience to climate change for the fragile ecosystems, communities and concerned persons such as by undertaking vulnerability impact assessments and provision of alternative livelihood assets; enhance development and dissemination of technology for climate change adaptation; and allocate financial resources for climate change resilient investments.

Likewise, Section 18 of the National Climate Change Act has designated the District Natural Resources Department as the department responsible for climate change matters in the districts and particularly the implementation of the DCCAP. In this regard, the functions of the District Natural Resources are well stipulated in Section 17 (2; a-i).

Section 19 of the Act designated the District Environment and Natural Resources Committee established under section 27 of the National Environment Act, 2019 as the Committee responsible for climate change matters in the district. The functions of this committee are in Section 19 (2; a-g)

Similarly, Section 20 of the Act has mandated a local government to appoint a lower local government climate change committee responsible for climate change in their local jurisdictions. Likewise, the functions of the lower local government climate change committee are stipulated in Section 20 (2; a-g)

2.3 Description of the Study Area

Source: Map extracted from Nebbi District Development Plan III

Nebbi District is located in the North-Western part of Uganda (West Nile sub region). It is bordered to the North by Madi-Okollo district, Zombo to the west, Pakwach to the South-East and the Democratic Republic of Congo to the South-West. In 2010 and 2017 the counties of Okoro and Jonam County were split off Nebbi to form Zombo and Pakwach Districts respectively, leaving Nebbi with only Padyere County.

Nebbi District is not well endowed with ecosystems like water bodies, wetlands and forests. Notably, according to the District Development Plan (DDP) for 2020/21-2024/25, the district has only one permanent water source (River Nyarwodho) while seasonal streams and springs mainly in Erussi Sub-County, and other seasonal/intermittent rivers/streams like Nyacara, Namthin, Ayila, Paicing and Alala with associated wetland coverage of 8% of the total district land area. Likewise, the district has 4 forest reserves that include 3 local forest reserves (LFRs): Acwera (21 ha), Erussi (21ha) and Nebbi (10ha), and 1 central forest reserve (CFR), Omier (2,380ha); the district forest coverage is 7% of the total land area.

The District lies between altitudes 2289 ft to 5224 ft above sea level. The landscape offers one of the best sceneries in Uganda. The generally extensive plains of the east gently rise into the undulating hills of the west. Faulting and rifting along the western arm of the East African rift valley zone extends from the neighbouring district of Pakwach from Panyimur into Jukia hills in Nebbi District. Up arching and tilting affected the Erussi and Goli uplands. Consequently, differences in

localized diastrophic forces led to a variation in relief with a marked ascend towards the Democratic Republic of Congo. The district has a raised plateau with metamorphic rocks with granitic intrusions and other features. The drainage system is basically constituted by Namrwodhu River which has great economic importance with potential sites for electricity generation besides; there are several other minor rivers, springs and wetlands.

Nebbi District is currently divided into 13 Lower Local Governments that include eleven (11) rural Sub-Counties; Akworo, Kucwiny, Ndhew, Atego, Nebbi, Erussi, Parombo, Padwot, Alala, Acana and Jupangira), two (2) Town Councils; Parombo and Nyaravur-Angal Town Councils; and a municipal council; Nebbi Municipal Council with three divisions of Thatha, Abindu and Central. The District has 60 parishes, 596 villages while Nebbi Municipality has got three (3) Divisions, nine (9) Wards and 46 cells. The District has a population of 298,300 (Male: 145,300 (48.7%) and Female: 153,000 (51.3%).

According to third District Development Plan (DDPIII) of FY2020/21 to FY2024/25, the economic activities in the District include the following:

(i) *Agriculture;* this sector employs 85% of the population, with 77% being women and 63% being youth. Besides, over 90% of the adults aged 18-59 years in Nebbi depend on subsistence farming as their main economic activity with existing potential for commercial farming. The major crops commonly grown include; Millet, sorghum, sweet potatoes, Simsim, Cassava, Ground nuts, cow peas and Maize Grain. Initially agricultural production in the district was mainly for subsistence however the trend has changed whereby a reasonable number of people are engaged in trade

(ii) *Livestock*: The key animals kept for both economic and social purposes include cattle, goats and poultry.

(iii) *Fishing*; fish farming in the district has boosted the economy and household incomes for the people in the sub-counties of Nebbi, Nyaravur, Kucwiny, Parombo, Akworo, Atengo and Erussi.

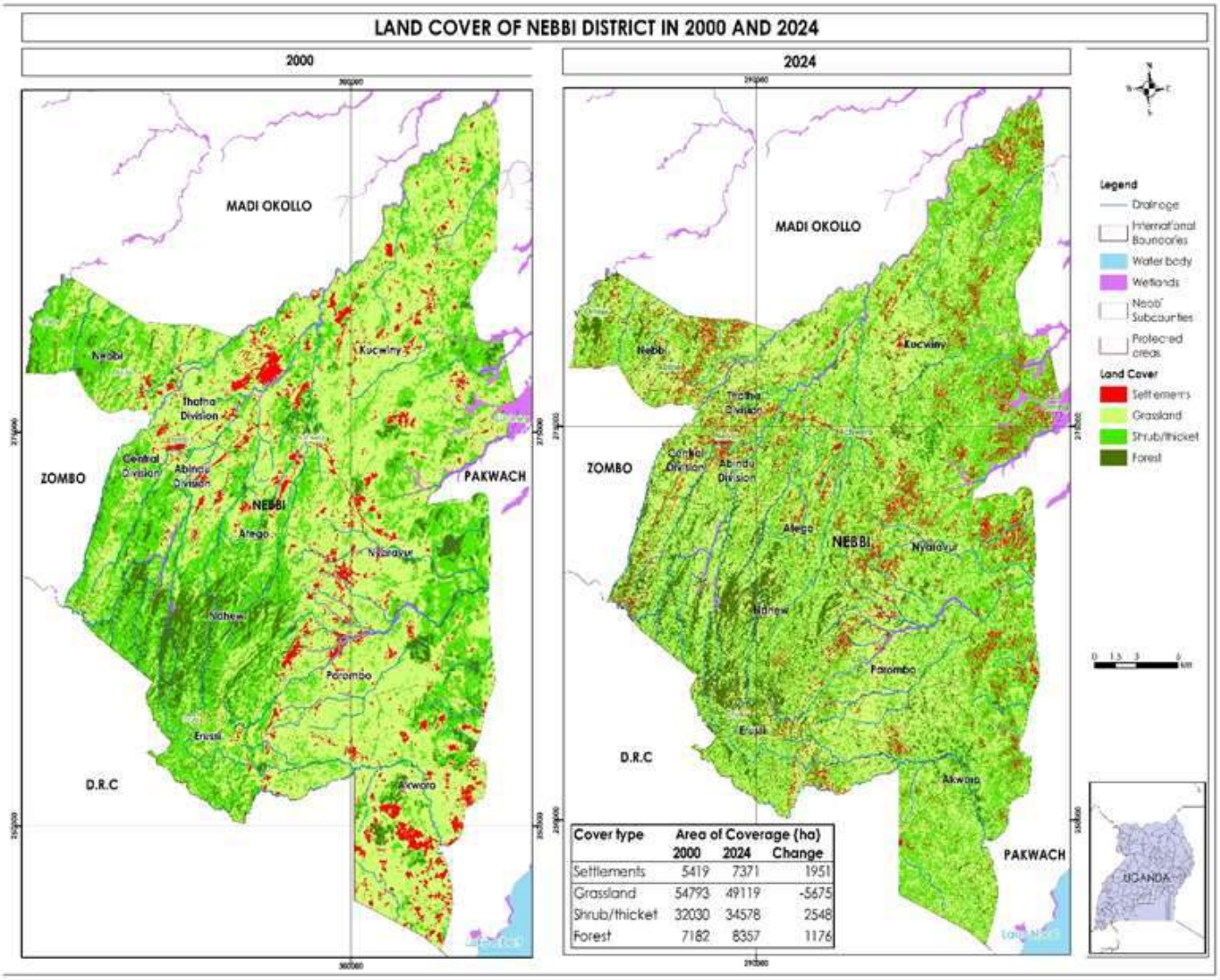
(iv) *Minerals and mining;* Nebbi anecdotical information indicates that there are four common types of previous mineral that is not being exploited namely; olivine, pyroxene, biotite and amphibole. Besides, other minerals that are being mined or exploited include sand, clay and rock across the district.

(v) *Other economic activities* include; tourism (still not well developed), trade (mainly micro small and medium enterprises (MSMEs), industrial services, market linkage services and financial services (SACCOs)

2.4 Land Cover and Land Use Change (LCLUC)

Land cover and land use change (LCLUC) maps produced by the National Environment Management Authority (NEMA) show that over the last 24 years, forest cover has increased while grassland has reduced. Probably this is due to the growing of trees by individuals, groups and institutions, and conversion of land to agriculture and settlement coupled with the frequent droughts could have contributed to the reduction in grassland. However, it is important to note that most of the trees grown are exotic species like pines, eucalyptus, teak and neem but not the indigenous species that are of great biodiversity importance and more useful for climate change mitigation.

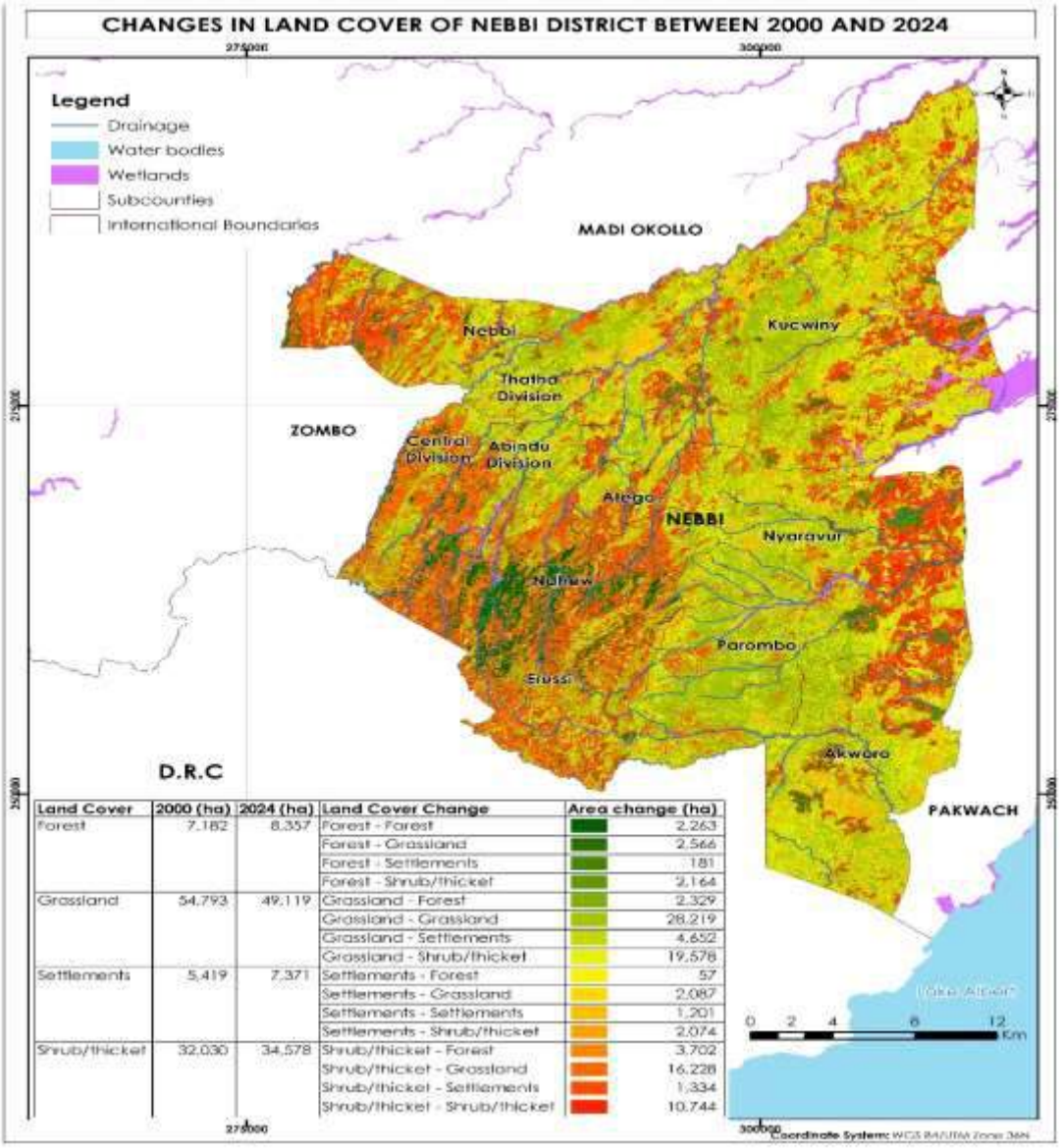
The maps below show the varying LCLUC in both Nebbi District in 2000 to 2024



Cover type	Area of Coverage (ha)		
	2000	2024	Change
Settlements	5419	7371	1951
Grassland	54793	49119	-5675
Shrub/thicket	32030	34578	2548
Forest	7182	8357	1176

Source: NEMA, April 2024

The above map shows that from 2000 to 2024, settlements have increased by 1,951 ha, which could have contributed to the loss of grassland worth 5,675 ha, while forest cover has increased by 1,176 ha



Land Cover	2000 (ha)	2024 (ha)	Land Cover Change	Area change (ha)
Forest	7,182	8,357	Forest - Forest	2,263
			Forest - Grassland	2,566
			Forest - Settlements	181
			Forest - Shrub/thicket	2,164
Grassland	54,793	49,119	Grassland - Forest	2,329
			Grassland - Grassland	28,219
			Grassland - Settlements	4,652
			Grassland - Shrub/thicket	19,578
Settlements	5,419	7,371	Settlements - Forest	57
			Settlements - Grassland	2,087
			Settlements - Settlements	1,201
			Settlements - Shrub/thicket	2,074
Shrub/thicket	32,030	34,578	Shrub/thicket - Forest	3,702
			Shrub/thicket - Grassland	16,228
			Shrub/thicket - Settlements	1,334
			Shrub/thicket - Shrub/thicket	10,744

Source: NEMA, April 2024

The above map shows land cover changes that have been caused by a combination of factors that include agriculture, settlements and climate change. Notably, the changes in grassland and shrub/thicket.

2.5 The Description and Analysis of the Climate of Nebbi District

The District is located within a humid equatorial region, prevailing winds and water bodies including lake Albert, Albert Nile, River Namrwodho, and many seasonal streams that occasion differences in precipitation patterns. Nebbi district experiences a purely tropical climate due to its location within the eastern topographical rainfall zone. The dry and sub-humid climate is associated with orographic rainfall and hail/thunderstorms. The District gets an average rainfall of 1,100mm per annum. Rainfall is bimodal in nature with peaks in May and October. The first short and usually unreliable rainfall is from late March – May, while the second and more reliable rains are in the July – November period. Dry spells are experienced in June – July and December – early March. Temperature is generally high except in Erussi and Ndhew Sub-counties. However, the rainfall pattern is gradually changing to one peak per annum. This is evidenced by prolonged draught and delayed beginning of the usual rainy season as indicated by late planting

of crops. The District is currently faced with the impacts of climate change as can be seen from prolonged dry spells, increased incidence of floods, erratic and unreliable rainfall, and high temperatures.

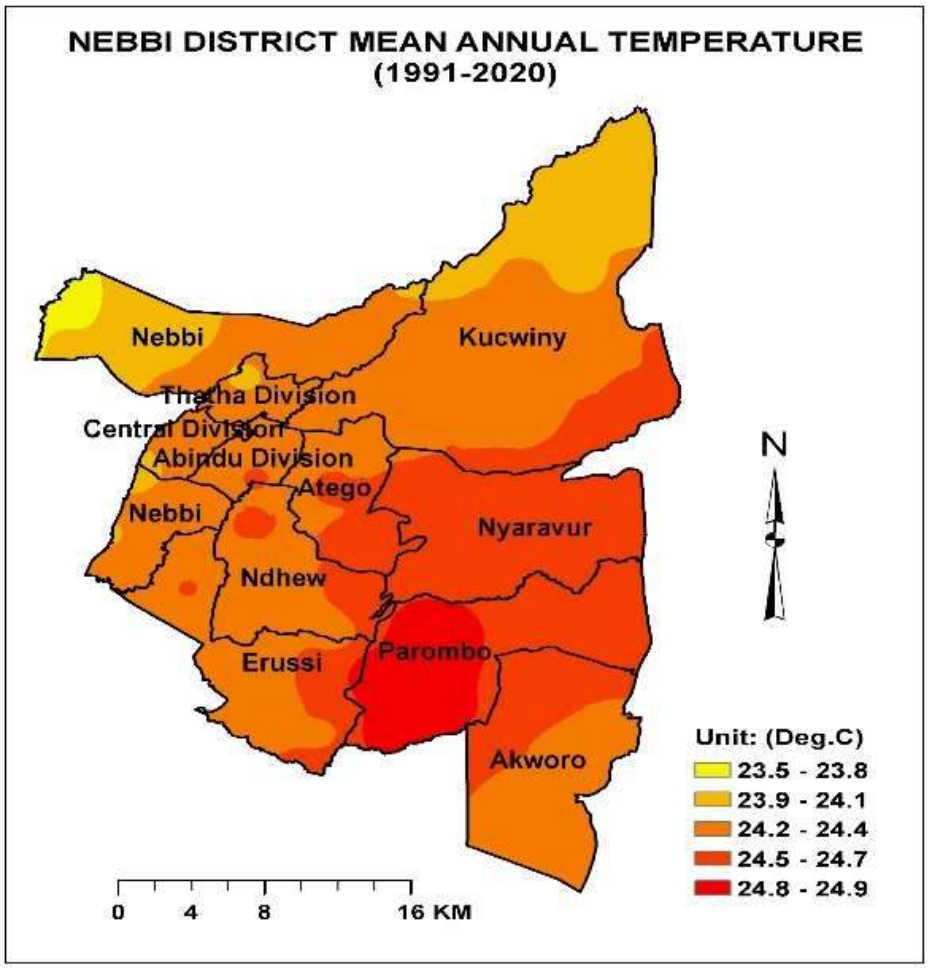
Nebbi district's climate is diverse due to the district's unique biophysical characteristics influenced by large rivers, water bodies and a highland to the west (Erussi). Variations in sea surface temperatures in the distant tropical pacific and Indian Oceans strongly influence the timing of annual precipitation in Nebbi district. The low land areas of Parombo, Nyaravur-Angal Town council, Kucwiny and Alala sub counties experience less precipitation than the west and is more susceptible to drought and floods.

