THE GOVERNMENT OF UGANDA

NANSANA MUNICIPAL COUNCIL

WORLD BANK GROUP

CLIMATE CHANGE AND VULNERABILITY ASSESSMENT REPORT FOR NANSANA MUNICIPALITY

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EXECUTIVE SUMMARY

Climate change poses a growing threat to both natural ecosystems and human settlements in Uganda, with urban and peri-urban areas like Nansana Municipality experiencing increasing climate-related vulnerabilities. Characterized by rapid urbanization, informal settlements, degraded wetlands, and poor drainage infrastructure, Nansana is particularly exposed to the adverse impacts of climate hazards such as flooding, prolonged dry spells, and increased temperatures. This Climate Change and Vulnerability Assessment (CCVA) report aimed to identify and analyze the climate-related risks affecting the communities, infrastructure, and ecosystems in Nansana Municipality.

The methods that were used to develop the CCVA for Nansana Municipality included literature review, stakeholder engagements, multi-hazard mapping and profiling, exposure, vulnerability and risk assessment. The key stakeholders that were consulted and validated this report included the senior environment officer, environmental officer, physical planner, and community development officer. The consultations were conducted at both the municipal and division levels.

Climate change in Nansana Municipality has manifested through increased temperatures, increased extreme events such as floods, prolonged dry spells, unpredictable and erratic rainfall patterns, increased amount of rainfall, and change of planting seasons. The climate hazards that occur in Nansana Municipality include drought, floods, lightning, hailstorms, and windstorms. These hazards have impacted the agriculture, education, energy, health, land and housing, manufacturing, social development, trade, transportation, and water and environment sectors of the municipality.

The areas that have a high level of exposure (more than 80 percent) to all the climate hazards in Nansana Municipality include Magigye, Wamirongo, Ttikalu, Maganjo, Wamala, Nansana West, Nabweru South, Migadde, and Busukuma. The wards that are highly vulnerable to all the hazards include Nabweru South, Kazo, Nabweru East, Wamirongo, Lugo, Ocheng 7/8, and Magigye. Similarly, the wards at risk of all hazards in Nansana Municipality include Maganjo, Nansana East, Nansana West, Nabweru North, Nabweru South, Kazo, and Ocheng 7/8.

Therefore, the government with support from partners should design innovative approaches to reduce the vulnerability and risk of these communities to multi-hazards and also increase their resilience and livelihoods. Some of those approaches may include;

- develop and maintain a local climate risk database to support evidence-based planning
- integrate hazard-specific data into local development plans
- upgrade and regularly maintain flood-prone drainage systems and culverts
- Promote stronger building materials, elevated housing, and storm-resistant roofing

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CHAPTER ONE: INTRODUCTION

1.1 Background

Nansana Municipality is located in Wakiso District in the Central Region of Uganda, and lies within the rapidly growing Greater Kampala Metropolitan Area (GKMA). As one of the most urbanized municipalities in Uganda, Nansana has witnessed substantial population growth, informal settlement expansion, and increased pressure on natural resources and infrastructure. This rapid urbanization has heightened the municipality's exposure and sensitivity to climate-related hazards such as floods, heat stress, and changing rainfall patterns.

Uganda's climate is characterized by two rainy seasons and is influenced by regional and global climate systems. In recent years, however, climate variability and change have become more pronounced across the country, including in urban areas like Nansana. The key challenges exacerbated by climate change in the municipality include increased frequency and intensity of flash floods due to heavy rains and poor drainage infrastructure, degradation of wetlands and green spaces as a result of encroachment and unregulated development, inadequate solid waste management contributing to blocked drainage and water contamination, and public health risks associated with poor sanitation and stagnant water, such as outbreaks of waterborne diseases. These challenges are compounded by a range of socio-economic and institutional factors such as limited adaptive infrastructure, low public awareness, poor land-use planning, and constrained financial resources for climate adaptation.

The Ugandan government, through its National Climate Change Policy and Vision 2040, emphasizes the need for local governments to mainstream climate change into development planning. In this context, the Climate Change Vulnerability Assessment for Nansana Municipality aims to support informed decision-making and guide the integration of climate resilience strategies into urban planning, infrastructure development, and service delivery. This assessment provides a foundation for understanding the current and future risks posed by climate change in Nansana and proposes evidence-based interventions that enhance the municipality's adaptive capacity, protect vulnerable populations, and build a sustainable urban environment.

1.2 Purpose and Objectives

1.2.1 Purpose

The purpose of the climate change and vulnerability assessment is to identify, analyze, and document the key climate-related risks and vulnerabilities affecting the communities, infrastructure, and ecosystems of Nansana Municipality.

1.2.2 Objectives

The objectives of the climate change and vulnerability assessment are;

I. To identify key climate hazards and their impacts on infrastructure, livelihoods, and ecosystems within the municipality.
II. To assess the vulnerability of populations and sectors in Nansana Municipality
III. To recommend practical and locally appropriate adaptation measures to strengthen climate resilience and inform policy and planning.

1.3 Policy, planning, and regulatory frameworks

The frameworks aim to reduce emissions, build resilience to climate impacts, enhance climate-resilient infrastructure and services, and strengthen the knowledge base. Table 1 outlines the policy,

regulatory, and planning frameworks that guide the planning and implementation of climate-resilient mitigation and adaptation strategies.

Frameworks, Policies, Plans and Acts	Relevance to Climate actions
International Frameworks	
United Nations Framework Convention on Climate Change (UNFCCC) 1992	Uganda signed and ratified the UNFCCC in 1992. The UNFCCC primarily focuses on developing NDCs, promotes integration of climate change into national planning, and enables access to international climate finance, capacity building and technology to align actions with global climate goals and strengthens institutional frameworks for coordinated climate action.
The Sendai Framework for Disaster Risk Reduction (2015-2030)	The **Sendai Framework** emphasize the need to **reduce disaster risks** that are exacerbated by climate change, including droughts, floods, and extreme weather events; encourage the integration of DRR into **climate change policies and plans**. With an aim of building **climate resilience**, improving EWS, and ensuring that climate adaptation efforts contribute to reducing vulnerability to climate-related disasters.
The United Nations Convention to Combat Desertification (1994)	The **UNCCD** focus on promoting sustainable land management practices that prevent desertification, land degradation, and drought; implementing climate-resilient agricultural practices, improve soil health and restore degraded lands; mitigating the impacts of climate change, enhance carbon sequestration, and increasing agricultural productivity in vulnerable areas, with the goal of contributing to **climate adaptation and greenhouse gas reduction**.
The Paris Agreement 2016	The **Paris Agreement** is a core in limiting global temperature rise to well below 2°C and pursue efforts to stay within 1.5°C; it guides the formulation and implementation of **NDCs**, which outline sector-specific strategies for climate mitigation and adaptation; enhances access to **international climate finance**, **capacity building and technology transfer**, and supports the transition to a low-carbon and climate-resilient development pathway.
Kyoto Protocol (2005)	The **Kyoto Protocol** primary focus is on reducing greenhouse gas emissions; implementing **emission-reduction projects**, access **climate finance**, and promote **low-carbon technologies**, supporting climate action goals is easy through Clean Development Mechanism CDM.
Sustainable Development Goals (2015).	The **SDGs**, specifically **Goal 13 (Climate Action)**, focus on strengthening resilience and adaptive capacity to climate-related hazards; promoting the integration of climate change measures into national policies, strategies, and planning; encouraging access climate finance, invest in renewable energy, and promote sustainable land and resource use to achieve a **low-carbon, climate-resilient future**.
African Union Agenda (2063)	Focuses on promoting a prosperous and sustainable Africa by supporting inclusive green growth, environmental sustainability, and climate-resilient economies; advocating for **renewable energy adoption**, **sustainable land use**, and **climate-smart agriculture;** encouraging regional cooperation and resource mobilization to tackle climate change effectively.
IGAD Initiatives on Drought & Desertification Strategy (2021-2025)	The strategy focuses on promoting climate-resilient agriculture, **sustainable land management**, **ecosystem restoration**; addressing land degradation and reduce vulnerability to climate shocks; promoting **cross-border**

Frameworks, Policies, Plans and Acts	Relevance to Climate actions
	collaboration, capacity building, and the use of **climate-smart practices**; contributing to greenhouse gas reduction, enhanced adaptive capacity and improved food security in drought-prone areas.
UN 2030 Agenda	The agenda adopted in 2015, outlines **17 SDGs**, with **Goal 13 (Climate Action)** directly calling for urgent steps to combat climate change and its impacts; guides the integration of climate change into national planning, encourages **resilient development**, and supports **access to international climate finance and technology**.
The Ramsar Convention on Wetlands (1971)	The Ramsar Convention promotes the **conservation and wise use of wetlands**, which advocates for **carbon storage**, **climate regulation**, and **biodiversity conservation** by buffering climate impacts and supporting climate-resilient livelihoods including fishing, eco-tourism, and sustainable agriculture.
National Planning frameworks	
Uganda Vision (2040)	The Vision acknowledges climate change as a hindrance to development thus promotes a shift to a **green economy** focusing on **low-carbon development**, **renewable energy**, and **sustainable natural resource use**; It also supports integration of climate change adaptation and mitigation into all sectors of the economy to ensure long-term sustainability.
Third National Development Plan (2020/21 - 2024/25)	NDPIII focuses on **integrating of climate change** into national and local development plans. It promotes **sustainable use of natural resources**, **environmental protection**, and **low-emission development pathways** through **Program 9**. It has supported **investment in climate-smart technologies** and encourages coordination among sectors to strengthen climate resilience.
Updated Nationally Determined Contribution (2022)	The Updated NDC outlines country's enhanced commitments to **reduce greenhouse gas emissions** by 24.7% by 2030, prioritizing sectors including **agriculture, energy, forestry, and waste management**. It promotes **transition to clean energy climate-smart agriculture** and **afforestation**, while advocating for inclusive participation and gender-responsive approaches.
Uganda Disaster Preparedness Plan (2005 – 2009)	Although it was formulated before Uganda's formal climate change policy frameworks, the plan indirectly supports climate goals by enhancing national capacity to prepare for **climate-induced hazards** such as floods and droughts.
National Disaster Risk Management (DRM) Plan (2011 – 2028)	The DRM Plan supports country's climate resilience efforts by promoting **risk-informed development planning**. It acknowledges the growing impact of **climate-induced hazards** including droughts, floods, and landslides, and advocates for **adaptation measures** that reduce long-term vulnerability to climate change.
NRM manifesto (2021 – 2026)	The Manifesto fronts the importance of sustainable **natural resource management** as a foundation for Uganda's future development. It profiles a commitment to **climate-smart agriculture**, which aims to enhance productivity while minimizing environmental degradation. It promotes the adoption of **innovative technologies** that can reduce carbon emissions and

Frameworks, Policies, Plans and Acts	Relevance to Climate actions
	enhance environmental sustainability. It also calls for the integration of **climate change adaptation** and **mitigation** strategies across all sectors, including agriculture, energy, infrastructure, and transport to ensure **climate resilience** in both urban and rural communities.
Uganda National Adaptation Programmes of Action (2007	NAPA establishes strategic approach to **climate change adaptation** by identifying the most vulnerable communities and sectors. It focuses on actions that enhance resilience in sectors including health agriculture and water resources. It proposes **adaptation measures** including promoting drought-resistant crops, improving water storage, and enhancing EWS for extreme weather events.
Health Sector Development Plan (2015-2020)	The plan recognizes the growing impact of **climate change** on public health, basically through **climate-sensitive diseases** including cholera malaria, and waterborne diseases. It aims to enhance the need for **climate adaptation strategies** to protect health systems and improve **healthcare access** for vulnerable populations. The plan also supports initiatives such as **vector control** in malaria-prone areas and strengthening health sector capacity to handle climate-related health crises.
The Water Action Plan (1995)	The plan centers on improving **water resource management** by ensuring sustainable water use in the face of growing climate change impacts. It emphasizes the development of **water infrastructure, water conservation** and promotion of **efficient irrigation** practices that are important for adapting to **climate-induced water scarcity** and droughts. It also advocates for better management of **wetlands** to improve water retention and resilience to climate-related shifts in water availability.
National Policies	
The 1995 Constitution of Uganda	The Constitution lays the **foundation for environmental protection**, recognizing the duty of the state and citizens to protect natural resources, such as water, land, wetlands, and biodiversity. It mandates that **development must be ecologically sustainable**, which supports climate action by providing a legal basis for integrating environmental and climate considerations into national and local policies.
National Environment Management Policy (1995)	NEMP establishes a framework that focus on integrating **climate considerations** and **environmental sustainability** into Uganda's development agenda by promotes **sustainable use of natural resources**, supports climate change mitigation and adaptation measures, and advocates for **integration of climate issues into sectoral plans, policies and budgets**. NEMP encourages the **mobilization of financial and technical resources** for environmental protection and resilience building.
Uganda National Land Policy (2013)	The policy advocates for **climate-resilient land use planning** by promoting **sustainable land management practices** that prevent degradation and enhance productivity. It encourages **protection of fragile ecosystems** including forests, wetlands and mountainous areas, which are crucial for carbon sequestration and climate regulation. The policy also emphasizes the integration of **climate change adaptation strategies** into land tenure and utilization systems.