2.5.1 Spatial Distribution of Mean Annual Temperature and Rainfall

Data and information got from Uganda National Meteorological Authority (UNMA) shows the spatial distribution of mean annual temperature and rainfall in 1991-2020 as below:

Observed Temperature (1991-2020)

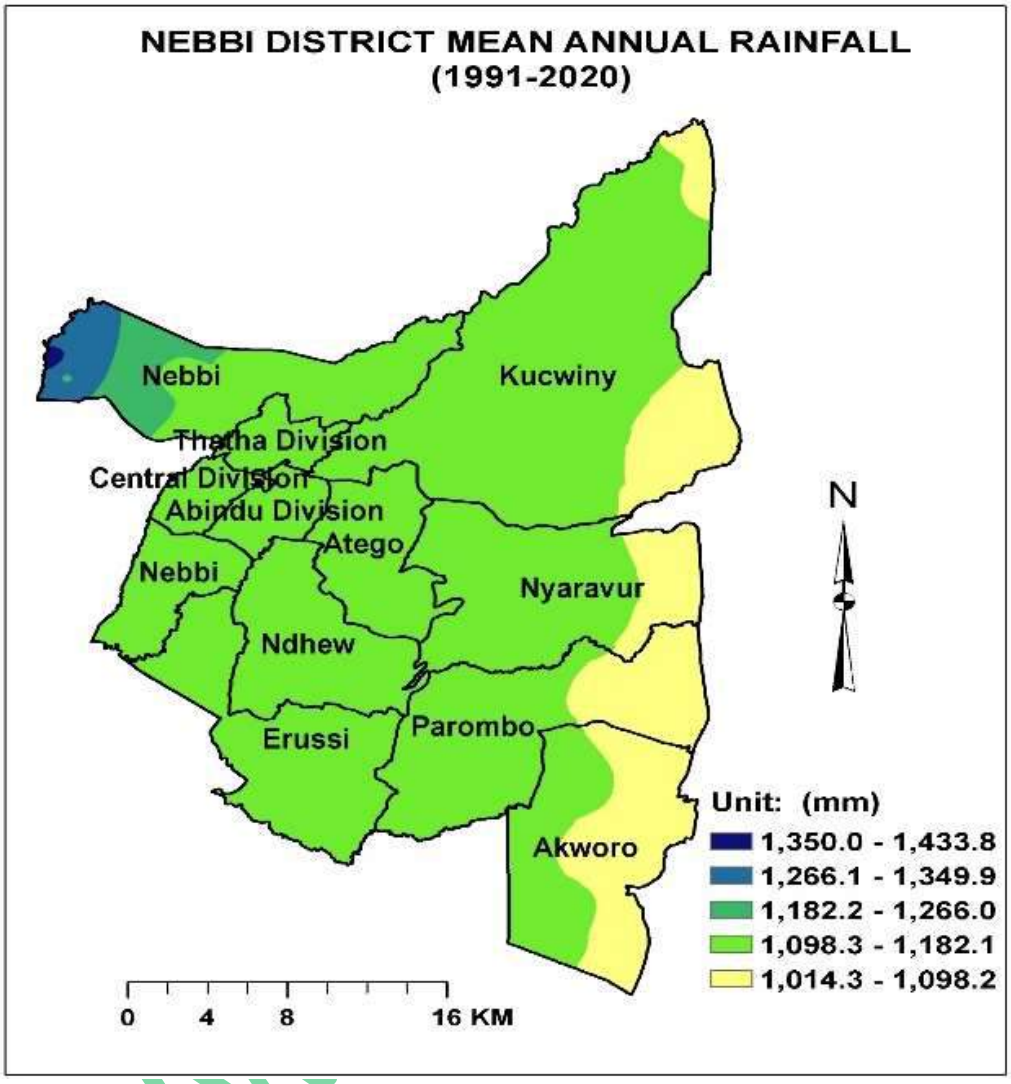
The spatial maps indicate Parombo, Nyaravur and parts of Akworo areas respectively are hotter (24.5º C to 24.9º C) than the rest of the parts in Nebbi district (23.5º C to 24.4º C). The western part of Nebbi district is generally cooler than the eastern as indicated below



Source: UNMA, May 2024

Observed Rainfall (1991-2020)

Rainfall distribution also indicates the western and central parts of the district receiving more rainfall (1,098.1 mm to 1433.6 mm) than the eastern parts of the district (1014.3 mm to 1098.2) as indicated below;

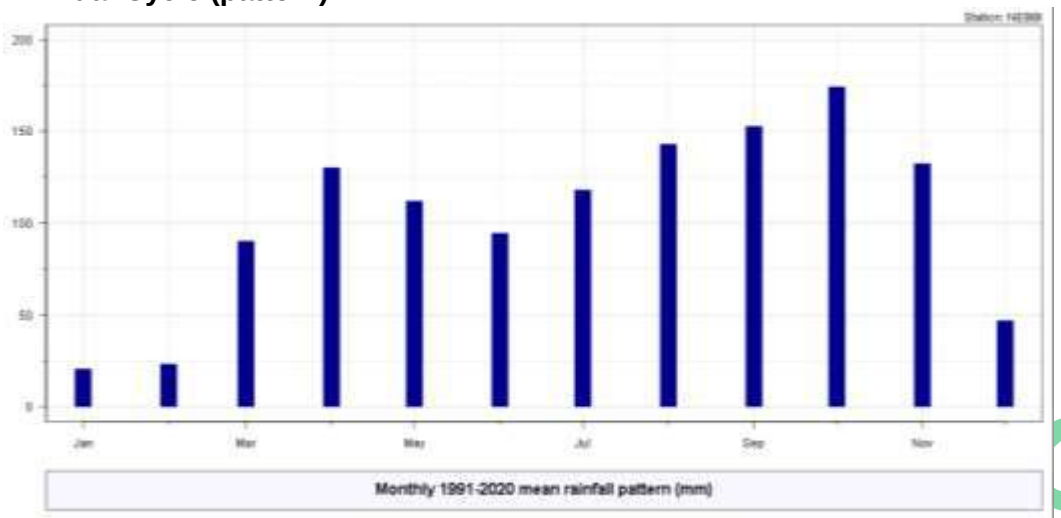


Source: UNMA, May 2024

Mean annual rainfall and temperature pattern and trend

Trend analysis based on detailed temporal scales (annual, seasonal, monthly) were performed through the Mann–Kendall trend test and the Theil–Sen slope method

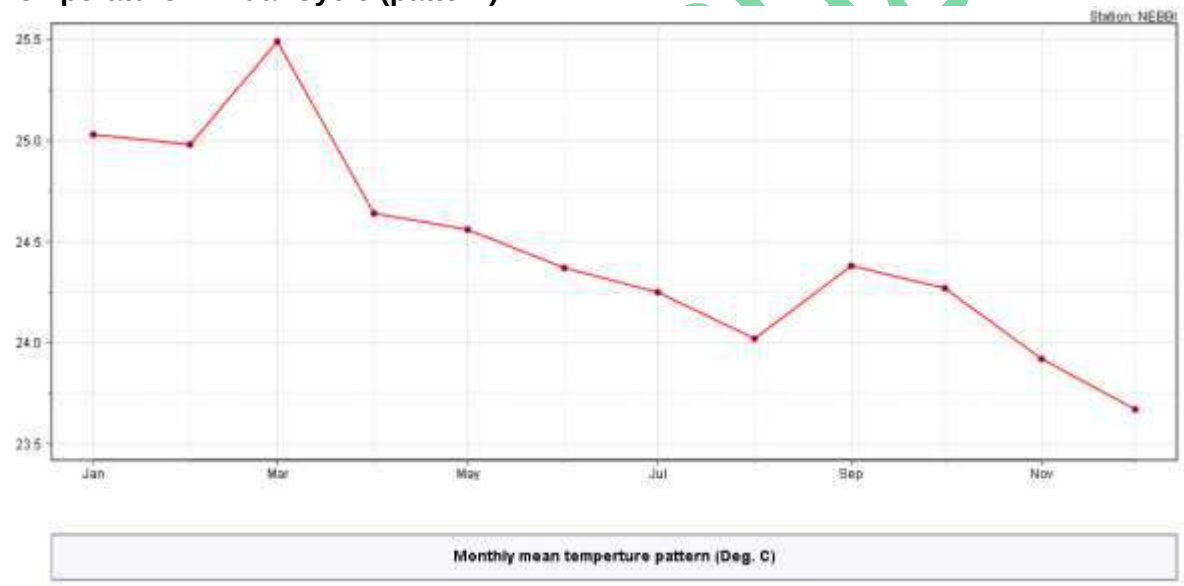
Rainfall Annual Cycle (pattern)



Source: UNMA, May 2024

Nebbi rainfall generally is unimodal from March to November with a slight relaxation in June with two distinct growing seasons with the second growing season (July to November) being longer that the first (March to May).

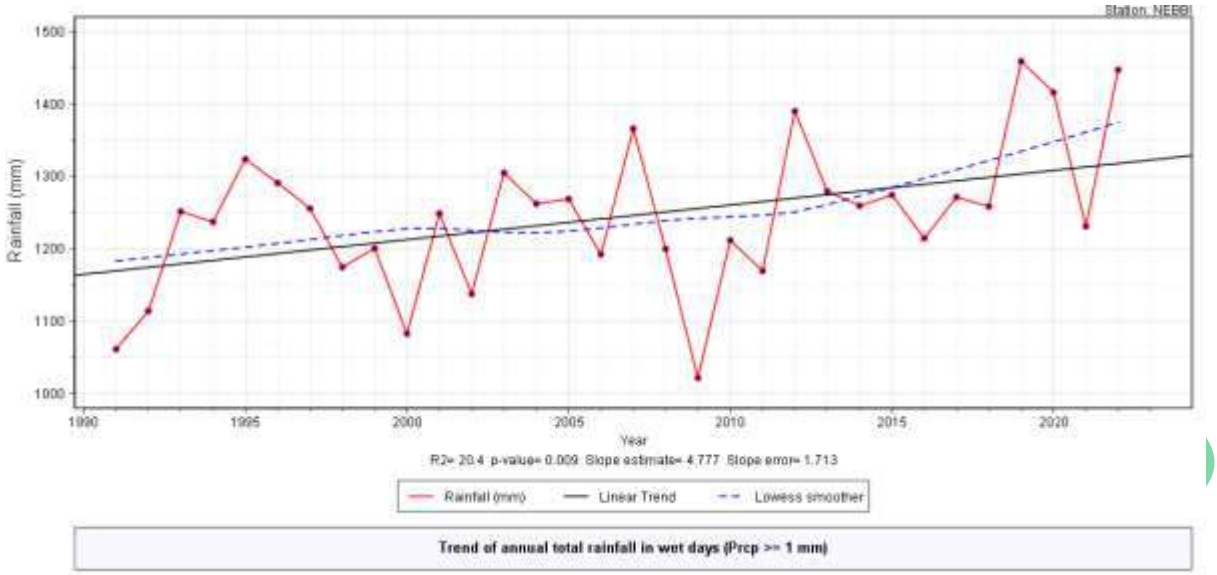
Temperature Annual Cycle (pattern)



Source: UNMA, May 2024

Mean monthly temperature for 1991-2020 period varies between 23.6º C to 25.5º C , with the highest in March.

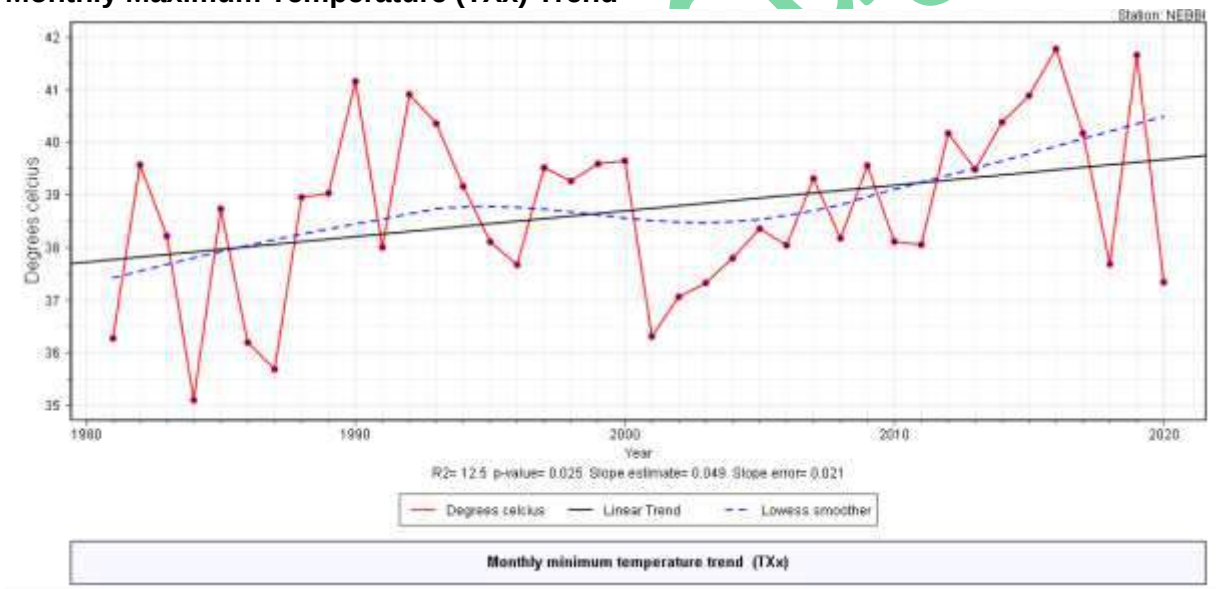
Annual Total Rainfall Trend



Source: UNMA, May 2024

Inter-annual variability with significantly increasing total annual rainfall trend at the rate of 4.8 mm/annum from 1991-2022 ranging between 1000 mm to 1400 mm.

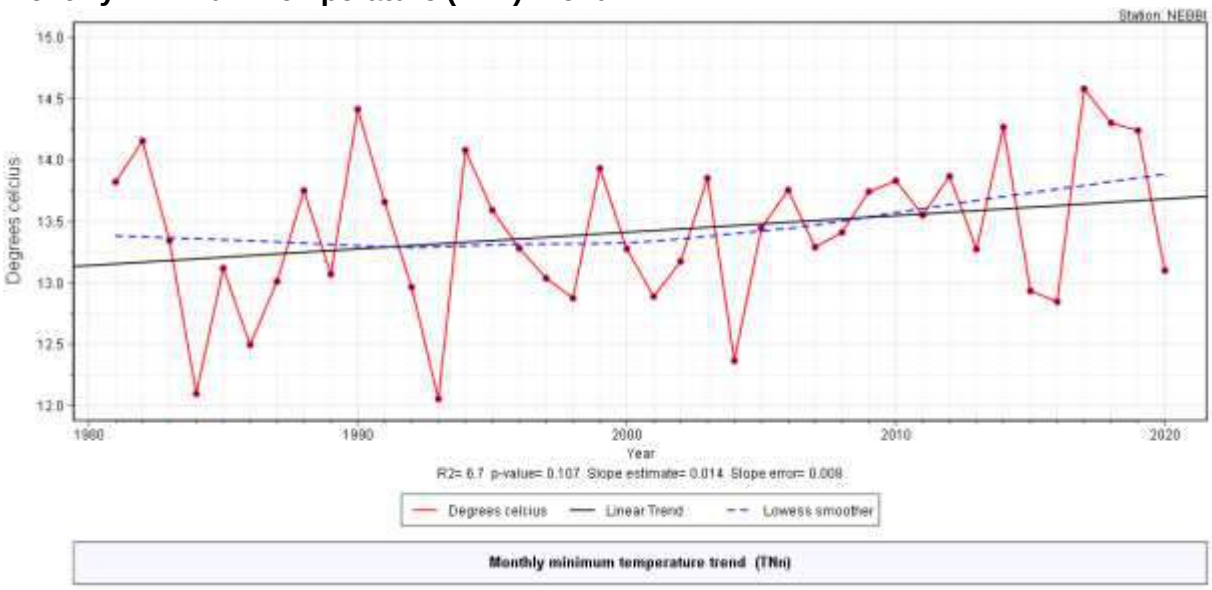
Monthly Maximum Temperature (TXx) Trend



Source: UNMA, May 2024

TXx revealed inter-annual variability ranging between 25.0 to 41.5º C in the period 1991-2022. However the significantly increased trend was depicted at the rate of 0.49º C/decade.