Frameworks, Policies, Plans and Acts	Relevance to Climate actions
Uganda National Climate Change Policy (2015	The policy is a **central framework for addressing climate change**, guiding both mitigation and adaptation efforts, promotes **low-carbon development**, encourages **sustainable energy use**, and advocates for **integration of climate change into all national and sectoral plans;** supports **green economy initiatives** and provides direction for mobilizing **climate finance**, research, and technology transfer to build national climate resilience.
Disaster Preparedness and Management Policy (2010)	Although the policy primarily focuses on disaster management, it also recognizes the increasing climate-related hazards including floods, droughts, and landslides and their impacts; promotes the mainstreaming of climate change adaptation into disaster risk reduction strategies and supports actions that build community resilience to the long-term impacts of climate change.
The Uganda Forestry Policy	The policy seeks to promote sustainable forest management for climate change mitigation through biodiversity conservation and carbon sequestration; encourage afforestation, reforestation and restoration of degraded forest ecosystems, all which contribute to greenhouse gas emissions reduction and enhancing climate resilience across landscapes.
The Water Statute (1995)	The Water Statute advocates for **sustainable use, conservation, efficient water use, protection of water resources**, and resilience building in water supply systems which is key for climate adaptation. It establishes the legal basis for **integrated water resources management (IWRM)** approach to ensure water availability amidst changing climate patterns.
The Gender Policy (1997)	The policy primarily emphasizes **equity and inclusiveness in climate change planning and response**. It recognizes that women and men experience climate impacts differently and promotes the **integration of gender perspectives into environmental and climate policies**; it advocates for **women's participation in climate actions**, mainly in sectors including agriculture, water, and energy, which are highly climate-sensitive
National Acts	
National Forestry and Tree Planting Act (2003)	The Act establishes a legal framework that prioritize sustainable expansion of forests and management for climate change mitigation through carbon sequestration. It also promotes afforestation, tree planting, and reforestation in degraded areas, and supports the conservation of natural forest reserves to reduce greenhouse gas emissions and protect biodiversity.
National Climate Change Act (2021)	The Act primarily seeks to address climate change. It mandates the **integration of climate change into all national and sectoral plans, policies and budgets**. It has established institutional structures for **climate governance**, enforces commitments under international agreements (e.g., the Paris Agreement), and promotes **emissions tracking**, **low-carbon development**, and **climate finance** mechanisms to support climate-resilient growth.
National Disaster Preparedness and Management Act (2021)	The Act supports **climate change adaptation** by integrating **disaster risk reduction (DRR)** into national development plans which helps address the vulnerabilities of sectors including water resources, agriculture and health to climate change impacts such as droughts and floods. The Act enhances Uganda's capacity to prepare for and manage **climate-induced hazards**,

Frameworks, Policies, Plans and Acts	Relevance to Climate actions
	promoting the **sustainability** of communities through EWS, resource mobilization, and adaptive measures.
The National Environment Act (NEA) 2019	The NEA provides a framework for environmental management which emphasizes sustainable development and the integration of environmental concerns into national planning. It established the NEMA, a coordinating, monitoring, regulatory, and supervisory body for environmental activities. The Act seeks to address emerging environmental issues, including climate change, by promoting strategic environmental assessments and the management of hazardous chemicals.
The National Water Policy (1999)	The **policy** provides a framework that prioritize sustainable management and development of water resources. It has promoted IWRM for adapting to climate variability and ensuring the equitable and efficient use of water across all sectors. It also supports water conservation and sustainable water supply for rain-fed agricultural production affected by climate change; it addresses the need for efficient use of water in industries and urban areas to reduce the carbon and water footprints of these sectors.
The Water Act (1997)	The Act establishes a framework for the use, protection, and management of water resources. It supports climate adaptation efforts, ensuring that water use for various purposes including agricultural, domestic, industrial, and energy production is conducted sustainably. This helps mitigate the impacts of climate change by maintaining the availability and integrity of water resources.
Land Act, 1998	The Act establishes a framework for land tenure including customary, freehold, Mailo, and leasehold; ownership, and management. Although the Act does not explicitly address climate change issues, but it encourages sustainable land-use practices and long-term investments in land conservation, which are important in climate change mitigation and adaptation strategies.
The Local Governments Act (1997)	The Act, entrusts local governments with the management of natural resources within their jurisdictions. It empowers local authorities to implement environmental policies and programs customized to their specific contexts, facilitating more effective responses to climate change challenges; LGs can develop and enforce ordinances related to environmental conservation, promote sustainable land use practices, and engage communities in climate adaptation initiatives and enables grassroots-level climate action, fostering resilience and sustainable development.
Public Finance Management Act, 2015	PFMA carries out the systematic integration of climate change in planning and budgeting by emphasizing prudent financial management which ensures that resources are efficiently allocated toward climate-related initiatives; it facilitates the government's ability to fund climate adaptation and mitigation programs which help building resilience against climate change impacts.
The National Water & Sewerage Corporation Act. 1995	The policy gave rise to establishment of the National Water and Sewerage Corporation (NWSC). The NWSC has been responsible for piped water provision and focus on expanding water and sewerage services in large urban centres and small

Frameworks, Policies, Plans and Acts	Relevance to Climate actions
	urban centres. In this context, the Act supports the implementation of **IWRM**, encouraging the sustainable management and conservation of water resources, contributes to enhancing **climate resilience** in urban areas, helping communities adapt to the impacts of climate change, such as altered precipitation patterns and water scarcity.

1.4 Location of Nansana Municipality

Nansana Municipality is located in Wakiso district within the central region of Uganda. Nansana Municipal Council is located approximately 9.6 kilometers from the centre of Kampala, the capital city of Uganda along Kampala-Hoima Road. The municipality covers an area of 295.3 square kilometers and borders Wakiso Town Council, Mende and Masuliita sub-counties to the West; Kampala city to the South; Kasangati Town Council and Kyampisi sub-county to the East; and Bombo Town Council as well as Makulubita, Nyimbwa, and Kalagala sub-counties to the North. Nansana municipality has four divisions namely Gombe, Busukuma, Nansana, and Nabweru divisions (**Figure 1**).

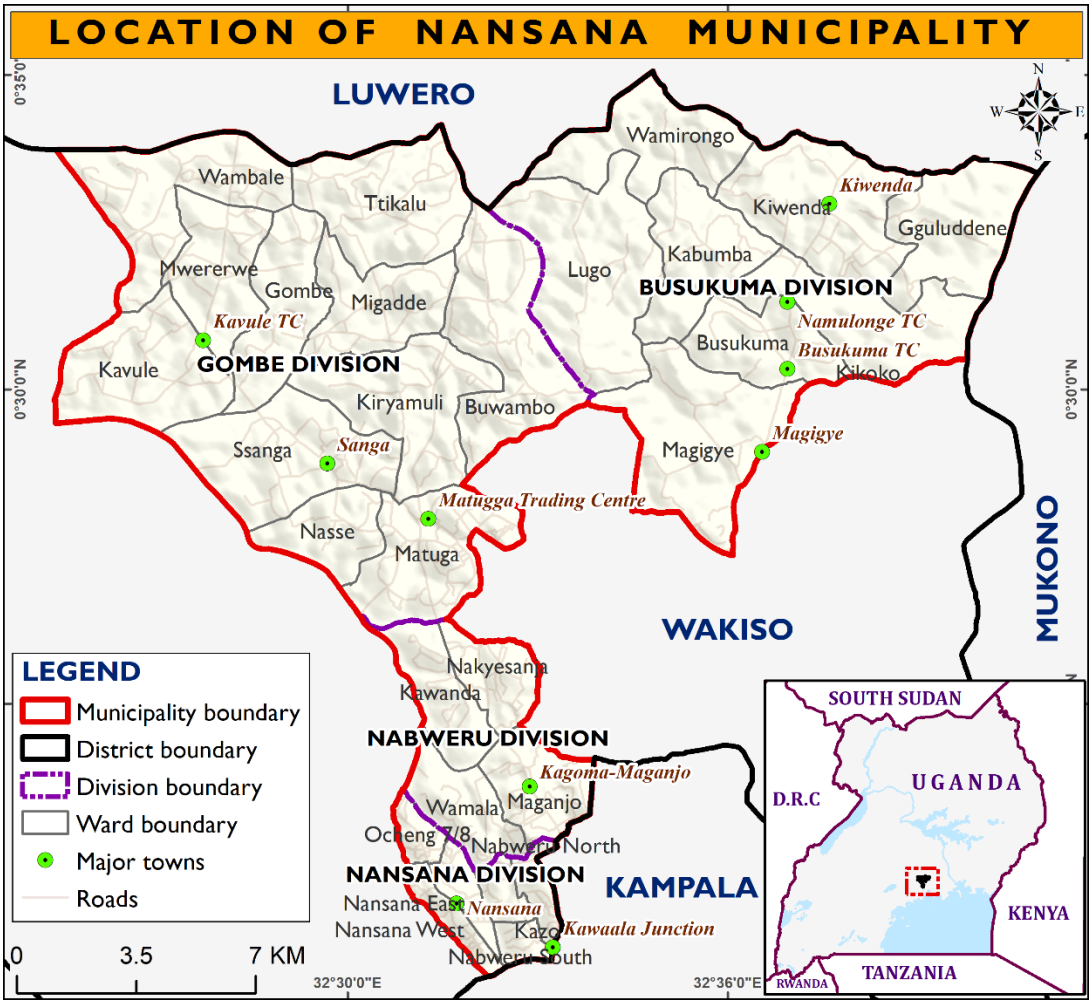


Figure 1: Location of Nansana Municipality in Uganda

CHAPTER TWO: METHODOLOGY

The Climate Change and Vulnerability Assessment report for Nansana Municipality was developed using a diverse methodological approach. The methods used in the assessment are described below.

2.1 Literature Review

A comprehensive review of relevant literature was conducted to examine the key indicators of climate change in Nansana Municipality, assess its sectoral impacts, analyze the policy and institutional landscape governing climate change, identify gaps in current policies, and align findings with national adaptation and mitigation priorities. Key documents reviewed included the *Uganda National Climate Change Policy (2015)*, the *National Climate Change Act (2021)*, the *Uganda National Adaptation Programmes of Action (NAPA, 2007)*, sector-specific *National Adaptation Plans (NAPs) for Agriculture and Health*, the *National Development Plan IV*, *Vision 2040*, *the Uganda National Urban Policy, the Updated Nationally Determined Contribution (NDC, 2022)*, the *Wakiso District Development Plan*, and the *Wakiso Multi-Hazard, Risk, and Vulnerability Profile*, among others. This review provided a robust foundation for identifying climate risks, informing policy recommendations, and enhancing resilience planning for Nansana Municipality.

2.2 Key Informant Interviews

Several key informants were consulted to understand the hotspot areas and sectors in Nansana municipality that are affected by climate change, the climate risks affecting communities in the municipality, the impact of climate change on local livelihoods and ecosystems, the localized adaptation and mitigation options that align with national plans, the observed environmental changes, the key indicators for tracking progress and outcomes, and recommendations for adaptive management and continuous improvement. At Nansana Municipal Council, the key informants consulted included the senior environment officer, the municipal environment officer, and the municipal physical planner. At the divisions, the key informants included the community development officers, environment officers, and forest officers. The key informants were conducted using a key informant guide that was reviewed by the client before testing and deployment.

2.3 Focus Group Discussion (FGD)

The consultant held various FGDs in the different divisions of Nansana municipality to further understand the impacts of climate change on local livelihoods and ecosystems, the climate risks affecting communities in the municipality, the areas mostly affected by climate change, the community perceptions of climate change and early warning systems, the adaptation and mitigation strategies to the impacts of climate change, and recommendations for adaptive management. Each FGD involved 10 participants, purposively selected based on their understanding of climate change. Key consideration was taken to ensure balanced participation of the different gender categories (men, women, and youth) and age (18-35, 36-60, 60+) in the FGDs. The marginalized groups, such as the elderly and the disabled, were included in the focus group discussions. The FGDs were conducted using a checklist that was reviewed by the client prior to testing and deployment.

2.4 Climate Risk Assessment

Climate risk assessment was conducted for five (5) climate events and these included drought, floods, hailstorms, lightning, and windstorms. To assess drought in Nansana municipality, rainfall data was obtained from CHIRPS (Climate Hazards Group InfraRed Precipitation with Station data) for the period 1994-2024. The Standardized Precipitation Index (SPI) was used to assess the magnitude of meteorological drought in the municipality. The SPI was computed using the Drought Indices Calculator (DrinC). Drought was then categorized based on SPI values as described by (Guttman, 1999; McKee et al., 1993).

Flooding in Nansana municipality was delineated using the HEC-GeoRAS tool. The input datasets included rainfall, elevation, land use/cover, and stream geometry data. The flood extents were then categorized into flood hazard intensities based on water depth: very high (>2m), high (1.5m-2m), moderate (1m-1.5m), and low (0.5m-1m).

Hail is a form of solid precipitation. It consists of balls or irregular lumps of ice; each called a hailstone. Data about the number of hail days was obtained from the Uganda National Meteorological Authority (UNMA) for a period of 30 years (1994-2024). The UNMA data was collated with hailstorm historical data from the Desinventar database. This data was pre-processed and interpolated using the Inverse Distance Weighted (IDW) technique in the GIS environment. The interpolated layer was classified into low, moderate, high, and very high hailstorm hazards.

Lightning is the occurrence of a natural electrical discharge of very short duration and high voltage between a cloud and the ground or within a cloud. Lightning happens when the negative charges (electrons) in the bottom of the cloud are attracted to the positive charges (protons) in the ground (Earth Networks, 2023). Thunder day data was used to profile lightning, and this was supplemented with Over-shooting Tops (OT) data acquired from NASA Meteosat Second Generation (MSG) 3km resolution Spin-Enhanced Visible Infrared Imager (SEVIRI). The lightning hazard zonation was generated with reference to flashes per square kilometre per year and classified as very low, low, moderate, high, and very high; concerning their severity (**Table 1**).

Table 1: Lightning hazard intensity scale

Intensity Class	OT Counts/month	Flash density (strikes/yr/km^2)
High	10-15	50-75
Moderate	5-10	10-50
Low	2-5	< 10

Wind is the perceptible natural movement of air. To develop the windstorm hazard, the assessment adopted the wind speed modelling approach by Morjani (2011). Wind speed data for Nansana municipality was collected from the climate engine website for the period 1994-2024. The spatial distribution of wind hazard intensity was done by conducting a kriging interpolation analysis and applying the Beaufort wind scale. The windstorm hazard was classified into very low, low, moderate, high, and very high (Table 2).