Monthly Minimum Temperature (TNn) Trend



Source: UNMA, May 2024

Increasing TNn trend at the rate of 0.14º C/decade. However there is inter-annual variability ranging between 12.1º C to 14.6º C.

Notably, the above trends in the spatial distribution of mean annual temperature and rainfall explain why the lowlands of the greater Kucwiny, Nyaravur and Parombo experience long dry spell or drought as they hotter than other parts of the district especially the western parts that receive more rainfall. Besides, the western and central parts of the district like Erussi and Ndhew are highlands whose rains are partly influenced by the Congo westerlies from Congo basin that contribute to the wetter conditions within the highlands than the lowlands. Unfortunately, the lowlands are also vulnerable to other climate risks like windstorms and extreme weather events such as floods.

Besides, according to the District State of Environment Report (DSOER) of 2012/2013, the first short and usually unreliable rainfall is from late March – May, while the second and more reliable rains fall in the August – October period. Dry spells are experienced in June – July and December – early March. Temperature is generally high except in the highlands of the western and some parts of the central areas of the District. The rainfall pattern is gradually changing to one peak per annum. This is evidenced by prolonged draught and delayed beginning of the usual rainy season as indicated by late planting of crops.

2.5.2 The Experiences and the Views of the Community on the Climatic Trends in Nebbi District

During the consultations, the members explained their experiences and provided views that corroborate the spatial distribution of mean annual temperatures and rainfall provided by UNMA and explained as above. In this regard, most of the community members who were interviewed, from their indigenous knowledge, noted that the warm season of February to May, after the dry cold wind (Harmattan) is now warmer and it is characterized by sunshine intensity, high temperatures both at day and night time that makes people sleep in the compounds during the nights. Besides, the community narrated and revealed that temperatures have increased more during the first season in recent times. According to the community's point of view, sunshine is now more intense than when we were young (over 30 years ago).

In regard to rainfall, the community members who were interviewed revealed that there 2 rain seasons; first and second rains and that both seasons are wet and moderately wet. That in the past, first season rainfall onset was early in February and rainfall cessation was in late May. In the last 20 years, the community members reported late onset of rainfall in March and early cessation in May. The late onset of rainfall coupled with the early cessation means there is shorter growing season. The rainfall is characterized by strong winds and hailstorms. Besides, late onset of rains has resulted into the reduction in yields of crops like cowpea that require adequate rainfall In addition, according to the community, in the past, the second season onset of rainfall was in early July and cessation in early December with adequate amounts and intensity. However, presently second season onset of rainfall is in September and cessation in November. The seasonal distribution of rainfall is variable, rainfall duration is two months and amount received is less. Furthermore, that that the types of winds have changed in nature over the last 20 years as there is growing uncertainty about the direction of flow and it has become more intensive and destructive in recent times than in the past.

2.6 The Study and its Objectives

Based on the bio-physical and climate variations, scope and severity of climate risks and their impacts, and the level of climate vulnerability, 8 were selected out of the 13 lower local governments for the study on climate risk and vulnerability assessment (CRVA) in Nebbi District. The 8 lower local governments include: Nyaravur-Angal and Parombo Town Councils, Parombo, Alala, Kucwiny, Jupangira, Erussi and Ndhew sub-counties. Some of the bio-physical and agro-ecological characteristics of the selected local governments are as describe below:

Nyaravur-Angal and Parombo town councils, Alala, Kucwiny and Parombo sub- counties are characterized by northwestern savannah and grasslands with agro-ecological conditions for mixed agriculture, annual crops, oilseed production and cotton cash crops, and livestock. The district's Parish Development Model (PDM) priority crops and livestock for the sub counties are cassava, cereals, cotton, apiary and goats.

Erussi, Ndhew and Jupangira sub counties are characterized by highlands ranging from 1200-1500 meters above sea level with agro-ecological conditions favoring cereals and root crops cultivation—particularly coffee, Irish potato, sweet potatoes, cassava, millet/sorghum, cooking banana "matooke", maize, groundnuts, beans, soybeans, piggery and goats. Land holdings are small with high population densities. The district's PDM priority production for the zone includes Irish potato, Arabica coffee, matooke, cassava, tea, dairy, poultry, and fisheries.

The purpose of the Climate Analytical Study was to conduct Climate Risk and Vulnerability Assessment (CRVA) for priority adaptation sectors in Nebbi District Local Government by providing relevant information on the existing and effective local adaptation practices that should be integrated into capacity building of the targeted communities and the responsible institutions or local governments in order to inform food security and agricultural programming and investment decisions. Thus, the study aims at providing information for climate action (adaptation), and enhancing the capacities of target communities and the responsible institutions, especially the District and lower local governments.

2.7 The Study Methodology

The study was conducted using mainly qualitative research methods including review of secondary literature and a field mission that held consultative meetings with the key stakeholders that included the local communities by using Key Informant Interviews and Focus Group Discussions. Participatory assessment tools such as historical climate trends and timeline analysis, risk and vulnerability assessment, and impact hazard mapping and copping assessment were used to collect information on climate change hazards, exposure, risk, vulnerability and response in the selected lower local governments. The climate analytical study seeks to enhance

general and specific understanding of Nebbi district's climate change risks, impacts and vulnerability at the community level, including trends and projections, focusing on population and livelihood vulnerability and the sustainable development of key sectors. The study focused on climate risk assessments to identify the likelihood of future climate hazards and their potential impacts on key sectors and the adaptation actions in Nebbi District. The information and analysis provided by the study will inform the prioritization of climate action and investments in adaptation in the respective communities and sectors, including community and institutional capacity building.

The climate risk and vulnerability assessment study was guided by the following questions:

a) What are the key climate risks in Nebbi District?
b) What are the priority risks in the District? (based on scope (area and number of people affected), severity (level of damage/magnitude/depth), and urgency (time required to manage), scale of 1-5 where 1 is lowest and 5 is highest level of the risk. Notably, scope and severity are the major factors that determine the level of climate risks.
c) What are the current/potential impacts of the climate risks?
d) How much is the impact? (scale-how many? depth-degree of change, pattern-how frequent? and duration- how long? 1-5
e) Which sectors are most vulnerable to climate risks and their impacts? (scale of 1-5)
f) Who experiences the impacts and at what magnitude? farmers, women and young people, businesses etc? (ranking according to the magnitude (scale, depth, pattern and duration of the impacts based on low, medium or scale of 1-5)

2.8 Limitations of the Study

There are a number of limitations to this assessment that include the incompleteness of the projected climate data for Nebbi District. Besides, there are limited district-specific climate data that constrained the CRVA. In addition, the high levels of uncertainty in the climate change models, particularly for the key climate hazards greatly limited the ability to undertake economic analysis of the impacts of climate change and of adaptation measures. Furthermore, the environmental and social impacts like land tenure impacts of the proposed adaptation options have not been considered as part of this assessment yet they account greatly for ecosystem and community resilience to climate change and its impacts. Moreover, the CRVA methodology has been mainly qualitative in technique and has been prepared based on the information available at time of preparation, besides being constrained by the limited budget for the study.

3 THE KEY FINDINGS

3.1 The Local Drivers of Climate Change in Nebbi District

According to the available data/information from the DOSER of 2012/2013 and the third District Development Plan (NDDPIII) and discussions with the stakeholders, the key drivers of climate change in Nebbi District include but not limited the following factors:

Environmental degradation and depletion of natural resources that are characterized by: deforestation and indiscriminate cutting of trees for charcoal and at times for cultivation and settlement; uncontrolled and illegal bush burning that degrades and depletes the biomass including forests and wetlands that would regulate local climate and enhance adaptation; and encroachment of wetlands for agricultural expansion. Besides, other environmental degradation factors are linked to practices like poor farming methods and cultivation within the riverbanks that accelerate soil erosion and subsequent siltation of the existing rivers like Ayiila, Nyachara, Namthin and Namrwodo, notably some of the rivers have become seasonal due to reduction in water volume, possibly due siltation and other factors like temperature intensity and poor catchment management.

Population pressure on land resources: According to Uganda Bureau of Statistics (UBOS, 2023), Nebbi District has a total land area of 985km2 with a total population of 306,300 people (48% male and 52% female) and its population density stands at 311 people per square kilometre. The population growth rate is 3% per annum (this is majorly due to high fertility rate of 6.2% and declining level of infant mortality rate of 88/10,000 of children born). Besides, the population largely depends on agriculture, which employs over 85% of the people (77% being women and 63% youth). These demographic and livelihood scenarios have contributed to the depletion of natural resources like forests, tree cover, riverbanks and hilly areas that have contributed to environmental degradation and resultant climate change and associated risks and hazards as the increasing population exerts pressure on land resources for survival.

Poverty that contributes to climate change and its impacts as the poor people seeks for livelihood assets like food and income from the use of natural resources like land, forest, wetlands and water resources. The more the poor use these natural resources without any sustainability efforts like sustainable management practices like climate smart agriculture and other conservation strategies, the more they are degraded and thus aiding climate change and its impacts. In addition, the poor usually have limited or constrained livelihood alternatives and tend to depend solely natural resources for their survival with limited adaptive capacity to cope up with climate risks and hazards.

Low institutional and community capacities; Both the District and the Lower Local Governments have limited capacity in terms of skilled manpower and finance to invest in environment conservation and sustainable management of natural resources to enhance climate adaptive capacity of the community and ecosystems in the District. The poorly managed and degraded natural resources like land, forests and water resources contribute significantly to climate change and its impacts including reducing adaptive capacity. Likewise, the communities in Nebbi District have low capacity in investing in climate action (adaptation) like afforestation and re-afforestation, sustainable land management and integrated management of water resources due to limited knowledge/lack of awareness and finance.

Limited access to technology in that the communities have limited access to technologies such as water harvesting facilities, irrigation technologies and energy saving stoves that would not only enhance environment conservation but also enhance community and ecosystem adaptive capacity. The existing technologies are either not affordable or not appropriate to local

environment. Besides, in some instances, the communities lack knowledge/lack of awareness and skills in the use of the existing technologies.

3.2 Overview of Climate Risks and Vulnerability Assessment

According the consultations conducted in the target lower local governments and studies carried out by partners like AFARD and AWO International, the key climate risks and hazards are:

Rising temperatures and heat intensity: The District's yearly temperature is 27.46ºC and it is 3.99% higher than Uganda's averages with annual high temperature of 32.17ºC and annual low temperature of 20.56ºC. Temperature variations that are characterized by rising temperatures are responsible for the prolonged drought (usually in June-July and December-March) and wildfires (common in the lowlands) in Nebbi District.

Irregular pattern of rainfall and precipitation intensity: Located at an elevation of 727.61 meters (2387.17 feet) above sea level, Nebbi has a tropical wet and dry or savannah climate. Nebbi typically receives about 100.81mm (3.97 inches) of precipitation and has 194.38 rainy days (53.25% of the time) annually. However, with time the rainfall pattern has changed from two to one season characterized by irregular short season with excessive rains, floods and long dry spells.

Windstorms: The changing weather of Nebbi District is characterized by strong winds and hailstorms which cause destruction of crops, animals and properties, damage social services infrastructure like health units and schools, sanitation facilities and thus causing public health problems. Besides, the windstorms contribute to distress and psychological stress within the affected communities.

Jonathan Cook et al (USAID 2016) state that, climate vulnerability can be determined by three interacting factors: exposure to climate stressors, sensitivity to those stressors, and adaptive capacity to manage stressors. Notably, the three factors that influence climate vulnerability have been explained in Annex I of this report. Climate stressors are changes in weather conditions that include but not limited to temperatures, precipitation or rainfall that are associated with prolonged dry spells or drought and floods respectively. However, there are also non-climate stressors that influence vulnerability; such stressors could be economic, social, political, institutional, physical and environmental factors within a society.

Uganda Climate Risk Country Profile (2021) states that, some trends that require urgent actions to mitigate against the impacts of climate change, reduce climate vulnerability and improve on the country's adaptive capacity. Some of these trends state that: increased temperatures are expected in Uganda, where under a high-emission scenario, monthly temperature change is expected to increase by 1.8°C for the 2050s and by 3.7°C by the 2090s, and increased temperatures will also contribute to increased aridity coupled with the length and severity of the dry season; rainfall is predicted to increase significantly with intensity and frequency of extreme rainfall events are associated with rainstorms and floods; flooding, particularly in low-lying areas (flood plains and lakeshores) of the country that are most risky. Each year, floods impact on nearly 50,000 people and costs over $62 million; drought affected close to 2.4 million people between 2004 and 2013, and drought conditions in 2010 and 2011 caused an estimated loss and damage value of $1.2 billion, equivalent to 7.5% of Uganda's 2010 gross domestic product; temperature rise as well as the increase in the frequency and intensity of extreme drought and floods are likely to reduce crop yields and cause a loss in livestock with significant implications on food security. In addition, water resources are likely to be increasingly strained in Uganda's climate future especially in the water-stress areas.

The impacts of these climate risks/threats like floods and draughts are far-reaching and significant on both the natural environment like forests, water and the associated natural resources, and human beings or human livelihood assets like food security, income, household energy, water, and health. Thus, climate change impacts affect both nature (ecosystems) and human survival. However, notably, climate change has adverse impacts on the built environment too; such as infrastructure, housing and urban facilities.

The National Risk and Vulnerability Atlas of Uganda 2019 and the Country Climate Risk Profile of 2021 identify floods, landslides, mudslides, prolonged drought, lightning, hailstorms, windstorms, and earthquakes as the common climate-induced hazards and risks. Consequently, according to the updated Nationally Determined Contribution (NDC, 2022) of Uganda, the key sectors that are vulnerable to climate hazards and risks include: agriculture with vulnerability rating of 4.07 and risk rating of 4.18 (where 1 is less vulnerable, less risk and 5 is most vulnerable, most risk); water with 4.63 and 4.75 respectively; fisheries (3.00 and 4.00); business (3.75 and 4.00); forests (3.25 and 4.25), and ecosystems (wetlands, lakeshores/riverbanks, mountainous and hilly areas, rangelands) with both vulnerability and risking rating at 5.00. Other sectors include; health, built infrastructure, transport, manufacturing and energy. It should be noted that most of these are primary production sectors that contribute greatly to the national economy and human survival in Uganda.

According to the 4th Annual Report of the Intergovernmental Panel on Climate Change (IPCC AR4, 2007), climate vulnerability is a function of the character, magnitude and rate of climate variation to which a system or population is exposed, its sensitivity and its adaptive capacity. Accordingly, climate vulnerability assessments emphasise exposure, sensitivity and adaptive capacity of systems, assets and populations. Therefore, adaptation would also include any efforts to address these key elements of climate vulnerability (exposure, sensitivity and adaptive capacity). Sensitivity is the degree to which a system is affected, either adversely or beneficially, by climate-related stimuli which include all the elements of climate change, including mean climate characteristics like temperatures and precipitation, climate variability, and the frequency and magnitude of extremes. Exposure refers to environmental factors; the extent to which the environment makes people or systems more vulnerable to climate risks and hazards. Adaptive capacity is the ability of a system or a community to adjust to climate change, including climate variability and extremes. Thus, vulnerability is the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes.

Risk assessments focus primarily on the projected changes in climatic conditions, inventory of potentially impacted assets, the likelihood of the impact happening and the resulting consequences. Relatedly, the Local Climate Risk and Vulnerability Assessment (CRVA) Report (2021) shows that Uganda has a high climate vulnerability and a low adaptive capacity and this corroborated by the Notre Dame Global Adaptation Initiative (ND-GAIN 2021) that ranked Uganda as the 13th most-vulnerable country in the world to climate change and 160th out of 192 nations in readiness to confront the threat. This implies that the country is very vulnerable and unprepared to respond to climate change impacts.

Notably, the main factors that influence climate vulnerability include: physical, social (society and culture), economic and environmental, factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards. Besides, climate vulnerability is influenced by institutional (management systems, structures, policies, planning and budgeting), political and psychological factors.

3.2.1 Climate Risk Assessment in Nebbi

Climate change is a reality in Nebbi District and manifests itself in forms of rising temperatures that contribute to prolonged drought, heavy rains that cause floods, windstorms, dry season wildfires, vectors, pests and diseases. Notably, according to the a study carried by AFARD and AWO in 2023, extreme weather conditions and events especially drought that have had devastating effects in the District started way back in early 1980s, 1988. 1995/96, 2008/9, 2012, 2017, 2020/21, while floods were reported in 1985, 2004, 2007, 2011, 2019 to 2022. These extreme weather events have been associated with increased incidents of pests and diseases for crops, malaria infections, thunderstorms and strong winds. The District now experiences shorter and more erratic rainy seasons and prolonged drought that contribute to crop failures, food shortage and famine, and a contributing factor to poverty too.

As adopted from the ongoing District Contingency Planning (DCP) process table 2A below shows the assessment of the key climate risks and hazards in Nebbi District. The assessment of the magnitude of the risks focuses on the weight of the relative risk (RR) which is a function of probability (P) of risks and severity of impacts (SI) thus RR= P x SI. The implication of this formula is that likelihood of risks (will occur, possible, doubtful, probable and inevitable) and the severity impact (low, moderate) significantly determine the level of the potential relative risk.