Table 2: Beaufort wind hazard intensity scale

Beaufort scale	Description	Wind speed (m/s)	Conditions	Windstorm Hazard Class
6	Strong breeze	10.8-14.5	Large tree branches/crops in motion; whistling heard in electric/telegraph wires; difficulty using umbrellas	Very low
7	High wind, moderate gale	14.6-20.0	Whole trees in motion; difficulty when walking against the wind	Low
8	Gale	20.1-22.0	Twigs break off trees; generally, impedes progress	Moderate
9	Strong/severe gale	22.1-28.0	Can cause slight structural damages	High
10	Storm, whole gale	> 28.1	Trees/crops uprooted; considerable structural damage, may be accompanied by widespread damage	Very high

2.5 Climate Change Projections

Daily baseline climate data (minimum temperature, maximum temperature, and precipitation) for Nansana municipality was obtained from the climate engine website for a period of 30 years (1994-2024). The baseline climate data was used to project the future climate in the municipality. The projection of future climate was done using the Agricultural Model Intercomparison and Improvement Project (AgMIP) implemented in R software. The projection utilized the delta method based on the sum of interpolated anomalies to high-resolution monthly climate surfaces.

The method produces a smoothed (interpolated) surface of changes in climates (deltas or anomalies). Then it applies this interpolated surface to the baseline climate, taking into account the possible bias due to the difference in baselines (Ramirez-Villegas and Jarvis, 2010). Twenty-nine models embedded in AgMIP protocol were used for climate projection (**Table 3**). The projection was done under two representative concentration pathways (RCP4.5 and RCP8.5); up to 2030, a projection year for the climate action plan. The projection outputs were summarized in MS Excel and represented as graphs. The spatial and temporal variation of climate projections were also done in ArcGIS using the Inverse Distance Weighted (IDW) Interpolation technique.

Table 3: General Circulation Models (GCM) used for climate projection of Nansana Municipality

No.	GCM	Symbol	Institution
1	ACCESS1-0	A	Commonwealth Scientific and Industrial Research Organization (CSIRO) and Bureau of Meteorology (BOM), Australia
2	BCC-CSM1-1	B	Beijing Climate Center, China Meteorological Administration
3	BNU-ESM	C	College of Global Change and Earth Systems Science, Beijing Normal University (BNU)
4	CanESM2	D	Canadian Centre for Climate Modelling and Analysis
5	CCSM4	E	US National Center for Atmospheric Research (NCAR)
6	CESM1-BGC	F	US National Science Foundation (NSF), US Department of Energy (DOE), and the US National Centre for Atmospheric Research (NCAR)
7	CMCC-CM	G	Euro-Mediterranean Center on Climate Change
8	CMCC-CMS	H	Euro-Mediterranean Center on Climate Change
9	CNRM-CM5	I	France National Centre for Meteorological Research
10	CSIRO-Mk3-6-0	J	Queensland Climate Change Centre of Excellence and Commonwealth Scientific and Industrial Research Organization (CSIRO)
11	FGOALS-g2	K	Chinese Academy of Sciences

No.	GCM	Symbol	Institution
12	GFDL-CM3	L	NOAA/Geophysical Fluid Dynamic Laboratory (GFDL)
13	GFDL-ESM2G	M	NOAA/Geophysical Fluid Dynamic Laboratory (GFDL)
14	GFDL-ESM2M	N	NOAA/Geophysical Fluid Dynamic Laboratory (GFDL)
15	GISS-E2-H	O	National Aeronautics and Space Association Goddard Institute for Space Studies (NASA GISS)
16	GISS-E2-R	P	National Aeronautics and Space Association Goddard Institute for Space Studies (NASA GISS)
17	HadGEM2-AO	Q	UK Meteorological Office - Hadley Centre
18	HadGEM2-CC	R	UK Meteorological Office - Hadley Centre
19	HadGEM2-ES	S	UK Meteorological Office - Hadley Centre
20	INMCM4.0	T	Russian Institute for Numerical Mathematics (INM)
21	IPSL-CM5A-LR	U	Institute Pierre Simon Laplace (IPSL)
22	IPSL-CM5A-MR)	V	Institute Pierre Simon Laplace (IPSL
23	IPSL-CM5B-LR	W	Institute Pierre Simon Laplace (IPSL)
24	MIROC5	X	University of Tokyo, Japanese National Institute for Environmental Studies (NIES), and Japan Agency for Marine-Earth Science and Technology (JAMSTEC)
25	MIROC-ESM	Y	University of Tokyo, Japanese National Institute for Environmental Studies (NIES), and Japan Agency for Marine-Earth Science and Technology (JAMSTEC)
26	MPI-ESM-LR	Z	Max Planck Institute (MPI) for Meteorology (low resolution)
27	MPI-ESM-MR	1	Max Planck Institute (MPI) for Meteorology (mixed resolution)
28	MRI-CGCM3	2	Japanese Meteorological Research Institute (MRI)
29	NorESM1-M	3	Norwegian Climate Centre

2.6 Vulnerability and Risk Assessment

Vulnerability to climate change refers to the degree to which a system, community, or individual is susceptible to, and unable to cope with, the adverse impacts of climate change, including climate variability and extremes (IPCC, 2014). Vulnerability is shaped by physical, social, economic, and political factors that affect how prepared and resilient individuals or communities are to climate-related hazards. Vulnerability is a function of exposure, the sensitivity of a household or livelihood to the stress associated with that exposure, and the adaptive capacity to recover from the impacts of that exposure.

*Vulnerability = (Exposure * Sensitivity) – Adaptive Capacity*

Exposure: The communities in Nansana municipality are mostly exposed to drought, floods, lightning, hailstorms, and windstorms. These hazards were ranked, weighed and normalized to produce the exposure index.

Sensitivity describes the socio-economic or demographic characteristics that can make people susceptible to the negative effects of exposure (Declet-Barreto et al., 2020). The sensitivity indicators that were assessed at ward level include access to health services, community awareness and preparedness, degradation of rivers, dependency on climate-sensitive sectors e.g., agriculture, dependence on surface water, drainage systems, housing quality, income levels, population density, unemployment, and wetland degradation. Some indicators, like income levels and wetland degradation, were compared with data from the Uganda Bureau of Statistics (UBOS) and Wetland Management Department (WMD), respectively. These indicators were ranked, weighed and normalized to produce the sensitivity index.

Adaptive capacity captures the potential of communities to avoid, minimize, or cope with the negative effects of multi-hazards. The adaptive capacity indicators that were assessed at ward level included access to clean water and sanitation, access to credit, access to early warning information, access to renewable energy, awareness of climate risks and adaptation practices, diverse livelihood options, education levels, extension services, good environmental management practices, healthcare infrastructure, proper waste disposal, rainwater harvesting, social networks, urban greening initiatives, and wetland and ecosystem restoration. These adaptive capacity indicators were ranked, weighed and normalized to produce the adaptive capacity index.

The exposure, sensitivity, and adaptive capacity indices were analyzed in the geographical information system (GIS) environment to generate the vulnerability index, which was mapped at the ward level.

Disaster risk is the likelihood of loss of life, injury or destruction and damage from a disaster in a given period (UNISDR, 2017). Disaster risk is widely recognized as the consequence of the interaction between a hazard and the characteristics that make people and places vulnerable and exposed (**Figure 2**).

Figure 2:The risk matrix
Source: de Brito et al., 2017

The multi-hazards experienced in Nansana municipality were combined, weighed, and normalized to produce the hazard index. The population of the communities in the different wards was considered the exposed element. The population data was normalized to produce the exposure index. The hazard, exposure, and vulnerability indices were analyzed and normalized to produce the risk index, which was mapped at the ward level.

CHAPTER THREE: CLIMATE CHANGE AND VULNERABILITY

3.1 Climate Trends and Projections

3.1.1 Observed and Projected Maximum Temperature Trends in Nansana Municipality

The observed average annual maximum temperatures for Nansana municipality are about 26.1 ºC, with a minimum of 24.8 ºC in July and a maximum of 28.3 ºC in February. For the climatological period 1994-2024, maximum temperature in Nansana municipality has increased at a rate of 0.31 ºC per decade. Between 1994 and 2024, the highest maximum temperature of 27.0 ºC was recorded in 2017 (**Figure 3**). The projections of maximum temperature (2025-2030) indicate an increase of 0.3 ºC and 0.6 ºC under moderate (RCP 4.5) and high (RCP 8.5) greenhouse gas (GHG) concentration scenarios respectively; relative to the 1994-2024 average.

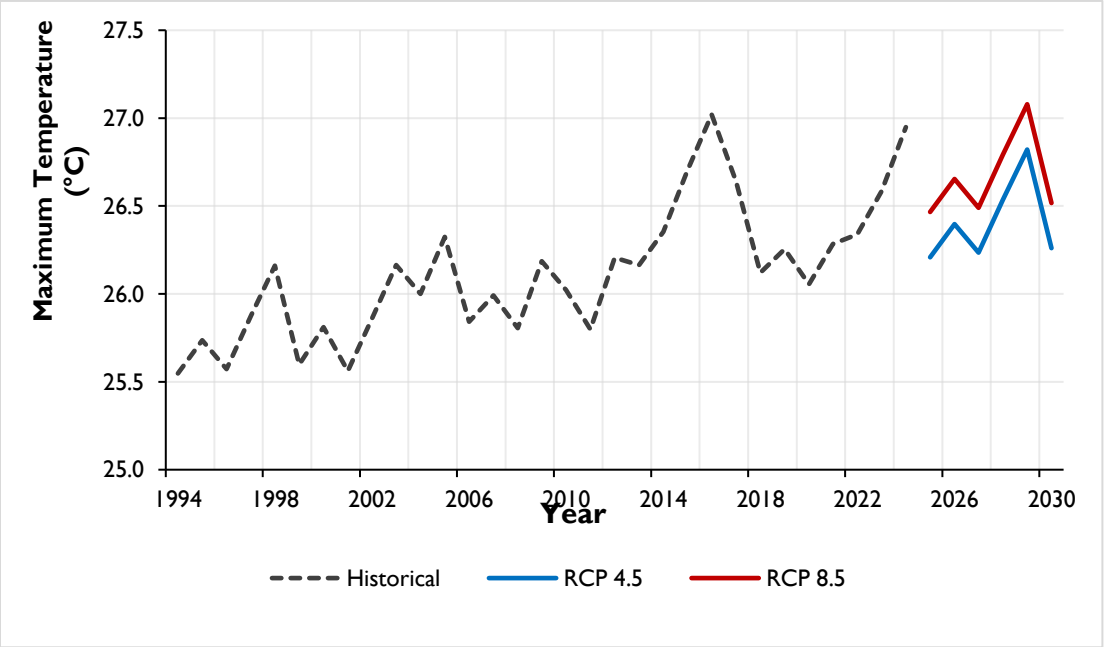


Figure 3: Historical and projected maximum temperature for Nansana municipality between 1994 and 2030

Busukuma and Gombe divisions are projected to have the highest maximum temperatures of between 26.8 ºC and 27.0 ºC compared to other areas especially under the high (RCP 8.5) greenhouse gas (GHG) concentration scenario (**Figure 4**).

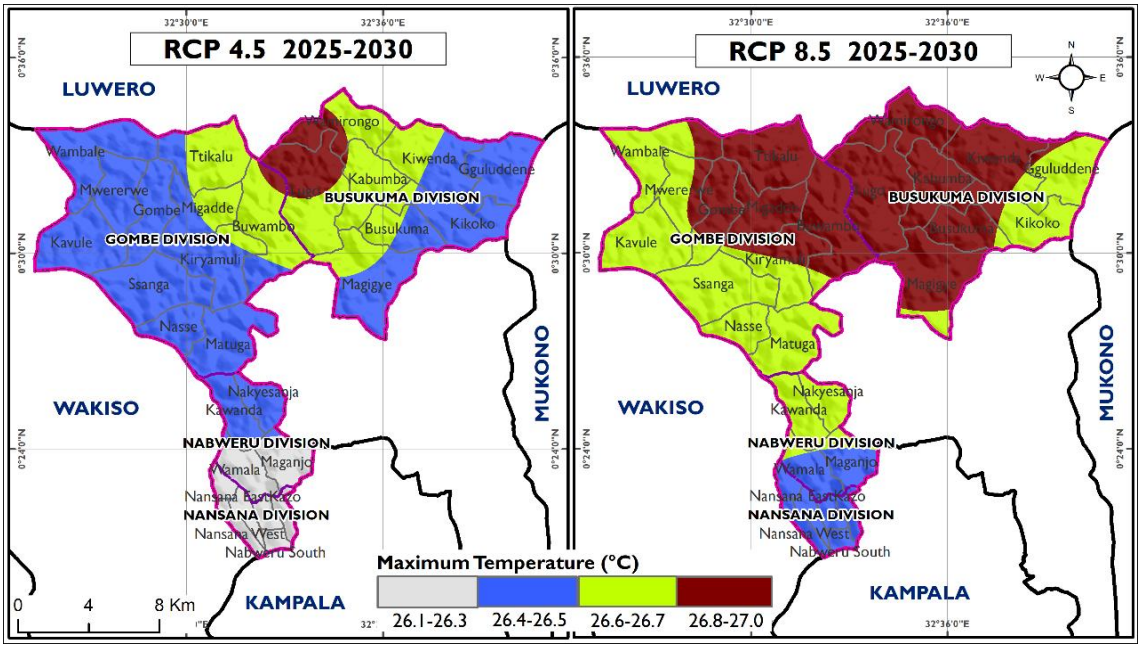


Figure 4: Projected maximum temperature for the 2025-2030 near-term projection period in Nansana municipality

3.1.2 Observed and Projected Minimum Temperature Trends in Nansana Municipality

The observed average annual minimum temperatures for Nansana municipality are about 17.0 ^{o}C, with a minimum of 16.3 ^{o}C in July and a maximum of 17.8 ^{o}C in April. For the climatological period 1994-2024, minimum temperature in Nansana municipality has increased at a rate of 0.19 ^{o}C per decade. Between 1994 and 2024, the highest minimum temperature of 17.7 ^{o}C was recorded in 2024 (**Figure 5**). The projections of minimum temperature (2025-2030) indicate an increase of 0.76 ^{o}C and 0.78 ^{o}C under moderate (RCP 4.5) and high (RCP 8.5) greenhouse gas (GHG) concentration scenarios respectively; relative to the 1994-2024 average.

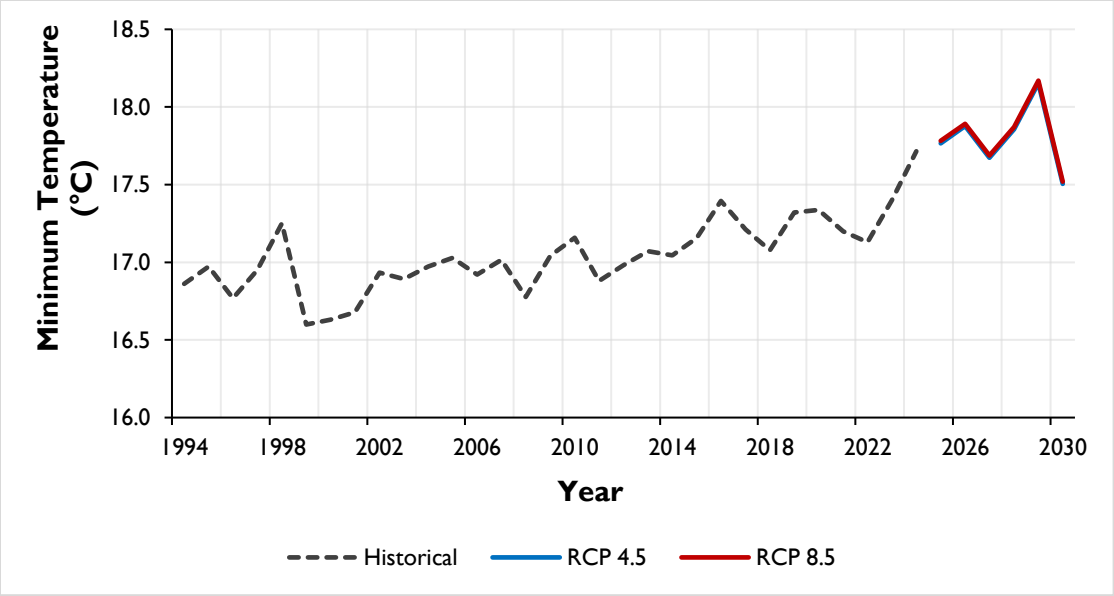


Figure 5: Historical and projected minimum temperature for Nansana municipality between 1994 and 2030

Nansana, Busukuma and Gombe divisions are projected to have the highest minimum temperatures of between 17.9 ºC and 18.0 ºC compared to other areas especially under the high (RCP 8.5) greenhouse gas (GHG) concentration scenario (**Figure 6**).

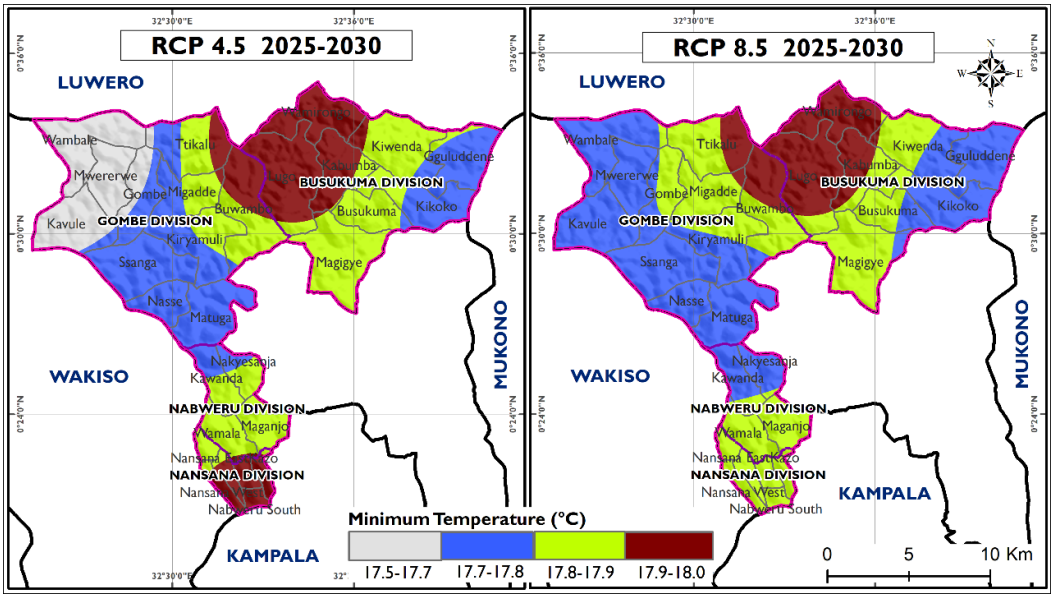


Figure 6: Projected minimum temperature for the 2025-2030 near-term projection period in Nansana municipality

3.1.3 Observed and Projected Rainfall Trends in Nansana Municipality

Between 1994 and 2024, the total annual average rainfall for Nansana Municipality was 1,363 mm, and mean monthly rainfall varied from 60.7 mm in July to 151.0 mm in November. For the climatological period 1994-2024, rainfall in Nansana municipality has increased at a rate of 4.66 mm per decade. Between 1994 and 2024, the highest annual rainfall of 1,670.5 mm was recorded in 2019 (**Figure 7**). The projections (2025-2030) indicate an increase of mean rainfall for Nansana Municipality.

Under RCP 4.5, mean rainfall is projected to increase by 220.9 mm (16.2%) relative to the 1994-2024 average. Similarly, under RCP 8.5, mean rainfall is projected to increase by 183.8 mm (13.5%) relative to the 1994-2024 average.

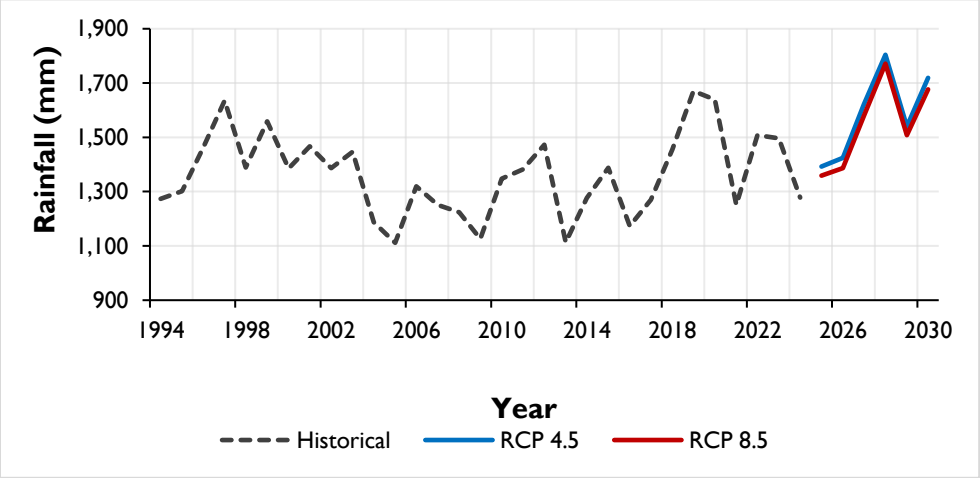


Figure 7: Historical and projected rainfall for Nansana municipality between 1994 and 2030

The highest projected mean rainfall in Nansana Municipality is expected in Busukuma division in the wards of Gguluddene, Kikoko, Kiwenda, and Busukuma (**Figure 8**).

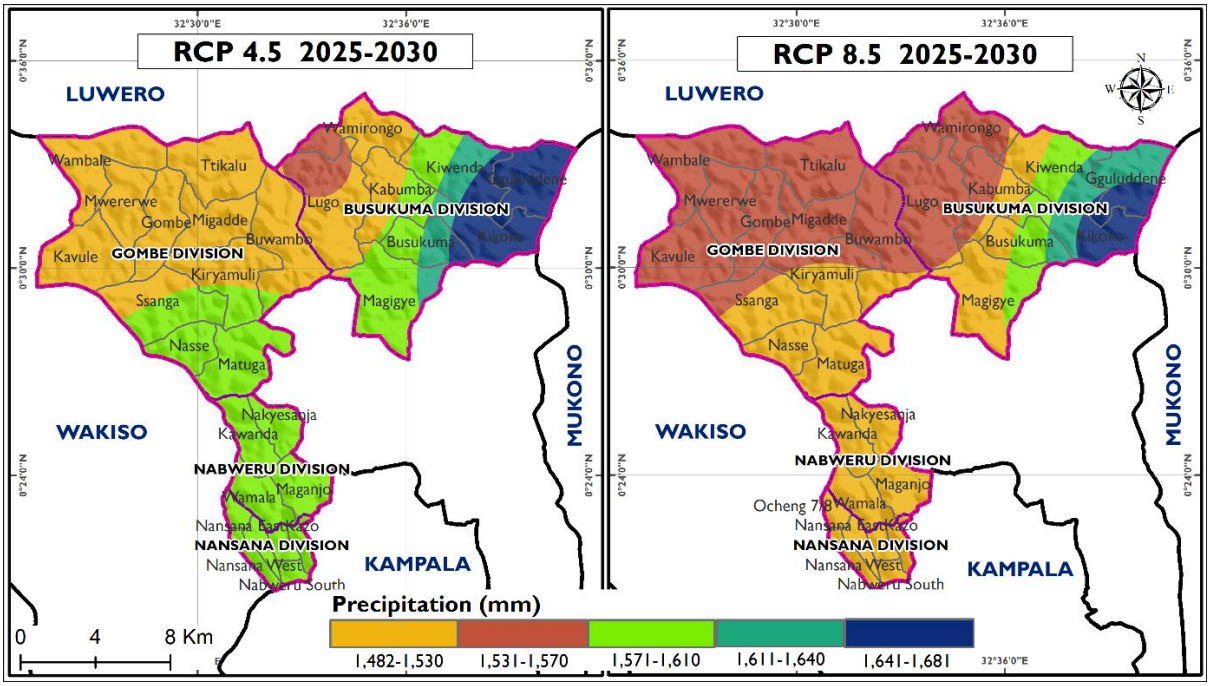


Figure 8: Projected rainfall for the 2025-2030 near-term projection period in Nansana municipality

3.2 Climate Hazards

Climate hazards refer to events or conditions resulting from climate or weather-related phenomena that have the potential to cause harm to people, property, and the environment (Zscheischler et al., 2020). The climate hazards that affect Nansana municipality include drought, floods, hailstorms, lightning, and windstorms. These climate hazards are briefly described below.

3.2.1 Drought Hazard

Drought is defined as a recurrent feature of climate that occurs when there is an extended period of abnormal deficiency in precipitation (relative to what is considered normal) (Sivakumar & Wilhite, 2002). Drought in Nansana Municipality has been attributed to environmental degradation majorly cutting down of trees, and encroachment of wetland ecosystems. The impacts of drought include water crisis, reduced crop and livestock productivity, and increased food prices. The warmer temperatures also favour the survival of some pests and parasites thus an increase in pests, parasites, and diseases. The biggest part of the municipality (64.5%) is exposed to low drought hazard. However, wards such as Maganjo, Migadde, Ttikalu, Gombe, Mwererwe, Wambale, and Wamirongo; are exposed to moderate drought hazard (**Figure 9**).

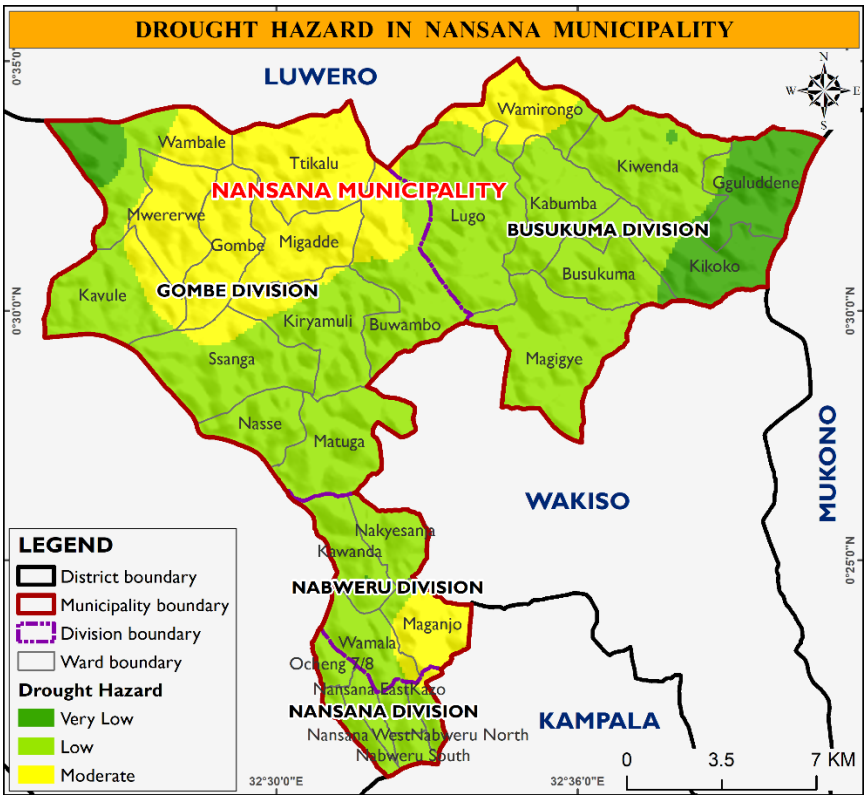


Figure 9: Drought hazard zonation in Nansana Municipality

3.2.2 Flood Hazard

Flooding is an overflow of water that submerges land that is usually dry (Farida & Maswanku, 2022). The floods in Nansana Municipality are majorly attributed to excessive rainfall due to climate change, clearing of trees and vegetation, encroachment of wetlands, municipal waste disposal in drainage channels, and increased farming of the river banks. The impacts of floods in Nansana Municipality include loss of lives; destruction of houses and household property; destruction of croplands; contamination of water sources; destruction of WASH facilities and infrastructure such as health centres, schools, roads, bridges and culverts. The biggest part of the municipality (26.3%) is exposed to floods of moderate intensity.