In addition, table 1 below shows the probability of occurrence of disasters in Nebbi District at the scale of 1-5, where 1 is the least and 5 is the highest probability. The table shows that prolonged dry spell/drought, wildfires and pests/diseases have the highest probability followed by floods and hail/windstorms. Thus, development of early warning systems (EWS) for disaster risk reduction (DRR) should take into account such probabilities.

Similarly, the DCP process has carried out mean risk assessment of the key risks as shown by tables below 2A&B MIA indicates the level of vulnerability to climate hazards/risks in the district that can be used for periodization. The table shows that prolonged dry spell/drought is the first priority hazard or risk followed by pests and diseases as the second priority, and wildfires being the third priority.

Table 1: Probability of occurrence of disasters in Nebbi District

Table 1: occurrence of Nebbi District

Probability of disasters in

S/No	Hazard/risks	Probability score (1-5)
	Prolonged dry spell/ drought	5
	Hail and wind storms	4
	Pest and diseases	5
	Floods	4
	Wild fire	5

Key: 1- Not Occur, 2 – Doubtful, 3 – Possible, 4 – Probable, 5 – Inevitable

Table 2: The Assessment of the levels of relative risks in Nebbi District

Hazard	Probability	Severity of Impacts	Relative Risk (RR)	Scope of vulnerability	Lower Local Governments
				Sectors	
	Relative likelihood this will occur	Overall Impact (Average)	Probability x Impact Severity		
	1 = Not occur 2 = Doubtful 3 = Possible 4 = Probable 5 = Inevitable	1 = Very Low 2 = Low 3 = Moderate 4 = High 5 = Very High	1-10 = Low 11-20 = Moderate 21-25 = High		
Prolonged dry spell/ drought	5	5	25	Agriculture, water and environment	-All lower local Governments except Erussi, Jupangira and Ndhew
Hail stones and wind storm	4	3	12	Agriculture and housing	Ndhew,Akworo,Nyaravur,Erussi, Jupangira and Abindu division
Pest and diseases	5	4	20	Agriculture and public health	All sub counties
Floods	4	3	12	Agriculture, water and environment, housing and public health	Kucwiny, Padwot, Abindu, Nebbi ,Thatha division.
Wild fire	5	4	20	Agriculture, water and environment, and housing	All sub counties except Erussi, Ndhew, Jupangira.

Key for Relative Risk

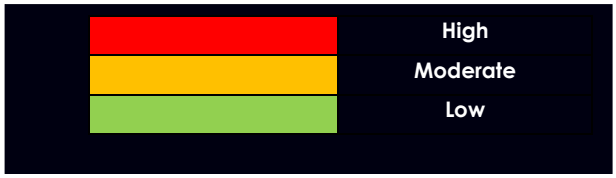


Table 3: The mean impact assessment (MIA) of key risks in Nebbi District

Hazard /risks	Probable Frequency	Size of Affected area	Size of population	Potential Lethality	Impact on critical infrastructure	Mean impact Score (2+3+4+5/4)	Hazard priority score (Impact Score X Prob. Freq)	Priority
Prolonged dry spell/ drought	3	3	3	3		3	9	1
Hail stones and wind storm	2	2	2	1		1.75	3.5	4
Pest and diseases	3	3	3	2		2.75	8.25	2
Floods	2	1	1	2		1.5	3	5
Wild fires	2	3	2	2		2.25	4.5	3
Probable Frequent: 1=Occasional, 2=Moderate, 3=Frequent Size, Population and Impact: 0=None/Negligible, 1= Low, 2= Moderate and 3= High								

Besides, AFARD through Climate Action Model (CAM) Project carried out sensitization and orientation of the local environment committees (LECs) in Nyaravur-Angal Town Council, who later formulated 5 village climate change adaptation action plans (VCCAAPs) based on the climate risks that they identified and prioritized during their village meetings. The results of the prioritization of climate risks by LECs are shown in matrix 1 below:

Table 4: The climate risks identified and prioritized by LECs in Nyaravur-Angal Town Council

Risk/ Threat/Impact	Criteria for prioritization			Total scores	Ranking
	Scope	Severity	urgency		
Omvoro cell					
Windstorms	5	5	5	15	1
Prolonged drought	3	3	2	8	4
Vectors/ pests and diseases	4	3	2	9	3
Floods	3	2	1	6	5
Wildfires	5	5	4	14	2
Prioritized risks/impacts: Windstorm, wildfires, and vectors/pests/diseases					
Paryema Cell					
Floods	3	3	2	8	3
Prolonged drought	5	4	3	12	2
Wildfires	5	5	4	14	1
Windstorms	3	3	2	8	3
Vectors/ pests/ diseases	5	5	4	14	1
Prioritized risks/impacts: Vectors/pests/diseases, prolonged drought, and windstorms					
Warathum Cell					
Floods	4	3	4	11	5
Prolonged drought	5	4	4	13	3
Wildfires	5	5	4	14	2
Windstorms	4	4	4	12	4
Vectors/ pests/ diseases	5	5	5	15	1
Prioritized risks/impacts: Vectors/pests/diseases, wildfires, and prolonged drought					
Acibu Cell					
Floods	4	4	3	11	3
Prolonged drought	5	4	4	13	2

Risk/ Threat/Impact	Criteria for prioritization			Total scores	Ranking
	Scope	Severity	urgency		
Wildfires	5	5	5	15	1
Windstorms	3	3	2	8	4
Vector/ Pest/ Disease	2	2	3	7	5
Prioritized risks/impacts: Wildfires, prolonged drought, and floods					
Akworo Cell					
Floods	3	4	5	12	3
Prolonged drought	4	5	5	14	2
Wildfires	5	5	4	14	2
Windstorms	3	4	4	11	4
Vectors/ pests/ diseases	5	5	5	15	1
Prioritized risks/impacts: Vectors, pests and diseases, wildfires, and floods.					

Notably, both DCP process and the meetings of the LECs in Nyaravur-Angal Town Council show that the common and therefore the priority climate risks and hazards in Nebbi District are; prolonged dry spells that contribute to drought; excessive short rains that contribute to floods; and dry season wildfires that destroy properties, threaten human life and degrade the environment especially ecosystems (biodiversity).

3.3.2 Sector Climate Vulnerability Assessment in Nebbi District

A climate vulnerability analysis can identify the what, where, when, and why of vulnerability, considering the social, economic, and environmental systems upon which people depend. In this way, climate vulnerability assessments (CVAs) offer valuable information to help reduce risk where it informs decision making at sector/policy, planning, program and project levels. The decisions taken should focus on priorities based on the magnitude of the climate risks or hazards or climate stressors, the level of the non-climate stressors (economic, social, institutional, political, physical and environmental factors), the existing coping mechanisms and other mitigation/adaptation options, availability of resources, and the existing opportunities.

The climate vulnerability assessment in Nebbi took into account the feedback during the consultations during this study, the ongoing DCP, studies carried out by AFARD and partners, and the national reports. The CVA focused on the key climate risks and hazards in the context of exposure, sensitivity and adaptive capacity of the sectors, geographical areas, ecosystems and the human communities. In addition, the CVA considered the early warning signs of the risks and hazards, who and what are at risk, the existing coping mechanisms and the key interventions.

Accordingly, the findings show that the key climate risks and hazards that contribute to the disasters in Nebbi District are: rising temperatures and prolonged dry spells that cause draught in most parts of the district; erratic heavy rains and precipitation intensity that contribute to floods, mainly in the lowlands and the most vulnerable sub-counties are Nebbi, Alala and Kucwiny; hail and windstorms in most parts of the district; dry season fires, especially in the rural sub-counties; and vectors, pests and diseases that contribute to crop and livestock losses, and human life too. The common diseases include malaria and diarrheal diseases caused by climate-related risks like rising temperatures (malaria) and floods (diarrheal diseases such as cholera and dysentery).

In addition, the CVA shows that the vulnerable sectors in the order of priority include agriculture, water and environment (quantity and quality of water, access to safe water and sanitation, ecosystem degradation and air pollution); public health, service delivery infrastructure like roads/bridges, health facilities and schools); and education (access to education during disasters).

Table 5: Climate Vulnerability Assessment in Nebbi District

Sectors/elements at risk	Climate vulnerability factors and criteria for rating (Low/medium/high)			Overall vulnerability rating	Magnitude/ degree of the impact of the risk	Early warning signs	The common coping mechanisms	The current key interventions	The most vulnerable areas
	Exposure	Sensitivity	Adaptive capacity						
					Risk and impacts-1: Rising temperatures Prolonged dry spells (drought, heat intensity)				
Community-based services sector (social groups like women/men, children, young people, youth, PWDs and the elderly) Community-based services sector (social groups like women/men, children, young people, youth, PWDs and the elderly)	High	Medium	Medium (existence of some coping mechanisms)	Medium (people develop some coping mechanisms such as diversification of livelihood assets like savings and income from other sources)	Rising temperatures and drought contribute to crop failures, low yields and food shortage that at times results into famine and thus affecting the livelihood of the local people. Besides, rising temperatures contribute to prevalence diseases like malaria	Rising temperatures and heat waves, dry winds, migration of birds and other wild animals	Cultivation of early maturing and drought resistant crops or fast growing crops	Distribution of improved seeds and planting materials to farmers coupled with mass/public education and awareness	District wide but mainly the rural sub-counties
Agriculture (crops and livestock)	High	High	Medium (some coping mechanisms	High (crops are highly susceptible/ vulnerable to rising	Crop failures and food shortage Loss/death of livestock due	Delayed rains Dry winds Drying of crops	Soil and water conservation techniques like mulching Growing of early maturing	Distribution of improved seeds, planting materials and breeds to farmers coupled with extension	The lowlands: Nebbi, Kucwiny, Alala, Padwot, Parombo, Acana, Atego, and Akworo sub-counties,

Sectors/elements at risk	Climate vulnerability factors and criteria for rating (Low/medium/high)			Overall vulnerability rating	Magnitude/ degree of the impact of the risk	Early warning signs	The common coping mechanisms	The current key interventions	The most vulnerable areas
	Exposure	Sensitivity	Adaptive capacity						
				temperatures/ drought)	to heat intensity	Death of livestock	and drought-resistant crops Early planting Raring of drought-animal breeds like goats and poultry Diversification of livelihoods like trade and savings	services, and public education/awareness	Nyaravur-Angal and Parombo Town Councils, and Nebbi Municipal Council
Water and Environment (water bodies, wetlands, forests/trees, fish, birds, soils and aquatic life)	High	Medium	Medium	Medium	Water bodies, forests/trees and wetlands regulate temperatures though they are affected by the extreme weather events (drought) – loss of surface water due to increased evaporation	Drying-up or reduced level of surface water like rivers, springs and wells Drying up/withering of vegetation like trees and grass Migration of birds and other animals	Use of water for production technologies (valley dams and valley tanks, irrigation schemes)	Provision of water through irrigation Restoration of the degraded ecosystems like wetlands and afforestation/re-afforestation programs Tree planting campaigns Public education and awareness	District wide but especially within the aquatic or water-related ecosystems like Acwera, Nyacara, Namrwodho and Ayila rivers with the associate wetlands; and forests like Acwera , Erussi , Omier and Nebbi forest reserves

Sectors/elements at risk	Climate vulnerability factors and criteria for rating (Low/medium/high)			Overall vulnerability rating	Magnitude/ degree of the impact of the risk	Early warning signs	The common coping mechanisms	The current key interventions	The most vulnerable areas
	Exposure	Sensitivity	Adaptive capacity						
					High temperatures and drought affect soil qualities like soil structure, texture, profile. water, organic matter, air and organisms like earth worms Birds adapt to high temperatures through re-allocation and their feathers	Shrinking of ecosystems like wetlands		The DDP has provided for the development of water catchment management plans.	
Infrastructure (roads/bridges, transport and housing	Medium	Medium	Medium	Medium	Variability/changes in temperatures (low to high and vice versa) weaken infrastructure	Cracks on bridges, dusts on project sites, roads and within homes during dry seasons		Mainstreaming climate risks and hazards in the District Development Plan (DDP)	District wide
Public health	High	High	High	Medium	High temperatures and heat intensity contribute to stress and headache	Sicknesses/ illnesses and death of people especially children and the elderly	Early medical treatment including traditional healing	Community-based health education programs through the District and Sub-county, County leaders and health workers	District wide

Sectors/elements at risk	Climate vulnerability factors and criteria for rating (Low/medium/high)			Overall vulnerability rating	Magnitude/ degree of the impact of the risk	Early warning signs	The common coping mechanisms	The current key interventions	The most vulnerable areas
	Exposure	Sensitivity	Adaptive capacity						
Education	Low	Medium	Medium	Medium	High temperatures and heat intensity contribute to stress for learners and teachers in schools	Rising temperatures/heat waves, and absenteeism from schools especially in the afternoons during hot days	Planting of shade trees within school compounds that at times serve as class rooms in the afternoons during dry seasons	Incorporation of tree planting in school environment education programs, and during the construction of schools The DDP has provided for checklists for disaster screening to inform the design, planning and implementation of projects.	District wide
Public Administration	Low	Medium	Medium	Medium	High temperatures and heat intensity contribute to stress to public servants (in offices) and thus causing inefficiency in service delivery during dry seasons and prolonged drought	Planting of shade trees within Local Government Head Quarters	Tree planting during the construction of offices	The DDP has provided for the development Disaster Risk Management Plan and checklists for Disaster, screening of the DDP to inform the design, planning and implementation of projects.	District wide

Sectors/elements at risk	Climate vulnerability factors and criteria for rating (Low/medium/high)			Overall vulnerability rating	Magnitude/ degree of the impact of the risk	Early warning signs	The common coping mechanisms	The current key interventions	The most vulnerable areas
	Exposure	**Sensitivity**	**Adaptive capacity**						
					Risk and impacts-2: Erratic heavy rains (precipitation intensity, floods)				
Community Development (human beings)	High	High	Low	Low	Erratic rains that contribute to floods cause significant adverse impacts on the human livelihoods from destruction of properties, loss of crops, food shortage, displacement, loss of lives, among others. Most communities of Nebbi District, especially the rural poor are vulnerable to floods	Late and heavy downpours Increased levels of surface water and bursting of riverbanks	Use of indigenous and local knowledge of weather Planting of trees within water catchment	The DDP has provided for the development and implementation of integrated catchment management plan for water resource areas, wetland and forest management plans, demarcation, gazettement and conservation of the degraded wetlands, and identification and protection of special biodiversity areas Public education, awareness and provision of information on weather	The lowlands; the most vulnerable: Nebbi, Alala, Padwot, Kucwiny and Abindu sub-counties

Sectors/elements at risk	Climate vulnerability factors and criteria for rating (Low/medium/high)			Overall vulnerability rating	Magnitude/ degree of the impact of the risk	Early warning signs	The common coping mechanisms	The current key interventions	The most vulnerable areas
	Exposure	**Sensitivity**	**Adaptive capacity**						
Agriculture (crops and livestock)	High	High	High	High	Crops are highly vulnerable to floods especially the annual/season crops like the tubers and cereals. Loss of crops lead to food shortage and famine; loss of household income and poverty.	Late and heavy downpours Increased levels of surface water and bursting of riverbanks	Use of indigenous and local knowledge of weather Planting of trees within water catchment Early opening of land and timely planting	The DDP has included the promotion Climate-Smart Agriculture (CSA) such as agroforestry as one of the adaption and mitigation measures to tackle climate change in the district. Public education, awareness and provision of information on weather	The lowlands; the most vulnerable: Nebbi, Alala, Padwot, Kucwiny and Abindu sub-counties

Sectors/elements at risk	Climate vulnerability factors and criteria for rating (Low/medium/high)			Overall vulnerability rating	Magnitude/ degree of the impact of the risk	Early warning signs	The common coping mechanisms	The current key interventions	The most vulnerable areas
	Exposure	Sensitivity	Adaptive capacity						
Water and Environment (water bodies, wetlands, forests/trees, fish, birds, soils and aquatic life)	High	Medium	Medium	Medium	Water bodies and the related resources like forests and wetlands absorb/control floods though: Floods contribute to water pollution and siltation affect aquatic life Floods escalate soil erosion Floods affect vegetation cover (water logging) like grassland	Increased levels of surface water and bursting of riverbanks Death of aquatic animals	Use of indigenous and local knowledge on weather Tree planting within water catchment Protection/gazzettement, restoration and sustainable use of forest and wetland resources	The DDP has provided for the development and implementation of management plans for water catchment areas; restoration of Forests and wetlands, and disaster risk management. Public education, information and communication on changes in weather	The lowlands Nebbi, Alala, Padwot, Abindu and Kucwiny sub-counties
Infrastructure (roads/bridges, transport and housing	High	High	High	High	Floods damage and destroy service delivery infrastructures like roads, bridges and housing Floods significantly affect transport network	Increased levels of surface water and bursting of riverbanks Submerging of roads and structures like bridges and houses within downstream areas	Raising of road surface to avoid water logging and improve resilience to floods Adoption of construction designs that are resilient to floods	The DDP has provided for checklists for disaster risk screening of projects and disaster risk management plans	The lowlands Nebbi, Alala, Padwot, Abindu and Kucwiny sub-counties