Table 4 shows the flood hotspots highlighted by the community members in the different divisions of Nansana Municipality.

Table 4: Flood hotspots in Nansana Municipality

Divisions	Busukuma	Nabweru	Nansana	Gombe
Hotspots	Kattabaana, Kasangati, Nasirye, Bulesa, Butera, Namawata, Kabonge-Buyaga, Kigemezi-Buwanuka, Nabutiti, Bukemba-Kabanyolo, Bulyankuyege-Butera, Namulonge TC	Kawempe B, Tula, Kisumu, Kakira, Nabweru Division Head Quarters, Wamala	Katalemwa, Katoogo, Lubigi, Bwaise, Kibwa, Katooke, Kazo, Lugoba-kazinga, Bujjagaali, Kabumbi	Watindo Wambale, Semuto, Ngalomyambe, Kavule, Gombe

The flood hazard hotspots in Nansana Municipality are presented in **Figure 10**.

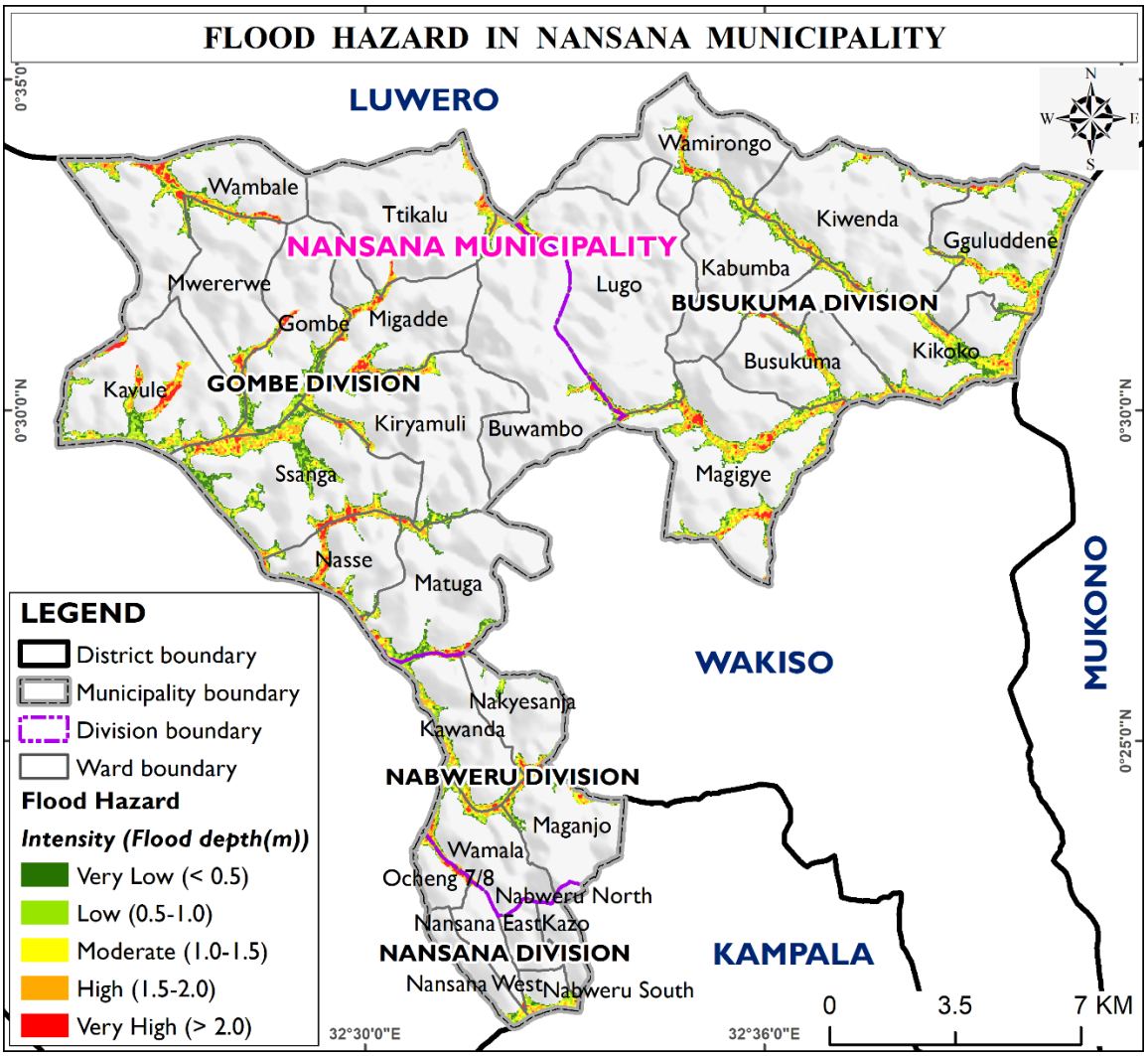


Figure 10: Flood hazard zonation in Nansana Municipality

3.2.3 Hailstorm Hazard

Hail is a form of solid precipitation. It consists of balls or irregular lumps of ice, each of which is called a hailstone. Hailstones consist mostly of water ice and measure between 0.2 inches and 6 inches in diameter. Hail develops when rising air in a thunderstorm, known as the updraft, lifts water droplets high into the atmosphere where temperatures are below freezing. This causes the water droplets to turn into hailstones before falling down to earth. The stronger the updraft, the larger the hailstones can become before succumbing to the pull of gravity and falling to the earth's surface. Depending on their intensity, hailstorms can destroy crops also cause temporary damage to WASH infrastructure (such as water points, and latrines). The entire municipality is moderately vulnerable to hailstorm hazard (**Figure 11**).

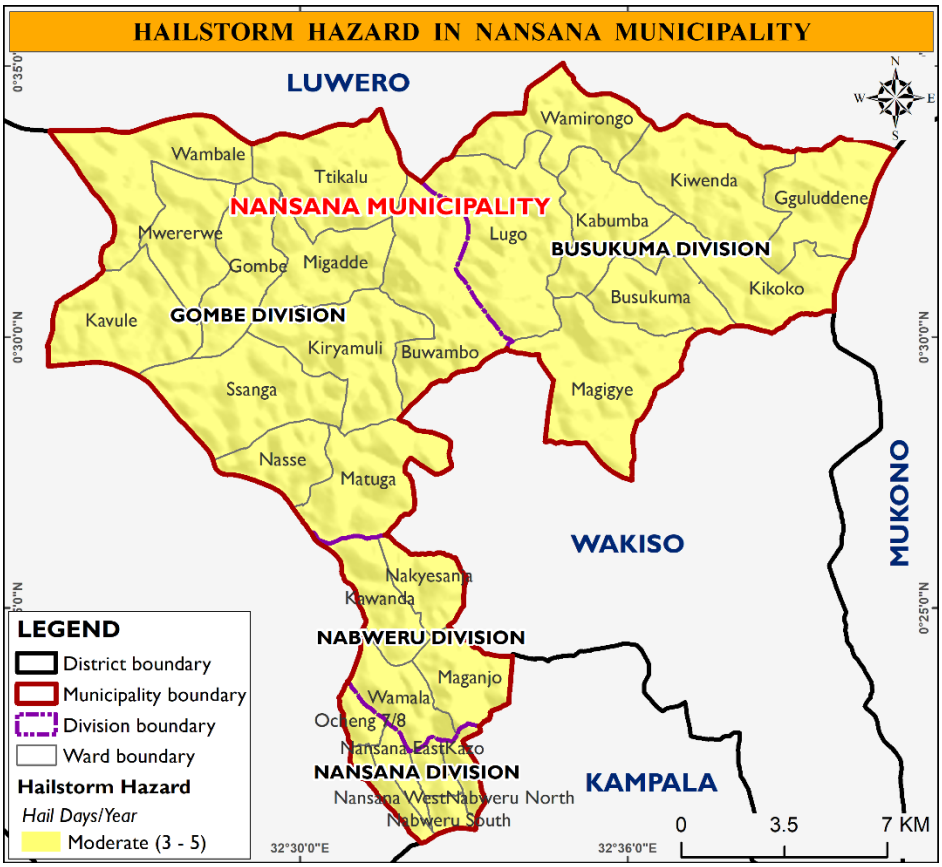


Figure 11: Hailstorm hazard zonation in Nansana Municipality
Data Source: *OPM, 2019*

3.2.4 Lightning Hazard

Lightning is the occurrence of a natural electrical discharge of very short duration and high voltage between a cloud and the ground or within a cloud (Agrawal & Nigam, 2014). The frequencies and severities of lightning incidences have increased, resulting in significant loss of life and property. Lightning happens under favourable conditions, where electrical discharges occur from a charge centre in a cloud either to: (i) the induced charge on the earth, (ii) the charge centres of another cloud, or (iii) a charge centre of the same cloud. The biggest part of Nansana Municipality (40.9%) is exposed to moderate lightning hazard. However, some areas in Wamirongo ward, Busukuma division are exposed to high lightning hazard (**Figure 12**).

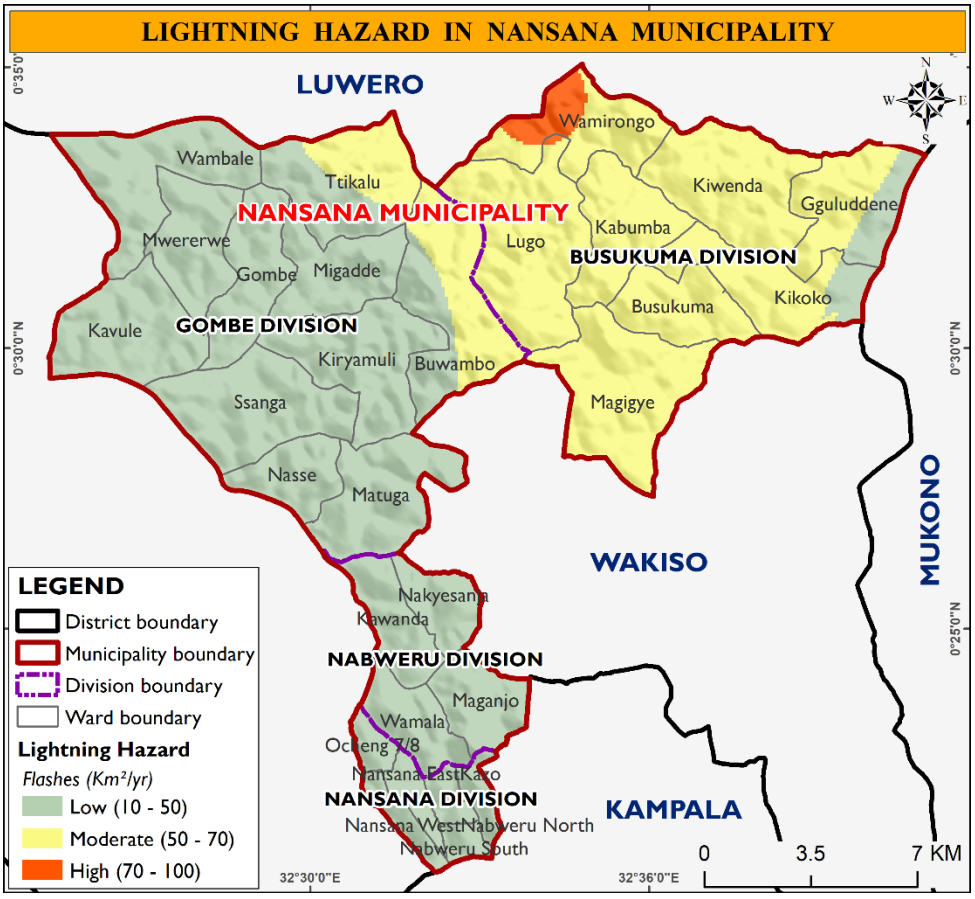


Figure 12: Lightning hazard zonation in Nansana Municipality

3.2.5 Windstorm Hazard

Wind is the perceptible natural movement of air. Wind is caused by differences in the atmospheric pressure. When a difference in atmospheric pressure exists, air moves from the higher to the lower pressure area, resulting in winds of various speeds. The impacts of windstorms in Nansana Municipality include air pollution, the spread of human diseases, uprooting of trees and considerable structural damage to buildings, power and telephone lines, communication masts and other urban infrastructure. The biggest part of the municipality (83%) is exposed to very low windstorm hazard, especially in Gombe and Busukuma divisions. Nansana division and some sections of Nabweru division are exposed to moderate windstorm hazard (**Figure 13**).

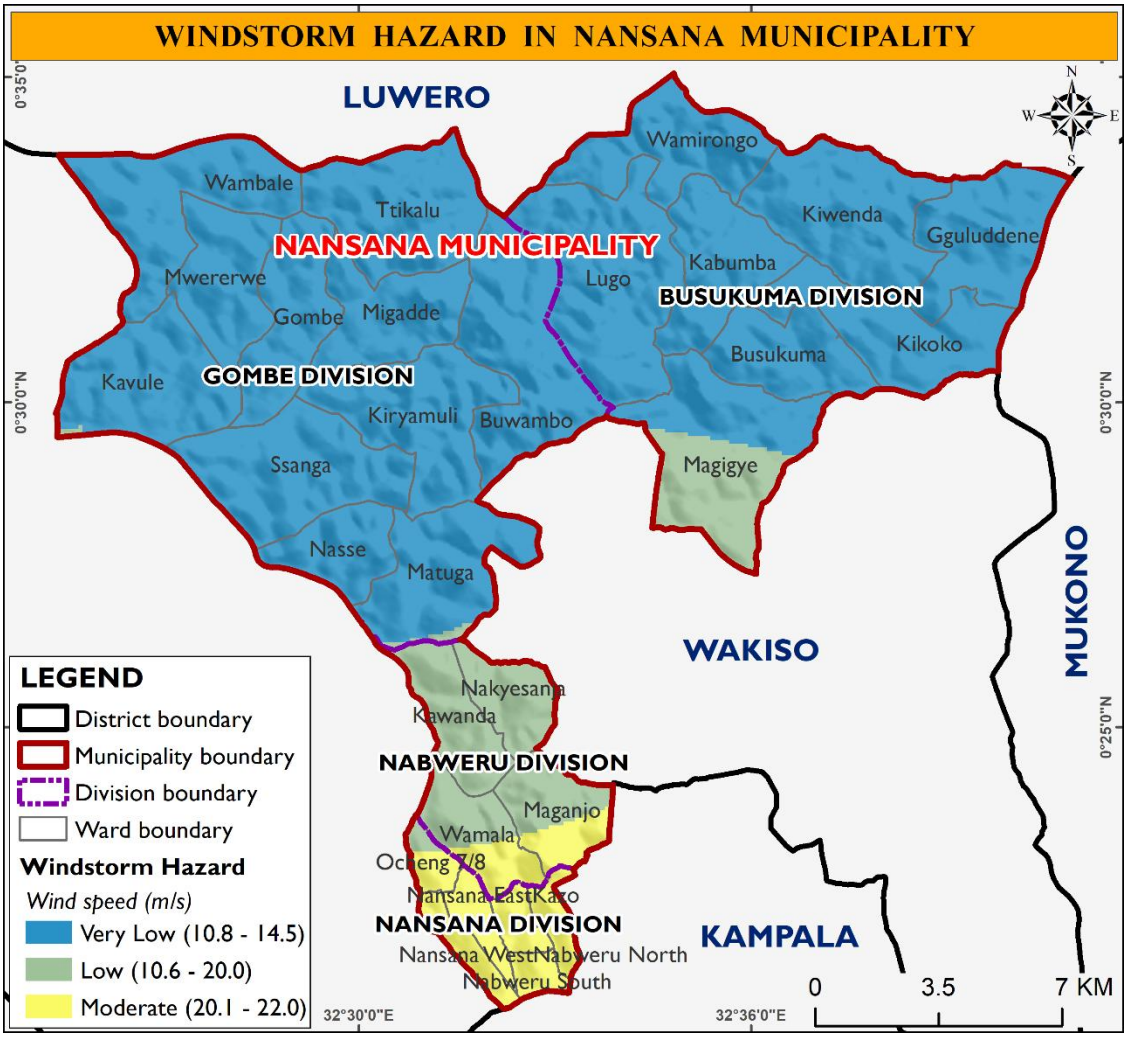


Figure 13: Windstorm hazard zonation in Nansana Municipality

3.3 Exposure Assessment

Exposure is defined as the situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas (UNISDR, 2017). The criterion considered for exposure assessment of elements at risk was location in moderate, high, and very high hazard intensities (OPM, 2019). Exposure of the elements at risk was done based on the availability of spatial datasets. **Table 5** indicates the elements at risk and their sensitivity to the different climate hazards.

Table 5: Sensitivity of elements at risk to the different climate hazards

Sector and Element at Risk	Data Source	Drought	Floods	Hailstorms	Lightning	Windstorms
1. Agriculture						
1.1 Farmlands	Satellite Imagery, 2025	High	High	Moderate	Low	Moderate
2. Education						
2.1 Schools	MoES, 2018	Low	High	Low	Moderate	High
3. Energy						

3.1 Substations	UMEME, 2024	Low	High	Low	High	Low
3.2 Transformers	UMEME, 2024	Low	Moderate	Low	High	High
3.3 Distribution lines	UMEME, 2024	Low	Low	Low	High	High
4. Health						
4.1 Health facilities	MoH, 2024	Low	High	Low	Moderate	High
5. Land and Housing						
5.1 Buildings	OSM & Satellite Imagery, 2025	Low	High	Low	High	Moderate
6. Social development						
6.1 Human population	UBOS Census, 2014	High	High	High	High	High
7. Transportation						
7.1 Roads	UNRA, 2022	Low	High	Low	Low	Low
8. Water and Environment						
8.1 Wetlands	WMD, 2021	Moderate	High	Low	Low	Low
8.2 Forests	Satellite Imagery 2025 & NFA 2024	Moderate	High	Low	Low	Low
8.3 Water sources	MWE, 2024	High	High	Low	Low	Low

3.3.1 Exposure of the agriculture sector to climate hazards

The agriculture sector element exposed to climate hazards in Nansana Municipality is farmlands.

The assessment showed that 26.8 Km^2 (25.2%) of farmlands are exposed to drought hazard in Nansana Municipality. Gombe (43.3%) and Nabweru (21.3%) divisions have the biggest proportion of farmlands exposed to drought hazard (**Table 6**).

A total of 8.4 Km^2 (7.9%) of farmlands are exposed to flood hazard in Nansana Municipality. Nabweru (13.3%) and Nansana (12.2%) divisions have the biggest proportion of farmlands exposed to flood hazard (**Table 6**).

All the farmlands (100%) in Nansana Municipality are exposed to hailstorm hazard. Gombe (52.4 Km^2) and Busukuma (43.9 Km^2) divisions have the biggest acreage of farmlands exposed to hailstorms (**Table 6**).

In Nansana Municipality, 3.2 Km^2 (3%) of farmlands are exposed to windstorms whereas 103.4 Km^2 (97%) are not exposed to this hazard (**Table 6**). The exposed farmlands to windstorm hazard are located in Nabweru and Nansana divisions.

Table 6: Exposure of farmlands to drought, flood, hailstorm, and windstorm hazards in Nansana Municipality

Climate Hazards	**Drought**				**Floods**				**Hailstorms**		**Windstorms**			
Division	Exposed		Not Exposed		Exposed		Not Exposed		Exposed		Exposed		Not Exposed	
	Area (Km^2)	%	Area (Km^2)	%	Area (Km^2)	%	Area (Km^2)	%	Area (Km^2)	%	Area (Km^2)	%	Area (Km^2)	%
Busukuma	2.4	5.4	41.3	94.6	3.8	8.8	40.0	91.2	43.9	100.0	0.0	0.0	43.7	100.0
Gombe	22.6	43.3	29.7	56.7	3.2	6.1	49.2	93.9	52.4	100.0	0.0	0.0	52.3	100.0
Nabweru	1.8	21.3	6.5	78.7	1.1	13.3	7.2	86.7	8.3	100.0	1.0	12.0	7.2	88.0
Nansana	0.1	3.2	2.3	96.8	0.3	12.2	2.1	87.8	2.4	100.0	2.2	93.5	0.1	6.5
Total	**26.8**	**25.2**	**79.7**	**74.8**	**8.4**	**7.9**	**98.5**	**92.1**	**107.0**	**100.0**	**3.2**	**3.0**	**103.4**	**97.0**

Figure 14 shows the exposure of farmlands to drought, flood, hailstorm, and windstorm hazards in Nansana Municipality.

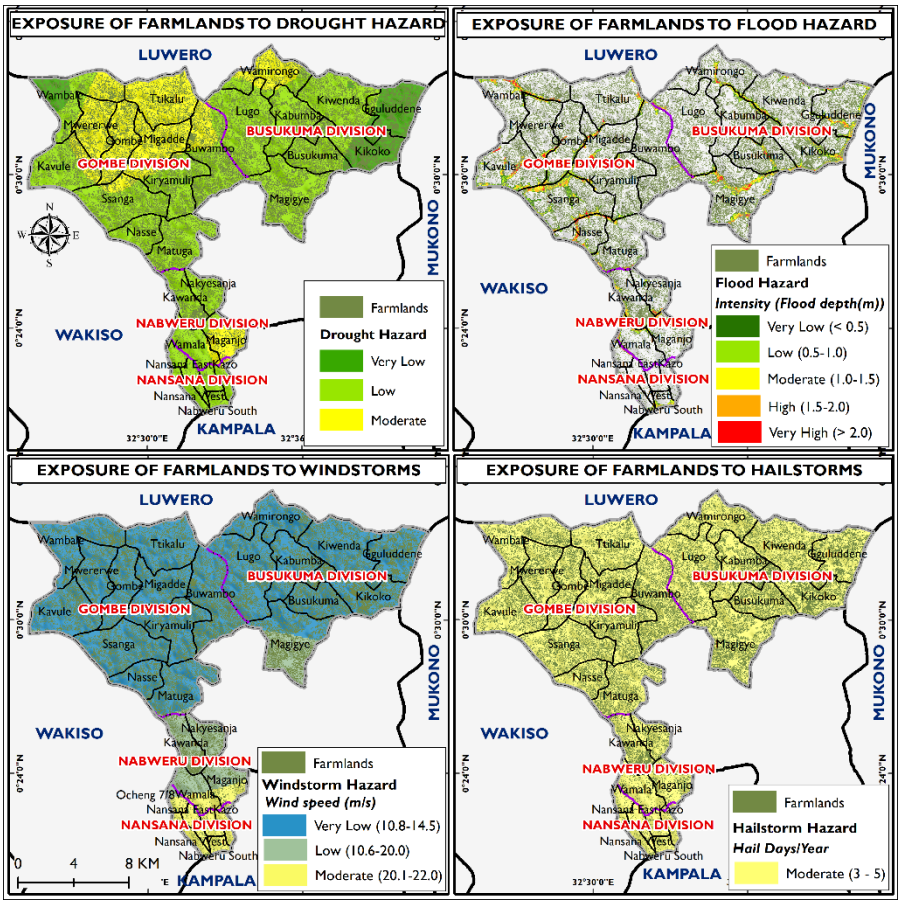


Figure 14: Exposure of farmlands to drought, flood, windstorm, and hailstorm hazards in Nansana Municipality

3.3.2 Exposure of the education sector to climate hazards

The education sector element exposed to climate hazards in Nansana Municipality is schools.

The analysis showed that 9 schools (2.6%) in Nansana Municipality are exposed to floods whereas 337 schools (97.4%) are not exposed to floods (**Table 7**). Nansana division (4.6%) has the biggest percentage of schools exposed to floods. Schools such as Light Nyange Quality School and Alliance High School in Ochieng 7/8 ward as well as Standard Parents Namungoona P/S in Nansana West; are highly exposed to floods.

A total of 59 schools (17.2%) are exposed to lightning hazard in Nansana Municipality (**Table 7**). The schools exposed to lightning in Nansana Municipality are located in Busukuma (98%) and Gombe (13.9%) divisions.

In Nansana Municipality, 138 schools (40.2%) are exposed to windstorms whereas 205 schools (59.8%) are not exposed to this climate hazard (**Table 7**). The schools exposed to windstorms in Nansana Municipality are located in Nansana (96.3%) and Nabweru (31.8%) divisions.

Table 7: Exposure of schools to floods, lightning, and windstorms in Nansana Municipality

Climate Hazards	Floods				Lightning				Windstorms			
Divisions	Exposed		Not Exposed		Exposed		Not Exposed		Exposed		Not Exposed	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Busukuma	0	0.0	49	100	48	98.0	1	2.0	0	0	49	100
Gombe	1	1.3	79	98.8	11	13.9	68	86.1	0	0	79	100
Nabweru	3	2.8	105	97.2	0	0.0	107	100.0	34	31.8	73	68.2
Nansana	5	4.6	104	95.4	0	0.0	108	100.0	104	96.3	4	3.7
Total	**9**	**2.6**	**337**	**97.4**	**59**	**17.2**	**284**	**82.8**	**138**	**40.2**	**205**	**59.8**

Figure 15 presents the schools exposed to floods, lightning and windstorms in Nansana Municipality.

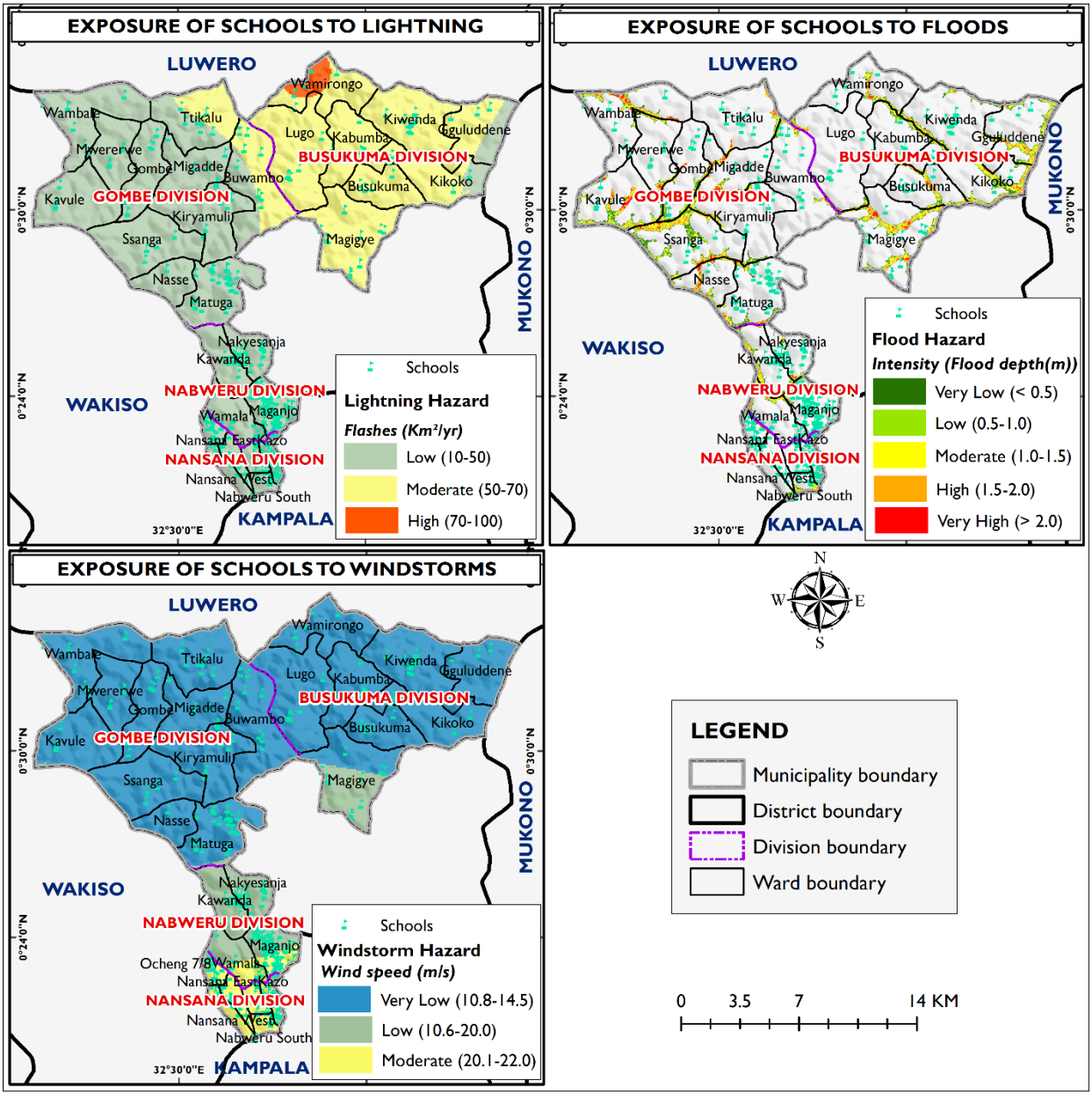


Figure 15: Exposure of schools to lightning, flood, and windstorm hazards in Nansana Municipality

3.3.3 Exposure of the energy sector to climate hazards

The energy sector elements exposed to climate hazards in Nansana Municipality include substations, transformers, distribution lines, and distribution poles.