Sectors/elements at risk	Climate vulnerability factors and criteria for rating (Low/medium/high)			Overall vulnerability rating	Magnitude/ degree of the impact of the risk	Early warning signs	The common coping mechanisms	The current key interventions	The most vulnerable areas
	Exposure	Sensitivity	Adaptive capacity						
Public health	High	High	Low	High	Floods contribute to emergence of vectors, pests and diseases to human beings, leading to death	Increased levels of surface water Floods-related diseases and death	Indigenous and local knowledge on weather Raising of ramps and construction of channels to avoid floods within homesteads Early medical treatment	The DDP has provided for checklists for disaster risk screening of projects and disaster risk management plans Public education and awareness on the health impacts of floods	The lowlands Nebbi, Alala, Padwot, Abindu and Kucwiny sub-counties
Education	High	High	High	High	Floods affect the movement of leaners and teachers to schools and thus constraining teaching and other education services. Destruction of schools and displacement of the community and thus disrupting school programs	Increased levels of surface water and bursting of riverbanks Submerging of roads and structures like bridges and houses within downstream areas	Raising of ramps and construction of channels to avoid floods within school premises Planting of trees within school compounds	The DDP has provided for checklists for disaster risk screening of projects and disaster risk management plans	The lowlands Nebbi, Alala, Padwot, Abindu and Kucwiny sub-counties

Sectors/elements at risk	Climate vulnerability factors and criteria for rating (Low/medium/high)			Overall vulnerability rating	Magnitude/ degree of the impact of the risk	Early warning signs	The common coping mechanisms	The current key interventions	The most vulnerable areas
	Exposure	Sensitivity	Adaptive capacity						
Public Administration	High	Medium	Medium	Medium	Floods affect transport network and thus constraining public to and from officers.	Increased levels of surface water and bursting of riverbanks Submerging of roads and structures like bridges and houses within downstream areas	Raising of ramps and construction of channels to avoid floods within public office premises Planting of trees within public office premises	The DDP has provided for checklists for disaster risk screening of projects and disaster risk management plans	The lowlands Nebbi, Alala, Padwot, Abindu and Kucwiny sub-counties

Sectors/elements at risk	Climate vulnerability factors and criteria for rating (Low/medium/high)			Overall vulnerability rating	Magnitude/ degree of the impact of the risk	Early warning signs	The common coping mechanisms	The current key interventions	The most vulnerable areas
	Exposure	Sensitivity	Adaptive capacity						
					Risk and impacts-3: Hail and windstorms				
Community (human beings)	High	High	Low	High	Most settlements within Nebbi District are exposed and vulnerable to hail and windstorms to the general terrain and lack of protective tree cover Hail and windstorms cause, displacement, loss of lives and properties	Strong winds Thunder Humid temperature	Use of indigenous and local knowledge on weather especially on changes in the flows and directions of winds Planting of trees for windbreaks	The DDP has provided for checklists for disaster risk screening of projects and disaster risk management plans Public education and awareness on local weather changes especially winds	District wide but the lowlands are more vulnerable: Nebbi, Kucwiny, Alala, Padwot, Parombo, Acana, Atego,and Akworo sub-counties, Nyaravur-Angal and Parombo Town Councils
Agriculture (crops and livestock)	High	High	Low	High	Crops are highly vulnerable to destruction by hail and windstorms Hail and wind storms contribute to soil erosion that is	Strong winds that affect crops as they start Thunder Humid temperature	Use of indigenous and local knowledge on weather Agro-forestry and inter-cropping (mixed annuals and perennials	Intensification of agricultural extension services CSA practices like agro-forestry The DDP has provided for checklists for	District wide but the lowlands are more vulnerable: Nebbi, Kucwiny, Alala, Padwot, Parombo, Acana, Atego and Akworo sub- counties, Nyaravur-Angal and Parombo Town Councils

Sectors/elements at risk	Climate vulnerability factors and criteria for rating (Low/medium/high)			Overall vulnerability rating	Magnitude/ degree of the impact of the risk	Early warning signs	The common coping mechanisms	The current key interventions	The most vulnerable areas
	Exposure	Sensitivity	Adaptive capacity						
					responsible for the loss of fertility which subsequently adversely affects agricultural productivity and production		Planting of trees windbreaks around gardens and land boundaries	disaster risk screening of projects and disaster risk management plans Public education and awareness on local weather changes	
Water and Environment (water bodies, wetlands, forests/trees, fish, birds, soils and aquatic life)	Low	Medium	High	High	Ecosystems like wetlands and forests are resilient to hail and windstorms However, environmentally degraded and bare areas are vulnerable to hail and windstorms	Strong winds that affect crops as they start Thunder Humid temperature	Tree planting within water catchment, restoration and conservation of wetlands and forests within riverbanks and hilly areas	Restoration of the degraded fragile ecosystems like forests and wetlands	District wide but the bare lowlands are more vulnerable
Infrastructure (roads/bridges, transport and housing	High	Medium	Medium	Medium	Hail and windstorms destroy buildings and human	Strong winds that affect crops as they start	Tree planting for windbreak	Development and implementation of the district disaster risk	District wide but the bare Lowlands are more vulnerable

Sectors/elements at risk	Climate vulnerability factors and criteria for rating (Low/medium/high)			Overall vulnerability rating	Magnitude/ degree of the impact of the risk	Early warning signs	The common coping mechanisms	The current key interventions	The most vulnerable areas
	Exposure	Sensitivity	Adaptive capacity						
					settlement units	Thunder		management plan	
Public health	Medium	Medium	Medium	Low	Hail and windstorms do not have direct impacts on public health though they can injuries and death. Besides, windstorms contribute to the movement of air pollutants especially dusts (particulate matter-PM) and black carbon (soot) from one place to another	Strong winds that affect crops as they start	Indigenous and local knowledge on the flows and directions of winds Tree planting for wind barriers	Tree planting campaigns. Public education and awareness	District wide but the bare Lowlands are more vulnerable
Education	High	Medium	Medium	Medium	Windstorms destroy school infrastructure and at times loss of lives	Strong winds that affect crops as they start	Tree planting for windbreak and barriers around schools	Development and implementation of district disaster risk management plans	District wide but the bare Lowlands are more vulnerable

Sectors/elements at risk	Climate vulnerability factors and criteria for rating (Low/medium/high)			Overall vulnerability rating	Magnitude/ degree of the impact of the risk	Early warning signs	The common coping mechanisms	The current key interventions	The most vulnerable areas
	Exposure	Sensitivity	Adaptive capacity						
Public Administration	High	Medium	Medium	Medium	Windstorms destroy public office buildings	Strong winds that affect crops as they start	Tree planting for windbreak and barriers around public offices	Development and implementation of district disaster risk management plans	
					Risk and impacts-4: Dry season wildfires				
Community (human beings)	High	Medium	Medium	Medium	Dry season wildfires contribute to loss of properties and lives especially rural houses that are grass-thatched	High temperatures Dry spells Dry winds	Creation of fire lines around homesteads Whistle blowing through community vigilantes	Community sensitization Development of byelaws Tree planting around homesteads	The lowlands: Nebbi, Kucwiny, Alala, Padwot, Parombo, Acana, Atego, and Akworo sub-counties
Agriculture (crops and livestock)	High	High	Medium	High	Dry season fires cause affect gardens and contribute greatly to crop losses	High temperatures Dry spells Dry winds Drying/ withering of crops Stray animals Death of livestock	Creation of fire lines around gardens Whistle blowing Tree planting around gardens	Community sensitization Development of byelaws	The lowlands: Nebbi, Kucwiny, Alala, Padwot, Parombo, Acana, Atego, and Akworo sub- counties

Sectors/elements at risk	Climate vulnerability factors and criteria for rating (Low/medium/high)			Overall vulnerability rating	Magnitude/ degree of the impact of the risk	Early warning signs	The common coping mechanisms	The current key interventions	The most vulnerable areas
	Exposure	Sensitivity	Adaptive capacity						
Water and Environment (water bodies, wetlands, forests/trees, fish, birds, soils and aquatic life)	High	High	Medium	High	Dry season fires contribute to ecosystem collapse and biodiversity loss Besides, the emissions of CO2 and black carbon from the dry season wildfires are GHGs and short-lived climate pollutant (SLCP) that contribute to global warming that causes climate change and its impacts	High temperatures Dry spells Dry winds Poor ecosystem health	Creation of fire lines around ecosystems like forests Whistle blowing	Community sensitization Development of byelaws Demarcation and restoration of ecosystems	The lowlands: Nebbi, Kucwiny, Alala, Padwot, Parombo, Acana, Atego, and Akworo sub-counties

Sectors/elements at risk	Climate vulnerability factors and criteria for rating (Low/medium/high)			Overall vulnerability rating	Magnitude/ degree of the impact of the risk	Early warning signs	The common coping mechanisms	The current key interventions	The most vulnerable areas
	Exposure	Sensitivity	Adaptive capacity						
Infrastructure (roads/bridges, transport and housing	High	Medium	Medium	Medium	Dry season wildfires do not have significant adverse impacts on all infrastructure but mainly housing especially the grass-thatched houses in rural areas	High temperatures Dry spells Dry winds	Creation of fire lines around homesteads Whistle blowing Tree planting around homesteads	Community sensitization Development of byelaws	The lowlands: Nebbi, Kucwiny, Alala, Padwot, Parombo, Acana, Atego, and Akworo sub-counties
Public health	High	Medium	Medium	Medium	Dry weather wildfires contribute to air pollution as they increase the levels of particulate matter (PM) and black carbon (soot) in the atmosphere CO2 and SLCP emissions are both bad for	High temperatures Dry spells Dry winds	Provision of information on weather Whistle blowing	Community sensitization Development of byelaws Massive tree planting	District wide

Sectors/elements at risk	Climate vulnerability factors and criteria for rating (Low/medium/high)			Overall vulnerability rating	Magnitude/ degree of the impact of the risk	Early warning signs	The common coping mechanisms	The current key interventions	The most vulnerable areas
	Exposure	Sensitivity	Adaptive capacity						
					climate and public health				
Education	Medium	Medium	Medium	Medium	Dry weather wildfires affect school buildings especially the ones in rural areas that are grass-thatched	High temperatures Dry spells Dry winds	Creation of fire lines around schools Provision of information on weather Whistle blowing	Community sensitization Development of byelaws Massive tree planting	District wide but mainly in rural areas where there are grass-thatched school buildings
					Risk and impacts-5: Vectors and pests (diseases)				
Community (human beings)	High	High	Medium	High	Vectors and diseases such as malaria and diarrhea diseases during climate-related disasters like drought and floods	Weather variations Symptoms of sicknesses	Use of indigenous and local knowledge on weather changes and disease patterns.	Community-based disease surveillances, sensitization and use of early warning systems	District wide but the vulnerable areas are: Akworo Parombo Nyaravur – Angal TC Kucwiny, Parombo TC Atego Padwot Alala

Sectors/elements at risk	Climate vulnerability factors and criteria for rating (Low/medium/high)			Overall vulnerability rating	Magnitude/ degree of the impact of the risk	Early warning signs	The common coping mechanisms	The curren t key interventions	The most vulnerable areas
	Exposure	Sensitivity	Adaptive capacity						
Agriculture (crops and livestock)	High	High	Medium	High	Crop losses, food shortage/famin e, and loss of income/povert y Poor health and massive death of livestock	Weather variations Yellow withering crops Loss of weight and appetite Emaciation and massive death of animals	Planting of disease resistant and early maturing crops; earl y planting; and vaccination of livestock Use of organic pesticides	Improving o n extension services Supply of improved crop/livestock varieties (seeds, planting materials an d animal breeds) to farmers	District wide but the vulnerable areas are: Akworo Parombo Nyaravur – Angal TC Kucwiny, Parombo TC Atego Padwot Alala
Water and Environment (water bodies, wetlands, forests/trees, fish, birds, soils and aquatic life)	Low	Low	Medium	Low	Loss of biodiversity species especially vegetation (grass, trees and forests) aquatic life due to pests and diseases	Withering of vegetation, death of birds and fish	Pests an d diseases surveillances	Pests an d diseases surveillances Development and implementation of ecosyste m (forest, wetlands and water resources) management plans	Within the LFRs, CRF, wetlands and riverine ecosystems in Nebbi, Erussi, Kucwiny, Alala, Padwot and Ategu sub-counties
Public health	High	High	Medium	High	Poor health, morbidity and	Weather variations	Early detections and	Community sensitization	District wide but the vulnerable areas are: Akworo

Sectors/elements at risk	Climate vulnerability factors and criteria for rating (Low/medium/high)			Overall vulnerability rating	Magnitude/ degree of the impact of the risk	Early warning signs	The common coping mechanisms	The current key interventions	The most vulnerable areas
	Exposure	Sensitivity	Adaptive capacity						
					death of humans	Sicknesses and illnesses	medical treatment Community-based surveillances	and awareness programs	Parombo Nyaravur – Angal TC Kucwiny Parombo TC Atego Padwot
Education	High	High	Medium	High	School going children are vulnerable to diseases malaria, worm infections and diarrhea caused by the impacts of climate change like floods. This has contributed to high school dropout rate and deaths among school going children	Weather variations Sicknesses and illnesses	Early detections and medical treatment Community-based surveillances	Community sensitization and awareness programs	District wide but the vulnerable areas are: Akworo, Parombo Nyaravur – Angal TC, Kucwiny, Parombo TC Atego, Padwot

Sectors/elements at risk	Climate vulnerability factors and criteria for rating (Low/medium/high)			Overall vulnerability rating	Magnitude/degree of the impact of the risk	Early warning signs	The common coping mechanisms	The current key interventions	The most vulnerable areas
	Exposure	Sensitivity	Adaptive capacity						
					Risk and impacts-1: Rising temperatures Prolonged dry spells (drought, heat intensity)				
Community-based services sector (social groups like women/men, children, young people, youth, PWDs and the elderly)	High	medium	Medium (existence of some coping mechanisms)	Medium (people develop some coping mechanisms such as diversification of livelihood assets like savings and income from other sources)	Rising temperatures and drought contribute to crop failures, low yields and food shortage that at times results into famine and thus affecting the livelihood of the local people. Besides, rising temperatures contribute to prevalence diseases like malaria	Rising temperatures and heat waves, dry winds, migration of birds and other wild animals	Cultivation of early maturing and drought resistant crops or fast growing crops	Distribution of improved seeds and planting materials to farmers coupled with mass/public education and awareness	District wide but mainly the rural sub-counties
Agriculture (crops and livestock)	High	High	Medium (some coping mechanisms	High (crops are highly susceptible/ vulnerable to rising temperatures/drought)	Crop failures and food shortage Loss/death of livestock due to heat intensity	Delayed rains Dry winds Drying of crops Death of livestock	Soil and water conservation techniques like mulching Growing of early maturing and drought-resistant crops Early planting Raring of drought-animal breeds like goats and poultry Diversification of livelihoods like trade and savings	Distribution of improved seeds, planting materials and breeds to farmers coupled with extension services, and public education/awareness	The lowlands: Nebbi, Kucwiny, Alala, Padwot, Parombo, Acana, Atego,and Akworo sub-counties, Nyaravur-Angal and Parombo Town Councils, and Nebbi Municipal Council
Water and Environment (water bodies, wetlands, forests/trees, fish, birds, soils and aquatic life)	High	Medium	Medium	Medium	Water bodies, forests/trees and wetlands regulate temperatures though they are affected by the extreme weather events (drought) – loss of surface	Drying-up or reduced level of surface water like rivers, springs and wells Drying up/withering of vegetation	Use of water for production technologies (valley dams and valley tanks, irrigation schemes)	Provision of water through irrigation Restoration of the degraded ecosystems like wetlands and afforestation/re-	District wide but especially within the aquatic or water-related ecosystems like Acwera, Nyacara, Namrwodho and Ayila rivers with the associate

					water due to increased evaporation High temperatures and drought affect soil qualities like soil structure, texture, profile. water, organic matter, air and organisms like earth worms Birds adapt to high temperatures through re-allocation and their feathers	like trees and grass Migration of birds and other animals Shrinking of ecosystems like wetlands		afforestation programs Tree planting campaigns Public education and awareness The DDP has provided for the development of water catchment management plans.	wetlands; and forests like Acwera , Erussi , Omier and Nebbi forest reserves
Infrastructure (roads/bridges , transport and housing	Medium	Medium	Medium	Medium	Variabilities/changes in temperatures (low to high and vice versa) weaken infrastructure	Cracks on bridges, dusts on project sites, roads and within homes during dry seasons		Mainstreaming climate risks and hazards in the District Development Plan (DDP)	District wide
Public health	High	High	High	Medium	High temperatures and heat intensity contribute to stress and headache	Sicknesses/illnesses and death of people especially children and the aged	Early medical treatment including traditional healing	Community-based health education programs through the District and Sub-County leaders and health workers	District wide
Education	Low	Medium	Medium	Medium	High temperatures and heat intensity contribute to stress for learners and teachers in schools	Rising temperatures/ heat waves, and absenteeism from schools especially in the afternoons during hot days	Planting of shade trees within school compounds that at times serve as class rooms in the afternoons during dry seasons	Incorporation of tree planting in school environment education programs, and during the construction of schools The DDP has provided for	District wide

								checklists for disaster screening to inform the design, planning and implementation of projects.	
Public Administration	Low	Medium	Medium	Medium	High temperatures and heat intensity contribute to stress to public servants (in offices) and thus causing inefficiency in service delivery during dry seasons and prolonged drought,	Planting of shade trees within Local Government Head Quarters	Tree planting during the construction of offices	The DDP has provided for the development Disaster Risk Management Plan and checklists for disaster screening of the DPP to inform the design, planning and implementation of projects.	District wide
					Risk and impacts-2: Erratic heavy rains (precipitation intensity, floods)				
Community (human beings)	High	High	Low	Low	Erratic rains that contribute to floods cause significant adverse impacts on the human livelihoods from destruction of properties, loss of crops, food shortage, displacement, loss of lives, among others. Most communities of Nebbi District, especially the rural poor are vulnerable to floods	Late and heavy downpours Increased levels of surface water and bursting of riverbanks	Use of indigenous and local knowledge of weather Planting of trees within water catchment	The DDP has provided for the development and implementation of integrated catchment management plan for water resource areas, wetland and forest management plans, demarcation, gazettement and conservation of the degraded wetlands, and identification and protection of special	The lowlands; the most vulnerable: Nebbi, Alala, Padwot, Kucwiny and Abindu sub-counties

								biodiversity areas Public education, awareness and provision of information on weather	
Agriculture (crops and livestock)	High	High	High	High	Crops are highly vulnerable to floods especially the annual/season crops like the tubers and cereals. Loss of crops lead to food shortage and famine; loss of household income and poverty.	Late and heavy downpours Increased levels of surface water and bursting of riverbanks	Use of indigenous and local knowledge of weather Planting of trees within water catchment Early opening of land and timely planting	The DDP has included the promotion Climate-Smart Agriculture (CSA) such as agroforestry as one of the adaption and mitigation measures to tackle climate change in the district Public education, awareness and provision of information on weather	The lowlands; the most vulnerable: Nebbi, Alala, Padwot, Kucwiny and Abindu sub-counties
Water and Environment (water bodies, wetlands, forests/trees, fish, birds, soils and aquatic life)	High	Medium	Medium	Medium	Water bodies and the related resources like forests and wetlands absorb/control floods though: Floods contribute to water pollution and siltation affect aquatic life Floods escalate soil erosion Floods affect vegetation cover	Increased levels of surface water and bursting of riverbanks Death of aquatic animals	Use of indigenous and local knowledge on weather Tree planting within water catchment Protection/gazettment, restoration and sustainable use of forest and wetland resources	The DDP has provided for the development and implementation of management plans for water catchment areas; restoration of forests and wetlands, and disaster risk management. Public education,	The lowlands Nebbi, Alala, Padwot, Abindu and Kucwiny sub-counties

					(water logging) like grassland			information and communication on changes in weather	
Infrastructure (roads/bridges , transport and housing	High	High	High	High	Floods damage and destroy service delivery infrastructures like roads, bridges and housing Floods significantly affect transport network	Increased levels of surface water and bursting of riverbanks Submerging of roads and structures like bridges and houses within downstream areas	Raising of road surface to avoid water logging and improve resilience to floods Adoption of construction designs that are resilient to floods	The DDP has provided for checklists for disaster risk screening of projects and disaster risk management plans	The lowlands; the most vulnerable: Nebbi, Alala, Padwot, Kucwiny and Abindu sub-counties
Public health	High	High	Low	High	Floods contribute to emergence of vectors, pests and diseases to human beings, leading to death	Increased levels of surface water Floods-related diseases and death	Indigenous and local knowledge on weather Raising of ramps and construction of channels to avoid floods within homesteads Early medical treatment	The DDP has provided for checklists for disaster risk screening of projects and disaster risk management plans Public education and awareness on the health impacts of floods	The lowlands; the most vulnerable: Nebbi, Alala, Padwot, Kucwiny and Abindu sub-counties
Education	High	High	High	High	Floods affect the movement of leaners and teachers to schools and thus constraining teaching and other education services. Destruction of schools and displacement of the community	Increased levels of surface water and bursting of riverbanks Submerging of roads and structures like bridges and houses within downstream areas	Raising of ramps and construction of channels to avoid floods within school premises Planting of trees within school compounds	The DDP has provided for checklists for disaster risk screening of projects and disaster risk management plans	The lowlands; the most vulnerable: Nebbi, Alala, Padwot, Kucwiny and Abindu sub-counties

					and thus disrupting school programs				
Public Administration	High	Medium	Medium	Medium	Floods affect transport network and thus constraining public to and from officers.	Increased levels of surface water and bursting of riverbanks Submerging of roads and structures like bridges and houses within downstream areas	Raising of ramps and construction of channels to avoid floods within public office premises Planting of trees within public office premises	The DDP has provided for checklists for disaster risk screening of projects and disaster risk management plans	The lowlands; the most vulnerable: Nebbi, Alala, Padwot, Kucwiny and Abindu sub-counties
					Risk and impacts-3: Hail and windstorms				
Community (human beings)	High	High	Low	High	Most settlements within Nebbi District are exposed and vulnerable to hail and windstorms to the general terrain and lack of protective tree cover Hail and windstorms cause, displacement, loss of lives and properties	Strong winds Thunder Humid temperature	Use of indigenous and local knowledge on weather especially on changes in the flows and directions of winds Planting of trees for windbreaks	The DDP has provided for checklists for disaster risk screening of projects and disaster risk management plans Public education and awareness on local weather changes especially winds	District wide but the lowlands are more vulnerable: Nebbi, Kucwiny, Alala, Padwot, Parombo, Acana, Atego,and Akworo sub-counties, Nyaravur-Angal and Parombo Town Councils
Agriculture (crops and livestock)	High	High	Low	High	Crops are highly vulnerable to destruction by hail and windstorms Hail and wind storms contribute to soil erosion that responsible for the loss of fertility which subsequently	Strong winds that affect crops as they start Thunder Humid temperature	Use of indigenous and local knowledge on weather Agro-forestry and inter-cropping (mixed annuals and perennials Planting of trees	Intensification of agricultural extension services CSA practices like agro-forestry The DDP has provided for checklists for disaster risk screening of	District wide but the lowlands are more vulnerable: Nebbi, Kucwiny, Alala, Padwot, Parombo, Acana, Atego,and Akworo sub-counties, Nyaravur-Angal and Parombo Town Councils

					adversely affects agricultural productivity and production		windbreaks around gardens and land boundaries	projects and disaster risk management plans Public education and awareness on local weather changes	
Water and Environment (water bodies, wetlands, forests/trees, fish, birds, soils and aquatic life)	Low	Medium	High	High	Ecosystems like wetlands and forests are resilient to hail and windstorms However, environmentally degraded and bare areas are vulnerable to hail and windstorms	Strong winds that affect crops as they start Thunder Humid temperature	Tree planting within water catchment, restoration and conservation of wetlands and forests within riverbanks and hilly areas	Restoration of the degraded fragile ecosystems like forests and wetlands	District wide but the bare lowlands are more vulnerable
Infrastructure (roads/bridges , transport and housing	High	Medium	Medium	Medium	Hail and windstorms destroy buildings and human settlement units	Strong winds that affect crops as they start Thunder	Tree planting for windbreak	Development and implementation of the district disaster risk management plan	District wide but the bare lowlands are more vulnerable
Public health	Medium	Medium	Medium	Low	Hail and windstorms do not have direct impacts on public health though they can injuries and death. Besides, windstorms contribute to the movement of air pollutants especially dusts (particulate matter-PM) and black carbon (soot) from one place to another	Strong winds that affect crops as they start	Indigenous and local knowledge on the flows and directions of winds Tree planting for wind barriers	Tree planting campaigns. Public education and awareness	District wide but the bare lowlands are more vulnerable

Education	High	Medium	Medium	Medium	Windstorms destroy school infrastructure and at times loss of lives	Strong winds that affect crops as they start	Tree planting for windbreak and barriers around schools	Development and implementation of district disaster risk management plans	District wide but the bare lowlands are more vulnerable
Public Administration	High	Medium	Medium	Medium	Windstorms destroy public office buildings	Strong winds that affect crops as they start	Tree planting for windbreak and barriers around public offices	Development and implementation of district disaster risk management plans	District wide but the bare lowlands are more vulnerable
					Risk and impacts-4: Dry season wildfires				
Community (human beings)	High	Medium	Medium	Medium	Dry season wildfires contribute to loss of properties and lives especially rural houses that are grass-thatched	High temperatures Dry spells Dry winds	Creation of fire lines around homesteads Whistle blowing through community vigilantes	Community sensitization Development of byelaws Tree planting around homesteads	The lowlands: Nebbi, Kucwiny, Alala, Padwot, Parombo, Acana, Atego, and Akworo sub-counties
Agriculture (crops and livestock)	High	High	Medium	High	Dry season fires cause affect gardens and contribute greatly to crop losses	High temperatures Dry spells Dry winds Drying/withering of crops Stray animals Death of livestock	Creation of fire lines around gardens Whistle blowing Tree planting around gardens	Community sensitization Development of byelaws	The lowlands: Nebbi, Kucwiny, Alala, Padwot, Parombo, Acana, Atego, and Akworo sub-counties
Water and Environment (water bodies, wetlands, forests/trees, fish, birds, soils and aquatic life)	High	High	Medium	High	Dry season fires contribute to ecosystem collapse and biodiversity loss Besides, the emissions of CO2 and black carbon from the dry season wildfires are GHGs and short-lived climate	High temperatures Dry spells Dry winds Poor ecosystem health	Creation of fire lines around ecosystems like forests Whistle blowing	Community sensitization Development of byelaws Demarcation and restoration of ecosystems	The lowlands: Nebbi, Kucwiny, Alala, Padwot, Parombo, Acana, Atego, and Akworo sub-counties

					pollutant (SLCP) that contribute to global warming that causes climate change and its impacts				
Infrastructure (roads/bridges , transport and housing	High	Medium	Medium	Medium	Dry season wildfires do not have significant adverse impacts on all infrastructure but mainly housing especially the grass-thatched houses in rural areas	High temperatures Dry spells Dry winds	Creation of fire lines around homesteads Whistle blowing Tree planting around homesteads	Community sensitization Development of byelaws	The lowlands: Nebbi, Kucwiny, Alala, Padwot, Parombo, Acana, Atego, and Akworo sub-counties
Public health	High	Medium	Medium	Medium	Dry weather wildfires contribute to air pollution as they increase the levels of particulate matter (PM) and black carbon (soot) in the atmosphere CO2 and SLCP emissions are both bad for climate and public health	High temperatures Dry spells Dry winds	Provision of information on weather Whistle blowing	Community sensitization Development of byelaws Massive tree planting	District wide
Education	Medium	Medium	Medium	Medium	Dry weather wildfires affect school buildings especially the ones in rural areas that are grass-thatched	High temperatures Dry spells Dry winds	Creation of fire lines around schools Provision of information on weather Whistle blowing	Community sensitization Development of byelaws Massive tree planting	District wide, but mainly in rural areas where there are grass-thatched school buildings
					Risk and impacts-5: Vectors and pests (diseases)				
Community (human beings)	High	High	Medium	High	Vectors and diseases such as malaria and	Weather variations	Use of indigenous and local	Community-based disease surveillances,	District wide but the vulnerable areas are: Akworo

					diarrhoeal diseases during climate-related disasters like drought and floods	Symptoms of sicknesses	knowledge on weather changes and disease patterns.	sensitization and use of early warning systems	Parombo Nyaravur – Angal TC Kucwiny Parombo TC Atego Padwot Alala
Agriculture (crops and livestock)	High	High	Medium	High	Crop losses, food shortage/famine, and loss of income/poverty Poor health and massive death of livestock	Weather variations Yellow withering crops Loss of weight and appetite Emaciation and massive death of animals	Planting of disease resistant and early maturing crops; early planting; and vaccination of livestock Use of organic pesticides	Improving on extension services Supply of improved crop/livestock varieties (seeds, planting materials and animal breeds) to farmers	District wide but the vulnerable areas are: Akworo Parombo Nyaravur – Angal TC Kucwiny Parombo TC Atego Padwot Alala
Water and Environment (water bodies, wetlands, forests/trees, fish, birds, soils and aquatic life)	Low	Low	Medium	Low	Loss of biodiversity species especially vegetation (grass, trees and forests) aquatic life due to pests and diseases	Withering of vegetation, death of birds and fish	Pests and diseases surveillances	Pests and diseases surveillances Development and implementation of ecosystem (forest, wetlands and water resources) management plans	Within the LFRs, CRF, wetlands and riverine ecosystems in Nebbi, Erussi, Kucwiny, Alala, Padwot and Ategu sub-counties
Public health	High	High	Medium	High	Poor health, morbidity and death of humans	Weather variations Sicknesses and illnesses	Early detections and medical treatment Community-based surveillances	Community sensitization and awareness programs	District wide but the vulnerable areas are: Akworo Parombo Nyaravur – Angal TC Kucwiny Parombo TC Atego Padwot

Education	High	High	Medium	High	School going children are vulnerable to diseases malaria, worm infections and diarrhoea caused by the impacts of climate change like floods. This has contributed to high school dropout rate and deaths among school going children	Weather variations Sicknesses and illnesses	Early detections and medical treatment Community-based surveillances	Community sensitization and awareness programs	As above

3.4 The Impacts of Climate Risks and Hazards in Key Sectors in Nebbi District

According to the information from the consultations and review of the relevant reports and publications, the climate vulnerable sectors in Nebbi District in order of priority include:

1) Production (Agriculture); the rising temperatures and projected rainfall increases during dry seasons threaten key crops in the district's agriculture sector affecting crops and enterprises such as maize, cotton, g/nuts, beans, coffee, horticultural crops like vegetables, Irish potato, sesame, fruit trees and apiary. For instance, the weather vagaries contribute to 60%-80% loss in crop yields. In addition, the previous heavy rains and floods also caused water logging that contributed to rotting of cassava in the gardens in Kucwiny and Alala sub counties that have been the biggest suppliers of cassava in the district.

The low agricultural production (low crop yields and animal outputs) contribute significantly to inadequate food and hence malnutrition due poor nutrition, hunger and theft of food from the gardens and stores. According to the District State of Environment Report (DSOER) for 2012/13, there was low food utilization during the reporting period where most people ate by chance (45.6%) and weekly consumption of cassava, beans and maize was between 1-5kgs. Except breakfast, people rarely took lunch and supper and food types eaten were poor in diet. Consumption of „muziri" (*Rastrineobola argenta)* was on the rise while milk became a luxury (82% did not take). Besides, during the reporting period, there was low access to food where 88% of household did not have enough food throughout the year and the reasons for not having food throughout the year due to drought that caused low and poor yields. In addition, it was also noted that food shortages were experienced in almost all households (87%) and the duration of shortages ranged from within a month (26%) to about six months (46%). Notably, the main causes for food shortage were drought, poor seeds, poor yields, hailstorm and inadequate incomes. Other attributes of food crisis included having one meal in a day where most (80%) households did not take three meals a day. All households were affected in one way or the other by the insufficient food supply that was characterized by hunger, school dropout, cases of theft insufficient food and poor nutrition, among others.

According to Nebbi District Health Department (2010), there were 872 cases of malnutrition reported in children of age 0-4 years and 296 cases in children of age 5 and above. During this study, it was found out that food crisis is still big problem in Nebbi District where 5-6 out of 10 households (50-60%) are taking only one meal a day like in Jupangira sub-county. In most cases, the food insecurity or crisis is characterized by low food availability (the proportion of households that take at least 3 meals in a day), in accessibility to food (the proportion of households with access to very good dietary diversity), low food utilization (24%), food instability, and poor nutrition.

Further impacts of climate change on agriculture in Nebbi District include: inadequate pastures for livestock as such farmers leave animals to roam during dry season thus destroying crops and the area vegetation; low food supply to the markets and hence facilitating household income insecurity; and massive death of livestock during the extreme weather events like drought and floods that are characterized by prevalence of vectors, pests and diseases.

2) Water and environment (ecosystems and water resources); the rising temperatures and prolonged drought contribute significantly to the drying of shallow wells and streams and thus causing ecosystem collapse, biodiversity loss and water crisis which is characterized by congestion at the water sources like boreholes and long distance to the water points. Besides, heavy rains and other climate risks/hazards like hail and windstorms enhance soil erosion that contributes to deterioration of soil fertility and productivity, and siltation of water bodies (like Alala stream and river Acwera).

Likewise, the extreme weather events such as prolonged drought and floods are associated with vectors, pests and diseases that affect both ecosystems and human beings.

In addition, the extreme weather events and the related climate risks and hazards contribute to the loss of ecosystems services like the wetlands and forests which provide food and nutrition, and other livelihood assets such as water, energy and household income in the District, besides regulating local climate (controlling drought), contributing to soil fertility for agricultural productivity and production, and supporting crop production pollination by biodiversity species like bees

3) The community and social groups (community-based service sector); certain groups of people are more vulnerable than others to the impacts of climate change due to social and economic factors like income, education, access to health care, and housing. Such factors affect people's ability to prepare and cope with climate hazards and thus impeding their adaptive capacity and resilience to climate change and its impacts. According to the findings, the climate vulnerable that should be prioritized for adaptation options and interventions include: farmers, children especially orphans, pregnant and lactating mothers as they lack nutritious foods, PWDs, the elderly, and business community.