3.3.3.1 Exposure of distribution substations to flood and lightning hazards

The assessment showed that 1 distribution substation of Kawanda (50%) is moderately exposed to floods whereas another distribution substation of Kawanda UETCL (50%) is not exposed to floods. Both distribution substations are found in Nakyesanja ward, Nabweru division, Nansana Municipality. Both substations are not exposed to lightning hazard. The exposure of distribution substations to floods and lightning is presented in **Figure 16**.

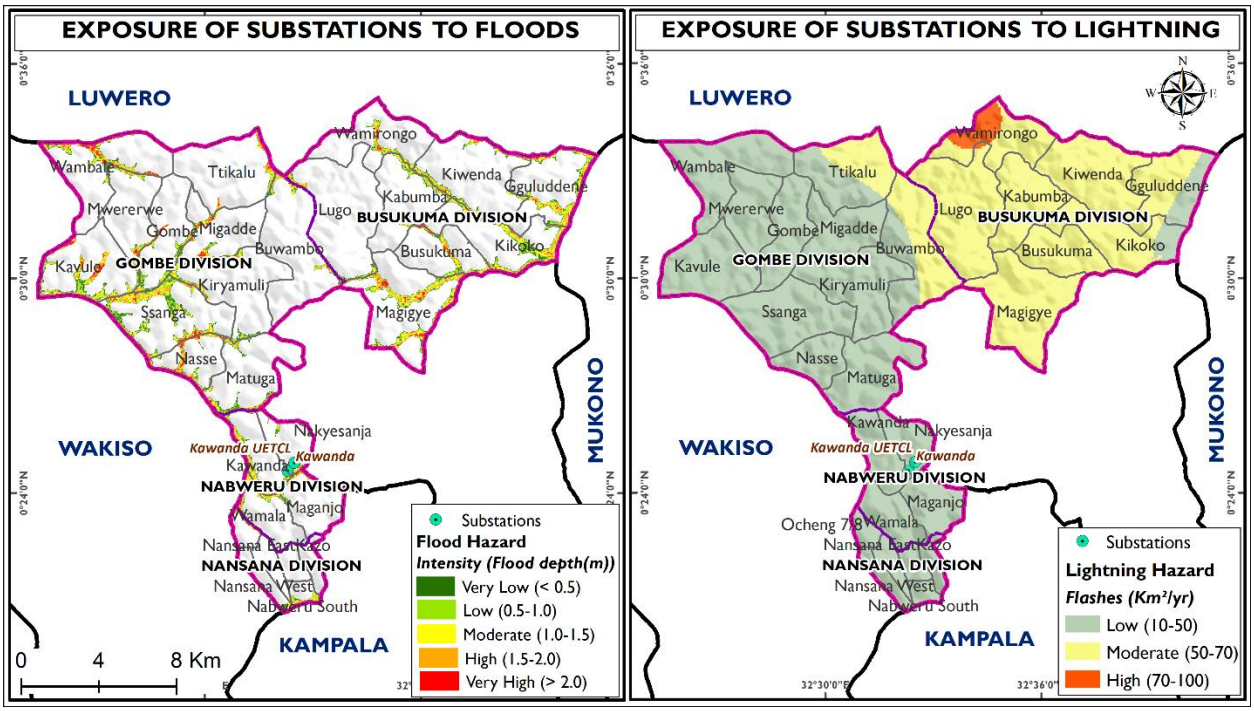


Figure 16: Exposure of distribution substations to floods and lightning in Nansana Municipality

3.3.3.2 Exposure of distribution transformers to lightning and windstorm hazards

The analysis showed that 56 distribution transformers (18.9%) are exposed to lightning hazard whereas 241 distribution transformers (81.1%) are not exposed to lightning hazard (**Table 8**). The exposed distribution transformers to lightning are located in Busukuma (92.3%) and Gombe (8.3%) divisions.

A total of 88 distribution transformers (29.6%) are exposed to windstorm hazard while 209 distribution transformers (70.4%) are not exposed to this hazard (**Table 8**). Nansana (95.5%) and Nabweru (30.1%) divisions have the biggest proportion of distribution transformers exposed to windstorm hazard.

Table 8: Exposure of distribution transformers to lightning and windstorm hazards

Climate Hazards	Lightning				Windstorms			
Divisions	Exposed		Not Exposed		Exposed		Not Exposed	
	Number	%	Number	%	Number	%	Number	%
Busukuma	48	92.3	4	7.7	0	0.0	52	100
Gombe	8	8.3	88	91.7	0	0.0	96	100
Nabweru	0	0.0	83	100	25	30.1	58	69.9
Nansana	0	0.0	66	100	63	95.5	3	4.5
Total	**56**	**18.9**	**241**	**81.1**	**88**	**29.6**	**209**	**70.4**

Figure 17 shows the distribution transformers exposed to lightning and windstorm hazards.

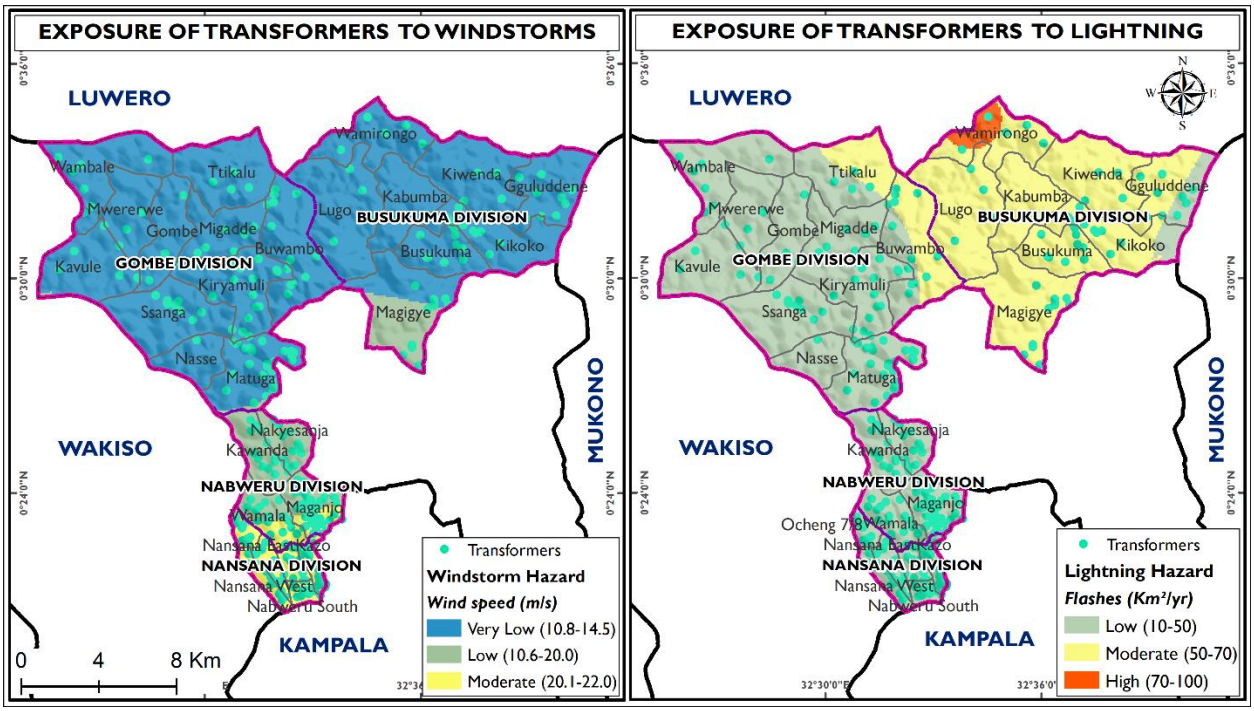


Figure 17: Exposure of distribution transformers to windstorm and lightning hazards in Nansana Municipality

3.3.3.3 Exposure of distribution lines to lightning and windstorm hazards

The assessment showed that 62.7 kilometers (22.4%) of distribution lines in Nansana Municipality are exposed to lightning hazard (**Table 9**). The exposed distribution lines to lightning hazard in Nansana Municipality are found in Busukuma (94.2%) and Gombe (9%) divisions.

A total of 30 kilometers (10.7%) of distribution lines are exposed to windstorms whereas 250.2 kilometers (89.3%) of distribution lines are not exposed to distribution lines (**Table 9**). Nabweru (17.2%) and Nansana (93.9%) divisions have the biggest proportion of distribution lines exposed to windstorm hazard.

Table 9: Exposure of distribution lines to lightning and windstorm hazards

Climate Hazards	Lightning				Windstorms			
Divisions	Exposed		Not Exposed		Exposed		Not Exposed	
	Length (Km)	%	Length (Km)	%	Length (Km)	%	Length (Km)	%
Busukuma	48.9	94.2	3.0	5.8	0.0	0.0	51.9	100
Gombe	13.8	9.0	139.0	91.0	0.0	0.0	152.8	100
Nabweru	0.0	0.0	53.2	100	9.2	17.2	44.0	82.8
Nansana	0.0	0.0	22.2	100	20.8	93.9	1.4	6.1
Total	**62.7**	**22.4**	**217.5**	**77.6**	**30.0**	**10.7**	**250.2**	**89.3**

Figure 18 shows the exposure of distribution lines to lightning and windstorm hazards in Nansana Municipality.

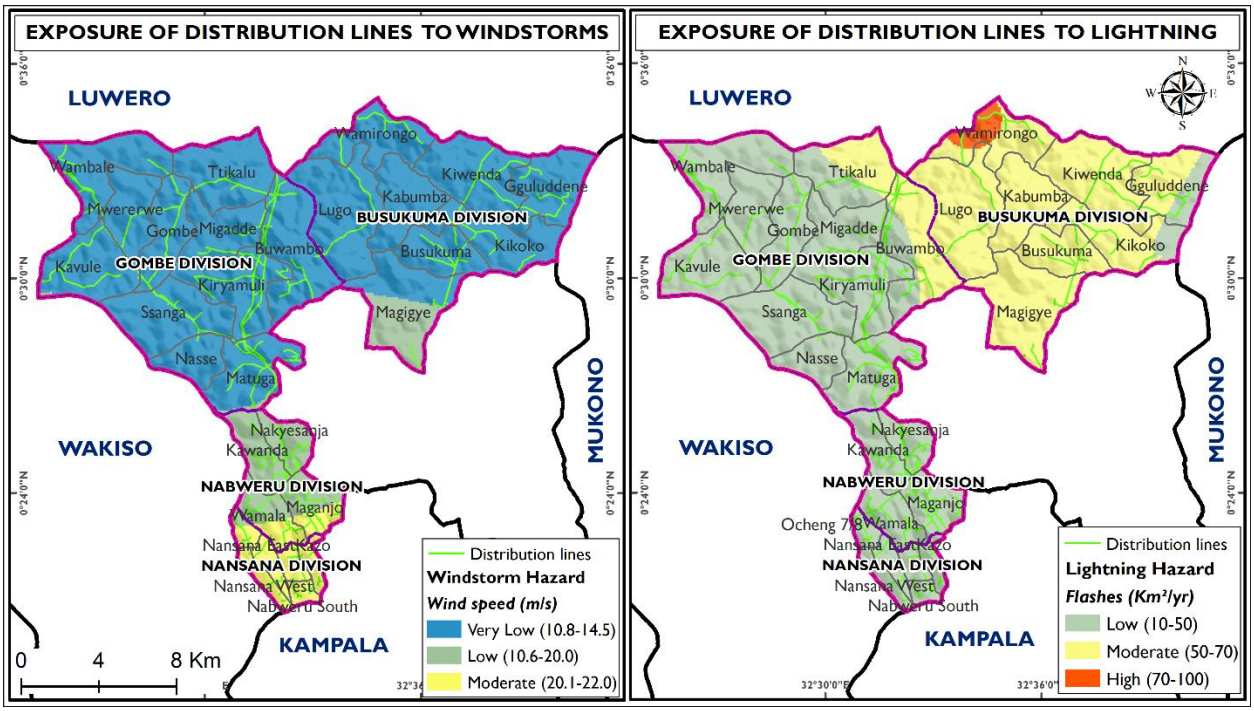


Figure 18: Exposure of distribution lines to windstorm and lightning hazards in Nansana Municipality

3.3.4 Exposure of the health sector to climate hazards

The health sector element exposed to climate hazards in Nansana Municipality is health facilities.

All the health facilities (100%) in Nansana Municipality are not exposed to flood hazard (**Table 10**).