For instance, table 3 below shows how the Local Environment Committees, under CAM Village Project/AFARD in Nyaravur-Angal Town Council, identified and assessed three (3) impacts of specific climate risks on social groups like women, children, young people, the youth and people with disabilities in a scale of 1-5; where 1-1.95 is low, 2-3.95 is medium and 4-5 is high. The vulnerability assessment focused on sensitivity, exposure and the adaptive capacity of each social group. For example, the higher the sensitivity and exposure with lower adaptive capacity implies that the social group is highly vulnerable to climate risks or climate change impacts. Below are the results of the vulnerability assessments carried out by the LECs in their respective villages:

Table 6: Angal-Nyaravur Town Council climate vulnerability assessment among social groups

Social group	**Assessment of 3 impacts on social groups**			**Average level of impact**
	Akworo Cell			
	Diseases	Destruction of houses and properties	Famine	
Women	4	5	5	4.7: High
Children	5	4	4	4.3: High
Elderly	2	2	2	2.0: Medium
PWDs	3	3	2	2.7: Medium
Youth	3	4	3	3.3: Medium
Acibu Cell				
	Famine	Loss of vegetation and crops	Displacement	
Women	5	5	5	5.0: High
Children	1	2	5	2.7: Medium
Elderly	3	2	4	3.0: Medium
PWDs	5	3	5	4.3: High
Youth	5	4	5	4.7: High
Paryema Cell				
	Famine	Destruction of properties and crops	Diseases	
Women	5	5	3	4.3: High
Children	5	5	5	5.0 : High
Elderly	5	5	2	4.0: High
PWDs	5	5	5	5.0: High
Youth	5	5	5	5.0: High
Omvoro Cell				

Social group	Assessment of 3 impacts on social groups			Average level of impact
	Akworo Cell			
	Diseases	Destruction of houses and properties	Famine	
	Famine	Poverty	Diseases	
Women	5	5	5	5.0: High
Children	5	2	5	4.0: High
Elderly	3	3	5	3.7: Medium
PWDs	5	4	5	4.7: High
Youth	4	3	5	4.0: High
Warathum Cell				
	Diseases	Destruction of properties	Famine	
Women	5	5	5	5.0: High
Children	5	2	4	3.7 :Medium
Elderly	3	2	3	2.7 : Medium
PWDs	4	5	4	4.3: High
Youth	5	5	4	4.7: High

Adopted from CAM Village Project/AFARD, March 2024

Notably, three (3) risks were identified and prioritized during brainstorming on a number of risks, consensus built and ranking done accordingly. Besides, the climate change impacts are not necessarily unilaterally related to the risks but rather in multi-lateral relationships where risks bear impacts that could have been caused by other risks. For example, rising temperatures which contribute to prolonged droughts could cause crop loss, food shortage and eventually famine that could have also been a result of crop failure due to excess rains and pests/diseases. This, therefore, means that planning for climate action should follow integrated and inter-twined approaches and processes that take care of the key causality- effect factors to ensure that the identified actions and interventions focus on the causes and effects of the prioritized climate risks.

The above CVA shows that women are the most climate- affected social segment, followed by PWDs and children. This scenario has significant adverse impacts on the household livelihoods where women bear the burdens of fending and caring for the households to have access to livelihood assets like food, water, energy, income and health. In addition, the situation is worse with women/female headed households, and where children, orphans, PWDs and the elderly are involved in the need for care including death of children and the elderly as it happened in Jupangira sub-county, Ayomo parish, Patongo village due to the recent flood. Thus, it is vital that adaptation options and interventions that focus on vulnerable social groups should prioritize women as entry points and as direct beneficiaries for the good of the entire household/family and other co-benefits.

4) Public health; the extreme weather events and the related climate risks like prolonged drought, floods, wildfires, hail and windstorms are usually associated with vectors and diseases such as mosquitoes for malaria and worms for diarrheal diseases, besides, destruction of latrines that contributes to open defecation which eventually accounts for poor sanitation and bad environmental health impacts like cholera and dysentery epidemics. Similarly, during such extreme weather events, there are high incidences of cough and flu especially during the long dry spells that also contribute to wildfires that cause loss of lives

5) Education; Floods, wildfires, hail and windstorms destroy school infrastructure like classrooms and latrines and thus affecting education services characterized by absenteeism by both the learners

and teachers, and school dropout. Likewise, prevalence of diseases as a result of extreme weather events affect school going children that at times leads to death and school dropout.

6) Infrastructure (engineering); Floods and hail/windstorms have contributed to the destruction of service infrastructure like roads/bridges, schools, houses (homes), and churches. This has often caused disruptions in the respective service delivery, homelessness, displacement/internal immigration, loss of property and at times death. These climate risks and hazards are common in the lowlands sub-counties of Nebbi, Kucwiny, Padwot and Alala sub-counties.

7) Public administration; Climate hazards like floods and windstorms at times destroy public administration infrastructure like offices and latrines which eventually affect service delivery. Relatedly, local governments especially the lower ones lack capacity to manage climate change and its impacts due to low staffing, inadequate skills and limited funding for adaptation options and interventions.

3.5 The Common Coping Mechanisms, Access to Adaptation Options and Opportunities in Nebbi District

It is important to note that, overtime, communities have adopted a number of coping mechanisms to adapt the climate risks and their impacts, these coping mechanisms will be discussed later in this report. It is important to note that, climate risk and vulnerability assessment (CRVA) is very important in identifying the climate risks and the assessment of the vulnerability factors (exposure, sensitivity and adaptive capacity) in order to identify measures and actions that enhance community and ecosystem climate resilience that focuses on ecosystem integrity and human livelihood assets like food, water, energy, health and income securities.

The common coping mechanisms, adaptation options and opportunities to enhance individual and community adaptive capacity include but not limited to the following as presented by sectors in table 6 below:

Table 7: Community copying mechanisms to climate change

Sector	Categories of adaptation	Level of exposure	Local adaptation measures
Agriculture	Agricultural adaptation	Crop and livestock production	■ Crop diversification, especially into vegetable and horticultural crops including tomatoes, cowpea, amaranthus spp, brinjals, etc . ■ Growing of early maturity crops ■ Early opening of land and timely planting ■ Planting drought, pest and disease resistant crop varieties ■ Used of improved varieties of crops (seeds/planting materials) and animal breeds ■ Using small irrigation facilities like watering cans during the dry season ■ Increase use of agrochemicals (acaricides, deworming drugs, pesticides and fungicides) ■ Sustainable land management practices like terracing and mulching
	Food security adaptation	Food production losses and crop failures	■ Preservation and storage of foods like sweet potato and vegetables

			■ Rationing of food among household members. ■ Skipping of meals ■ Theft of food ■ Limiting choice of food to mainly beans, vegetables and cassava that are cheap. ■ Produce buying and selling by local business men and women to ensure availability of food
Water and Environment	Ecosystem adaptation	Biomass (loss of forests, tree cover and grassland; cutting of trees for charcoal and kilns for bricks)	■ Tree planting by individuals, groups and institutions ■ Sand mining within riverbanks ■ Encroachment of riverbanks and wetlands for cultivation as the soil within the arable land has lost fertility due to ecosystem degradation
		Water resources management (unsustainable management and degradation of water resources	■ Use of small scale and micro irrigation facilities ■ Long distance walk for water by women for domestic water consumption ■ Water harvesting by households that have got iron sheet-roofed houses ■ Protection of water sources like wells, springs and boreholes by the communities and local governments ■ Relocating closer to water sources
Health	Health adaption	Prevalence of vectors and diseases like malaria, diarrhoeal diseases and stress due to climate change impacts like floods, drought and storms	■ Treatment in medical facilities ■ Use of traditional medicines ■ Use of indigenous knowledge in the detection and management of diseases ■ Relocation from the affected areas
Community services	Socioeconomic adaptation	Access to physical and non-physical resources	■ Diversification of livelihoods including spreading of risk through taking loans from VSLAs, sale of labour, sale of land, hire of land, fishing, hunting and petty trade in vegetables, cassava flour, silver fish and fish mongering, boda-boda, among othes

It is important to note that, some coping mechanisms are practices that can be adopted as climate action, while others are not adoptable, either because they are just ideals and attitudes or they could be counterproductive on climate resilience. For instance, it could be easily adoptable to consider livelihood diversification through VSLAs as climate finance mechanism. In contrast, it would be counterproductive to consider cultivating in wetlands during dry seasons as climate action as this coping mechanism would lead to the degradation of the wetlands and thus contributing to more rising temperatures and prolonged drought.

3.6 The Key Messages on Climate Risks, Hazards and their Impacts in Nebbi District

From the findings of this study, the common climate risks and hazards in Nebbi District that need to be prioritized for adaptation options and interventions are: rising temperatures and prolonged drought; rainfall intensity and floods; hail and windstorms; dry season wildfires; and vectors, pests and diseases. Notably, the climate risks and hazards occur in the whole district but the lowlands areas like Nebbi Sub-County, the Greater Kucwiny and the Greater Parombo are more vulnerable. These areas are susceptible and more vulnerable to weather variations and extreme weather events due to the landscape (lowlands) coupled with environmental degradation such as deforestation and uncontrolled tree harvesting, and encroachment of the riverbanks and the associated wetlands.

The main cause of the climate risks and hazards in the District is climate change that is mainly characterized by rising temperatures and rainfall intensity that cause prolonged drought and floods respectively with other associated hazards like wildfires, hail and windstorms. However, it is important to note that these risks and hazards are exacerbated by unsustainable human activities that degrade the environment and especially the ecosystems. Such activities include indiscriminate and massive tree cutting for wood fuel (firewood and charcoal) and uncontrolled bush burning particularly in Nebbi, the Greater Kucwiny,Nyaravur and Parombo areas. Likewise, deforestation (encroachment and depletion of the local forest reserves) and degradation of the key wetlands have not only contributed to environmental degradation but account significantly for the current weather vagaries and climate risks in the District. In addition, the poor farming methods within Erussi and Goli highlands, and the riverine valleys in the lowlands contribute to ecosystem loss and soil erosion especially within the river that contributes to the silting of the rivers and streams and thus affecting water availability (quantity and quality) for both humans and livestock, let alone surface water scarcity being partly responsible for the rising temperatures in the district.

Furthermore, inadequate knowledge or lack of awareness or the general apathy or people's attitude that environment protection is the sole responsibility of the Government, but not co-responsibility with the community or resource users like farmers, is responsible for the current irresponsible human activities and behaviour that are attributed greatly to the current environmental degradation and climate risks in the District. The community and the resource users are not responsive to the current environmental problems and as such, they do not take actions to avert the problems and their impacts on ecosystems, climate resilience and human livelihoods in the District

Additionally, certain policy and institutional challenges are also underlying factors that are responsible for climate risks and vulnerability in Nebbi District. Some of these challenges include: low resource mobilization skills among the technical staff; administrative and logistical gaps especially in lower local governments, like Alala and Jupangira sub-counties that do not have office blocks for service delivery coordination, coupled with limited number of technical staff and inadequate service delivery facilities at the lower local governments. In addition, there are few development partners such as NGOs who are involved in climate action initiatives, except few like AFARD and CARITAS. Besides, climate services like weather information are not easily accessible and where they are available, their uptake and use by the farmers or community is not effective

Moreover, the existing and potential climate risks and hazards have significant adverse impacts on the key sectors in the District of which the most vulnerable are agriculture, community development, water and environment including sanitation. Other sectors include infrastructure, public health, education, and public administration. Accordingly, enhancing and sustaining adaptive capacity to realize climate resilience requires increased financing, enhanced institutional and community capacity, and access to appropriate and affordable technologies for effective facilitation of climate action (adaptation and mitigation).

3.7 Future Climate Change Projections in Nebbi District

Depending on the scenario, temperature in Uganda is projected to rise by between 1.5 and 3.5 °C by 2080, compared to pre-industrial levels, with higher temperatures and more temperature extremes projected for the north and east of the country. The implication of this scenario is that eastern and northern Uganda should expect rising temperatures and therefore prolonged drought with the related risks like wildfires and diseases, and more rainfall or precipitation intensity that will contribute to floods, landslides, hail and windstorms plus other related risks.

Similarly, Nebbi District, being part of northern Uganda, is this scenario and thus the need for proactive but not reactive adaption and mitigation strategies. However, it is important that, the historical trends of the climate events in the Greater Nebbi in the last 3 or 4 decades are profiled in

order to inform the future projections to build another scenario for proactive adaption and mitigation planning. Accordingly, table 4 below shows the key climate events in the Greater Nebbi from 1980 to 2022.

Table 8: The key climate events in the greater Nebbi in 1980-2022

S/N	Year	Climate event
1.	1980	Drought that led to crop failure
2.	1983	Locust invasion that destroyed crops and vegetation
3.	1985	Flooding of river Oraa and river Nile
4.	1985	Strange disease that wiped out most of the animals in Alwi area
5.	1988 and 1990	Prolonged drought
6.	1990	Thunderstorms that killed a number of people
7.	1995	Prolonged drought and spread of cassava mosaic
8.	2004 and 2007	Flooding of river Oraa and river Nile
9.	2008 and 2009	Prolonged drought and spread of cassava mosaic
10.	2010 and 2011	Floods that destroyed a number of infrastructure
11.	2012	Drought that affected crop and livestock productivity
12.	2017	Drought
13.	2019	Floods around Pakwach that destroyed crop land and infrastructure
14.	2020	Drought that devastated farm land and livestock
15.	2020 and 2021	• COVID-19 that induced lockdown which also contributed to increase in agricultural activities • Spread of cassava mosaic
16.	2020, 2021 and 2022	Floods that caused major infrastructure damage
17.	2021	Prolonged drought
18.	2022	Hail/thunderstorms that devastated farmland

Adopted from a report on local climate change adaptation practices in Nebbi and Pakwach Districts by AFARD, AWO International and Partners (March 2023)

The following can be deduced from the climate events profiled in table 4 above, that:

(i) drought and floods have been the main climate events in the Greater Nebbi in the last 43 years;
(ii) the climate events became more regular and frequent in the last 30 years (from the 1990s);
(iii) drought is more frequent than floods and has been intensifying in the last 15 years (from 2008);
(iv) drought devastates farm land and livestock is associated with the spread of cassava mosaic;
(v) floods destroy farmland and infrastructure; and
(vi) agriculture and infrastructure are the vulnerable sectors to the main climate events (drought and floods)

The implications of the above deductions are that:

(i) Nebbi District Local Government should develop a proactive climate change adaption and mitigation plan based on the scenario of frequent and more intensifying drought and floods;

(ii) management of drought and its impacts should be a priority in the climate action planning process, interventions like tree planting and restoration of the degraded fragile ecosystems like forests and wetlands should be considered;

(iii) the climate action planning should focus on agricultural intensification to enhance productivity and production. In this regard, interventions like CSA, sustainable land management practices, access to improved seeds/varieties and breeds, agricultural financing and marketing, integrated pest and disease management; and enhanced agricultural extension should be considered holistically;

(iv) climate proofing mechanisms should be integrated in infrastructure planning, design and development. Such mechanisms would include checklists for project screening against climate risks and hazards during the designing of projects, development and implementation of disaster risk management plans for all infrastructure, and use of the indigenous and local knowledge on weather variations and the related climate risks during project designing and screening process; and

(v) improved access to and uptake of climate services, especially weather information is pre-requisite for a proactive adaptation and mitigation planning and implementation phases.

In addition to the climate events above, during another study carried by AFARD in Alala and Kucwiny sub counties in April 2024, local leaders and communities narrated key climate-related events that happened in 2003 to 2023 as provided in Table 5 below:

Table 9: Climate-related events that have marked Ngali (Alala sub-county) and Jafurnga(Kucwiny sub-county) areas over the last the 20 years

Events	Period						
	2003	2006	2009	2013	2019	2021	2023
Outbreaks of cassava mealybug and termites							
Reduced flooding of River Namrwodo							
Reduced amount and intensity of rainfall							
Very long drought/ watercourse drying of Azamba stream in Ngali and Oleke wetland in Jafurnga							
Appearance and proliferation of invasive species (weeds, *acacia sp*.)							
Great flooding and water logging of gardens							
Increase in high winds and reduction in cloud cover							
Rotting of immature and mature cassava tubers							
Proliferation of fall army worms (Spodoptera frugiperda) and variegated grass hoppers (Zonocerus variegatus)							
Outbreak of Contagious Caprine Pleuropneumonia (CCPP) in goats and sheep							

Adopted from SECAP-AFARD, April 2024

4 RECOMMENDED ADAPTAION STRATEGIES AND ACTIONS

Effective recommendations for climate action should focus on adaptation options and measures that are needs-based and results- oriented in terms of measures and actions that have great potentials in combating climate change and its impacts. The measures and actions should aim at enhancing protection, restoration and sustainable use of ecosystems (through provision of ecosystem services) enhanced agricultural productivity and production, improved human livelihoods and wellbeing, and reduced climate risk and vulnerability in Nebbi District.

Notably, adaptation options range from actions that build adaptive capacity knowledge creation and sharing of information, creating supportive institutional frameworks) or establish management systems and supportive mechanisms like better land management planning, insurance, social safety and financing mechanisms.

It is important to note that, an effective climate adaptation action is a function of access to financing, enhanced institutional and community capacity, and available and affordable technologies. These are the means of implementation that should be provided by the community like the farmers and business communities, the local and central governments, and partners like NGOs like AFARD, international NGOs such as AWO and CARITAS, the private sector, and other development partners.

Based on the prioritized climate risks and hazards, their impacts and the affected community needs, table 5 below shows a proposed climate adaptation measures and actions for the District Climate

Table 10: The proposed adaptation measures and actions for Nebbi district Climate Action Plan

Sector	Prioritized climate risks and hazards	Impacts of the climate risks and hazards	The affected community needs	Proposed adaptation measures and actions for the District Climate Action Plan (DCAP)
Production	Rising temperatures and heat intensity	Prolonged dry spell/drought	Food and income securities due to reduced crop yields and death of livestock	• Promoting climate-smart agriculture (CSA) practices like early land preparation and timely planting, agroforestry, mini/micro irrigation, among others • Promotion of sustainable land management (SLM) practices like terracing and mulching and other soil and water conservation practices • Promotion and use of improved varieties for crops (seeds/planting materials) and livestock • Promotion of crop diversification, especially vegetable and horticultural crops including cabbages, tomatoes, cowpea for both food security and nutrition values • Improvement in extension services to include comprehensive and intensive education and awareness programs on climate action for sustainable agriculture
	Irregular pattern of rainfall and precipitation intensity	Floods	Food and income securities as floods affect both crops and livestock	
	Hailstorms	Destruction of crops and livestock	Food and income securities as hailstorms destroy crops	
	Windstorms	Contribution to dry season wildfires that destroy crops	Food and income securities	
Water and Environment	Rising temperatures and heat intensity	Prolonged dry spell/drought contribute to ecosystem collapse and biodiversity loss like loss of tree cover, drying of rivers, seasonal wetlands, and grassland due to drought	• Food • Water • Grassing land • Fuel wood	• Restoration, protection and sustainable management of the fragile ecosystems (wetlands, water resources and forests) through afforestation, re-afforestation and massive tree planting (preferably the indigenous tree species) by individuals, groups and institutions • Promotion of integrated water resources management through improved catchment management • Promotion of mini/micro irrigation to provide water for production (crops and livestock)
	Irregular pattern of rainfall and precipitation intensity	Floods that contribute to the loss of biomass especially tree cover and grassland, pollution of rivers, springs and wells	• Food • Water • Fuel wood • Grassing land	
	Windstorms	Contribution to dry season wildfires that destroy biomass (forests, tree cover, wetlands and grassland) and crops	• Food • Grassing land • Fuel wood	

Sector	Prioritized climate risks and hazards	Impacts of the climate risks and hazards	The affected community needs	Proposed adaptation measures and actions for the District Climate Action Plan (DCAP)
				• Development and enforcement of Ordinances and byelaws on environment conservation including control of wild fires • Promotion of use energy saving stoves as contribution of the conservation of forests and tree cover
Community services	Rising temperatures and heat intensity	Prolonged dry spell/drought contributes to psycho-social discomfort, distress and stress		• Community education and awareness programs on the impacts of climate change and the adaption or coping mechanisms • Tree planting and establishment of woodlots within homestead • Promotion of alternative livelihood assets like businesses and savings like SACCOS/VSLAs to enhance social security/protection
	Irregular pattern of rainfall and precipitation intensity	Floods contribute to displacement of people and breakdown of social security, while women, children, people with physical disabilities (PWDs) and the aged are the most affected social segments.	• Housing • Social security/social protection	
	Wind and hail storms	Windstorms destroy properties like houses and homestead	• Housing • Social protection	
Education	Rising temperatures and heat intensity	Prolonged dry spell and drought contribute to stress for leaners and subsequent absenteeism from schools	Access to education	• Tree planting and establishment of woodlots within school compounds • Provision climate resilient/climate-smart school infrastructure and auxiliary service delivery infrastructure like roads, bridges and culverts
	Irregular pattern of rainfall and precipitation intensity	Floods cut off access to schools, besides, destroying school infrastructure like class rooms, laboratories, office blocks, and latrines		
	Windstorms	Windstorms destroy school infrastructure (class rooms, office blocks, laboratories and latrines		
Health	Rising temperatures and heat intensity	Prolonged dry spell and drought due to heat intensity contribute to psychological distress and stress that are causes of diseases like pressure and cardiac failures	Health wellbeing	• Promotion of community health education and awareness programs that focus on climate change and its impacts.

Sector	Prioritized climate risks and hazards	Impacts of the climate risks and hazards	The affected community needs	Proposed adaptation measures and actions for the District Climate Action Plan (DCAP)
	Irregular pattern of rainfall and precipitation intensity	Floods contribute to spread of diseases like malaria, cholera and other diarrhoeal/waterborne diseases		• Provision of safe water and sanitation for the affected communities • Relocation of the affected communities to safer areas
	Windstorms	Windstorms destroy health unit infrastructure	Access to health services	• Tree planting and establishment of woodlots within health facility compounds • Provision of climate resilient/climate-smart health infrastructure and auxiliary service delivery infrastructure like roads, bridges and culverts
Works	Irregular pattern of rainfall and precipitation intensity Windstorms	Foods and windstorms destroy service delivery infrastructure like roads, bridges, culverts, schools, health facilities, office blocks, among others	Access to socio-economic infrastructure services	• Mainstreaming of climate action in the planning, designing and implementation of service delivery infrastructure (promotion of climate-resilient/ climate-smart service delivery infrastructure or infrastructure climate-proofing

Notes:

(i) As observed in table 6 above, the community needs that are affected by the impacts of climate are food, household income, health wellbeing and access to education and infrastructure services that should be considered during the development of the DCAP;

(ii) Investments in climate-smart agriculture, sustainable management of ecosystems and promotion of alternative livelihood strategies and mechanisms will have significant positive impacts on the enhancement of climate resilience in Nebbi District; and

(iii) It is important that climate-smart initiatives are mainstreaming in the planning, designing and implementation of service delivery infrastructure

ANNEX I: DATA COLLECTION TOOLS AND METHODS

DATA COLLECCTION AND INFORMATION GATHERINGING TOOL FOR CLIMATE RISK VULNERABILITY ASSESSMENT (CRVA) IN NEBBI DISTRICT

1. Introduction

Climate Change vulnerability is defined by the IPCC as the susceptibility of a species, system or resource to the negative effects of climate change and other stressors, and includes three components: exposure, sensitivity, and adaptive capacity.

Exposure the extent to which a system or a person or something subject to a stressor (climate or non-climate stressor); either directly or indirectly exposed. It is the amount and rate of change that a person, a species or system experiences from the direct (like temperature, precipitation changes) or indirect (such as habitat shifts due to changing vegetation composition) impacts of climate change;

Sensitivity refers to the extent to which something will be positively or negatively affected if it is exposed to a stressor, this could also be directly or indirectly sensitive. It also refers to characteristics of a person, a species or system that are dependent on specific environmental conditions, and the degree to which they will likely be affected by climate change (for example; temperature or hydrological requirements); and

Adaptive capacity is the ability to take actions to reduce adverse impacts, moderate harm, or exploit beneficial opportunities from current climate extremes such as droughts and floods, as well as longer-term climate change. The adaptive capacities of individuals, households, and organizations vary according to their access to information, ownership of or access to resources, the skills of the people within these systems, and the ability to assess climate issues and make decisions. It is the ability of a species to cope and persist under changing conditions through local or regional acclimation, dispersal or migration, adaptation (e.g., behavioral shifts), and/or evolution.

Climate risk assessments identify the likelihood of future climate hazards and their potential impacts for cities and their communities. This is fundamental for informing the prioritization of climate action and investment in adaptation. Most authors and planners tend to focus on adaptation during CRVA, however, both adaptation and mitigation are complementary actions that need to be planned for and executed in integrated approaches. In any case, adaptation focuses on responses and tends to be reactive while mitigation is a proactive measure that looks at the scientific cause or attributions of climate change that is a result of global warming caused by GHG and other emissions

- The purpose of the Climate Risk and Vulnerability Assessment (CRVA) is to develop an understanding of the current and future climate risks facing the region.
- Vulnerability and risk assessments that combine physical and socio-economic information to show climate change risks in a particular area or a sector
- Steps: Prepare the organization for the assessment, 2) Define the scope of the assessment, 3) Collect climate data, including identifying climate stressors and scenarios, 4) Assess climate change impacts, 5) Finalize the assessment in preparation for adaptation planning, and 6) Monitor and review the assessment.
- CRVA process and results should answer the following questions?
  - What are the climate risks in Nebbi District?
  - What are the current/potential impacts of the climate risks and vulnerability?
  - How much is the impact? (scale-how many?, depth-degree of change, pattern-how frequent? and duration- how long?

- Who experiences the impacts and at what magnitude? farmers, women and young people, businesses, sectors etc? (ranking according to the magnitude (scale, depth, pattern and duration of the impacts based on low, medium or scale of 1-5)
- Which risks should be prioritized for climate action? (ranking according to low, medium or high impacts or scale of 1-5)

2. The focus of CRVA

Based on the above questions, the following are the elements of CRVA for ensuring effective climate action (adaptation and mitigation):

a) Identification and prioritization of climate risks and the corresponding mitigation measures
b) Assessment of the impacts of the identified risks
c) Categories of stakeholders and sectors that experience the risks and their impacts
d) Assessment and analysis of the vulnerability factors (exposure, sensitivity, and adaptive capacity) with a focus on the key enablers for climate resilience.

Vulnerability Index measures a country's exposure, sensitivity, and ability to adapt to the impact of climate change. ND-GAIN measures the overall vulnerability by considering six life-supporting sectors – food, water, health, ecosystem service, human habitat, and infrastructure.
The vulnerability index is created by counting the total number of flags in each census tract. The higher the count, the more vulnerable the population. Census tracts with a "caufion" symbol have 50% or more of their SVI flags from values with high Relative Standard Errors.
However, most of the literature characterizes vulnerability according to the basic formula: Risk + Response = Vulnerability

DATA COLLECTION TOOL FOR FOCUS GROUP DISCUSSIONS (FGDs)
Participants: Mixed gender (2 FGD per sub-county =12 participants)
Guiding questions:

(i) What are the key climate risks to agricultural production, food security and other livelihoods assets in Nebbi District? Causes?
- *probe to identify the key risks and their causes*
- *probe to identify any other livelihoods assets.*

(ii) Which risks are prioritized? Why? What are the proposed mitigation measures?

(iii) What are the current/potential impacts of the climate risks on agricultural production, food security and overall livelihood in Nebbi District?

(iv) How vulnerable are the major crops to climate risks?

(v) How much is the impact?
- *Probe to find out; location (where or commonality), history (since when?) scale (how many?), depth (degree of change), pattern (how frequent?) and duration (how long?) of the impacts*

(vi) Who experiences the impacts and at what magnitude?
- *Probe to find out; communities, farmers, women and young people, businesses, sectors, among others*

(vii) Which sectors are most vulnerable to climate risks and their impacts?

(viii) How do the stakeholders, groups and sectors cope up with the impacts of the identified and prioritized risks?

(ix) Are the coping mechanisms available and accessible by all the categories of the victims of the risks and their impacts?
- *Probe to find if the coping mechanisms are:*
  - *available within the community (including local natural and human available resources within the community?*
  - *not or at any financial cost?*
  - *within the local government service delivery system and accessible by all*
  - *from line ministries (specify the ministries and their interventions)*
  - *from other partners (specify partners and their interventions)*

(x) What should the following do to ensure effective climate action in the district? (adaptation and mitigation measures that will reduce climate vulnerability in the district):
- The community
- Farmers
- Business communities
- Local Governments
- Line ministries
- Civil society organizations

(xi) What are the community and institutional capacity gaps in managing climate risks and their impacts on agricultural production, food security and livelihoods in Nebbi District?

(xii) What should be done and by who should these gaps be addressed?

(xiii) What are the existing opportunities for the communities and local governments that can be utilized for effective management of these risks and their impacts on agricultural production, food security and livelihood?

(xiv) Which crops (food and cash crops) are more vulnerable to climate risks?

DATA COLLECTION TOOL FOR KEY INFORMANT INTERVIEW (KIIs)

Participants: (15)

a) National level and MDA staff
b) Cultural leaders
c) Nebbi District Local government officials
d) Lower local government officials

Guiding questions:

1.		What are the key climate risks to agricultural production, food security and other livelihoods assets in Nebbi District? (list)		Climate risks: options for multiple choices	✓ (Tick)		
	2.			1. Draughts/sustained high/increasing temperatures			
	2.			3. Floods/heavy and torrential rains			
	4.			5. Wildfires during season fires			
	6.			7. Sand/dust storms			
	8.			9. Hail/rain storms			
	10.			11. Windstorms			
	12.			13. Heat waves			
	14.			15. Cold and chilly winds			
	16.			17. High humidity			
	18.			19. Others (specify)			
	20.						
3.		Which ones are the priority risks? (at least 3-5)		1.			
	2.			3.			
	4.			5.			
	6.			7.			
	8.			9.			
		What are the causes of the climate risks prioritized above (list reasons)?					
	1.	2.					
	3.	4.					
	5.	6.					
	7.	8.					
	9.	10.					
		How much is each impact?					
	1.	2. Food insecurity due to crop failures like low yields	History (Year)	Scale (How many)	Depth (Degree of change)	Pattern (geographical/social distribution)	Duration (months)
	3.						
	4.	5. Pests, vectors and diseases					
	6.	7. Collapse of ecosystems and					

		loss of biodiversity species						
	8.	9. Soil erosion						
	10.	11. Displacement and loss of property including housing due to climate-related disasters						
	12.	13. Loss of income/poverty						
	14.	15. Epidemics like cholera						
	16.	17. Loss of socio-cultural identities due to displacement and immigration						
	18.	19. Loss of income						
	20.	21. Loss of arable and productive land						
4.		Who experiences the impacts of the climate risks? (Please tick accordingly)						
		The impacts of climate risks			The victims of the impacts			
	1.	2.			Community, farmers, women, young people, children, business communities			
	3.	4.			Community, farmers, women, young people, children, business communities			
	5.	6.			Community, farmers, women, young people, children, business communities			
	7.	8.			Community, farmers, women, young people, children, business communities			
	9.	10.			Community, farmers, women, young people, children, business communities			
5.		Are the coping mechanisms available and accessible by all the categories of the victims of the risks and their impacts? (Please tick multiple choices accordingly)						
		Coping mechanisms			Categories of victims of climate risks and their impacts			
	1.	2. Growing of adaptive variety of crops like draught-resistant and early maturity crops			Community, farmers, women, young people, children, business communities			
	3.	4. Mixed farming (crops, livestock, poultry)			Community; farmers; women; young people; children; business communities			
	5.	6. Financial support from savings, credit, trade and investments			Community; farmers; women; young people; children; business communities			
	7.	8. Climate-proof housing such as design and types of houses for human settlement			Community; farmers; women; young people; children; business communities			
	9.	10. Environment/ecosystem conservation like tree planting, fruit farming, protection of wetlands			Community; farmers; women; young people; children; business communities			

	11.	12. Sustainable land management practices (mulching, contour, and terracing methods of soil and water conservation	Community; farmers; women; young people; children; business communities	
	13.	14. Socio-cultural security /protection	Community; farmers; women; young people; children; business communities	
	15.	16. Others (Specify)	Community; farmers; women; young people; children; business communities	
6.		How do the stakeholders, groups, and sectors cope with the impacts of the identified and prioritized risks? (Please list)		
	1.	2.		
	3.	4.		
	5.	6.		
	7.	8.		
	9.	10.		
7.		What should the following entities do to ensure effective climate action in the district? (adaptation and mitigation measures that will reduce climate vulnerability in the district): (Please encircle multiple choices of entities for 1-5 below)		
	1.	2.	✓ The community ✓ Business communities ✓ Local Governments ✓ Line ministries ✓ Civil society organizations	
	3.	4.	✓ The community ✓ Business communities ✓ Local Governments ✓ Line ministries ✓ Civil society organizations	
	5.	6.	✓ The community ✓ Business communities ✓ Local Governments ✓ Line ministries ✓ Civil society organizations	
	7.	8.	✓ The community ✓ Business communities ✓ Local Governments ✓ Line ministries ✓ Civil society organizations	
	9.	10.	✓ The community ✓ Business communities ✓ Local Governments ✓ Line ministries ✓ Civil society organizations	
8.		What are the community and institutional capacity gaps in managing climate risks and their impacts on agricultural production, food security and livelihoods in Nebbi District? (please list)		
9.		What should be done and by who should these gaps be addressed? (please list)		

		Gaps (3-5)	Responsibility to address the gaps		
	1.	1.			
	2.	2.			
	3.	3.			
	4.	4.			
	5.	5.			
10.		What are the existing opportunities for the communities and local governments that can be utilized for effective management of these risks and their impacts on agricultural production, food security and livelihood? (Please tick multiple choices according the opportunities: 3-5)			
		Opportunities	Beneficiaries		
	1.	2.	Communities; Local Governments		
	3.	4.	Communities; Local Governments		
	5.	6.	Communities; Local Governments		
	7.	8.	Communities; Local Governments		
	9.	10.	Communities; Local Governments		
11.		**Climate vulnerability to crop production**			
		Dual purpose crops (Food/cash crops)	**Vulnerability rating (1-5; where 5 is the highest)**		
	1.	2. Cassava			
	3.	4. Maize			
	5.	6. Millet			
	7.	8. Sorghum			
	9.	10. Beans			
	11.	12. Simsim			
	13.	14. Ground nuts			
	15.	16. Fruits			
	17.	18. Vegetables (horticultural crops)			
	19.	20. Bananas			
		Cash crops			
	1.	2. Coffee			
	3.	4. Cotton			

Thank you for the time you have provided for this interview

ANNEX II: REFERENCE

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ANNEX III PICTORIAL PRESENTATION OF CONSULTATION WITH LOWER LOCAL GOVERNMENT STAKEHOLDERS AND VALIDATION MEETING

PICTORIAL PRESENTATION OF DISASTER OCCURRANCES IN NEBBI DISTRICT