The assessment showed that 11 health facilities (11%) in Nansana Municipality are exposed to lightning whereas 89 health facilities (89%) are not exposed to this hazard (**Table 10**). The exposed health facilities to lightning are found in Busukuma (90%) and Gombe (10.5%) divisions.

A total of 51 health facilities (51%) are exposed to windstorms in Nansana Municipality while 49 health facilities (49%) are not exposed to this hazard (**Table 10**). The health facilities exposed to windstorms are located in Nansana (95%) and Nabweru (41.9%) divisions.

Table 10: Exposure of health facilities to floods, lightning, and windstorms in Nansana Municipality

Climate Hazards	Floods				Lightning				Windstorms			
Divisions	Exposed		Not Exposed		Exposed		Not Exposed		Exposed		Not Exposed	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Busukuma	0	0	10	100	9	90	1	10	0	0	10	100
Gombe	0	0	19	100	2	10.5	17	89.5	0	0	19	100
Nabweru	0	0	31	100	0	0	31	100	13	41.9	18	58.1
Nansana	0	0	42	100	0	0	40	100	38	95	2	5
Total	**0**	**0**	**102**	**100**	**11**	**11**	**89**	**89**	**51**	**51**	**49**	**49**

The exposure of health facilities to the different climate hazards is shown in **Figure 19**.

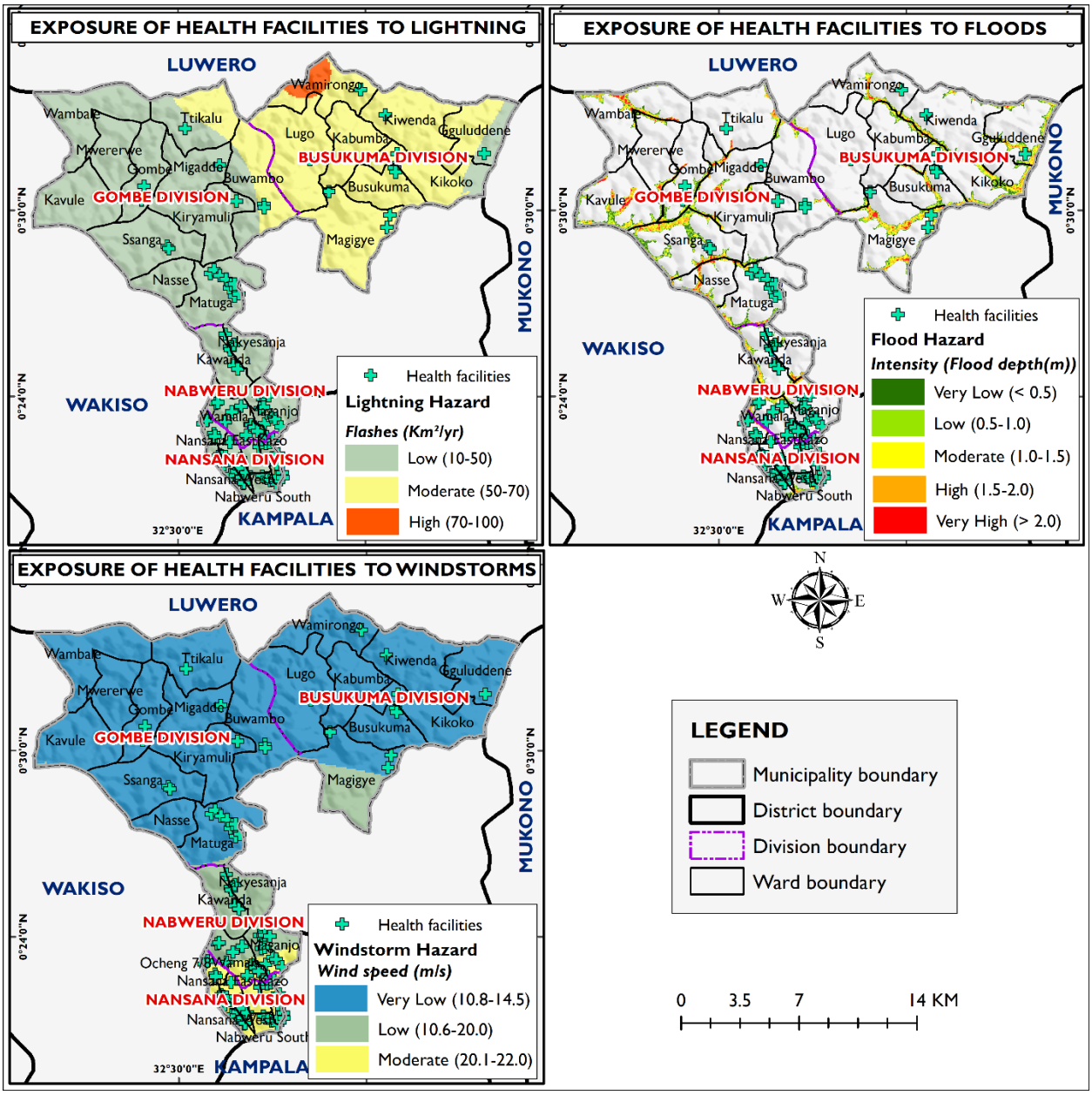


Figure 19: Exposure of health facilities to lightning, flood, and windstorm hazards in Nansana Municipality

3.3.5 Exposure of the land and housing sector to climate hazards

The land and housing sector element exposed to climate hazards in Nansana Municipality is buildings (both commercial and residential).

The analysis showed that 7,566 buildings (4.9%) are exposed to floods whereas 147,906 buildings (95.1%) are not exposed to flood hazard (**Table 11**). Nabweru (6.9%) and Busukuma (6.1%) divisions have the biggest proportion of buildings exposed to floods.

A total of 32,731 buildings (22%) are exposed to lightning hazard while 116,272 buildings (78%) are not exposed to this hazard (**Table 11**). The buildings exposed to lightning are found in Busukuma (95.3%) and Gombe (14.2%) divisions.

In Nansana Municipality, 53,059 buildings (35.6%) are exposed to windstorm hazard whereas 95,921 buildings (64.4%) are not exposed to this hazard (**Table 11**). The buildings exposed to windstorms in Nansana Municipality are found in Nansana (96.2%) and Nabweru (21.9%) divisions.

Table 11: Exposure of buildings to floods, lightning, and windstorms in Nansana Municipality

Climate Hazards	Floods				Lightning				Windstorms			
Divisions	Exposed		Not Exposed		Exposed		Not Exposed		Exposed		Not Exposed	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Busukuma	1,803	6.1	27,757	93.9	26,676	95.3	1,328	4.74	0	0	27,958	100
Gombe	1,601	3.6	42,599	96.4	6,055	14.2	36,592	85.8	0	0	42,572	100
Nabweru	2,215	6.9	29,661	93.1	0	0	30,119	100	6,619	21.9	23,553	78.1
Nansana	1,947	3.9	47,889	96.1	0	0	48,233	100	46,440	96.2	1,838	3.81
Total	**7,566**	**4.9**	**147,906**	**95.1**	**32,731**	**22**	**116,272**	**78**	**53,059**	**35.6**	**95,921**	**64.4**

The exposure of buildings to floods, lightning, and windstorms in Nansana Municipality is presented in **Figure 20**.

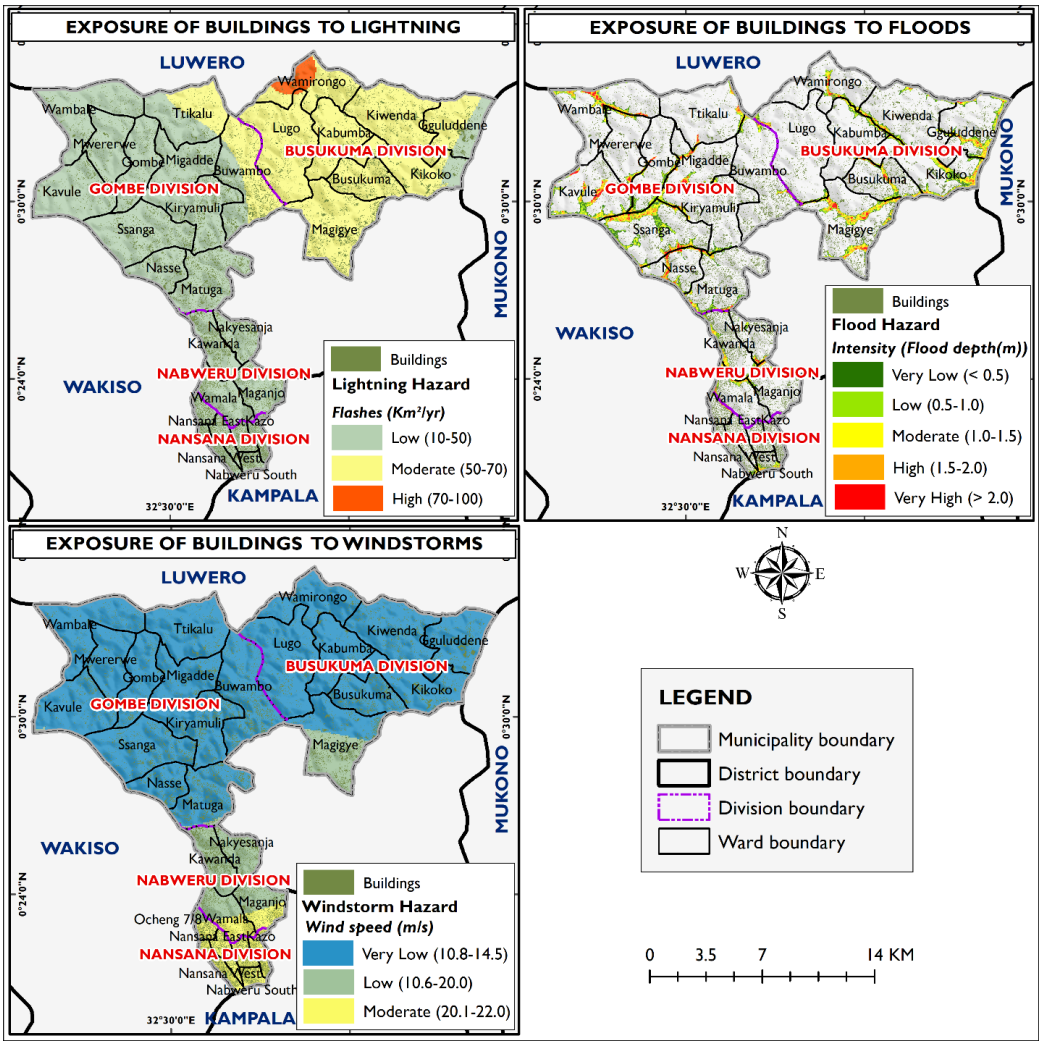


Figure 20: Exposure of buildings to lightning, flood, and windstorm hazards in Nansana Municipality

3.3.6 Exposure of the social development sector to climate hazards

The social development sector element exposed to climate hazards in Nansana Municipality is human population.

The assessment showed that 73,200 people (22%) are exposed to drought hazard in Nansana Municipality whereas 260,059 people (78%) are not exposed to drought hazard (**Table 12**). The biggest proportion of human population exposed to drought hazard is located in Nabweru (56.25%) and Gombe (30.2%) divisions. The wards highly exposed to drought include Maganjo, Ttikalu, Gombe, Migadde, Mwererwe, and Wamirongo (**Figure 21**).

A total of 23,944 people (7.2%) are exposed to floods whereas 309,315 people (92.8%) are not exposed to floods (**Table 12**). Busukuma (9.2%) and Nabweru (9.3%) divisions have the biggest percentage of human population exposed to floods. The wards with the biggest proportion of human population exposed to floods include Nabweru South, Nasse, Magigye, and Kikoko (**Figure 21**).

In Nansana Municipality, 43,988 people (13.2%) are exposed to lightning hazard whereas 289,271 people (86.8%) are not exposed to lightning (**Table 12**). The people exposed to lightning hazard are located in Busukuma (94.7%) and Gombe (10.2%) divisions. The wards with people that are highly exposed to lightning include Magigye, Busukuma, Kikoko, Kiwenda, Kabumba, Lugo, and Wamirongo (**Figure 21**).

The analysis showed that 156,969 people (47.1%) in Nansana Municipality are exposed to windstorm hazard whilst 176,290 people (52.9%) are not exposed to windstorms (**Table 12**). The human population exposed to windstorms is found in Nansana (96.4%) and Nabweru (25.4%) divisions. The wards with the biggest proportion of human population exposed to windstorms include Kazo, Nabweru North, Nabweru South, Nansana East, and Nansana West (**Figure 21**).

Table 12: Human population exposed to drought, floods, lightning, and windstorms in Nansana Municipality

Climate Hazards	Drought				Floods				Lightning				Windstorms			
Divisions	Exposed		Not Exposed		Exposed		Not Exposed		Exposed		Not Exposed		Exposed		Not Exposed	
	Popln	%	Popln	%	Popln	%	Popln	%	Popln	%	Popln	%	Popln	%	Popln	%
Busukuma	2,572	6.8	35,158	93.2	3,489	9.2	34,241	90.8	35,712	94.7	2,018	5.3	0	0	37,730	100
Gombe	24,552	30.2	56,758	69.8	5,526	6.8	75,784	93.2	8,275	10.2	73,035	89.8	0	0	81,310	100
Nabweru	39,209	56.2	30,520	43.8	6,489	9.3	63,240	90.7	0	0.0	69,729	100	17,718	25.4	52,011	74.6
Nansana	6,866	4.8	137,624	95.2	8,440	5.8	136,050	94.2	0	0.0	144,490	100	139,251	96.4	5,239	3.6
Total	**73,200**	**22.0**	**260,059**	**78.0**	**23,944**	**7.2**	**309,315**	**92.8**	**43,988**	**13.2**	**289,271**	**86.8**	**156,969**	**47.1**	**176,290**	**52.9**

Figure 21 shows the percentage of human population exposed to drought, floods, lightning, and windstorm hazards in Nansana Municipality.

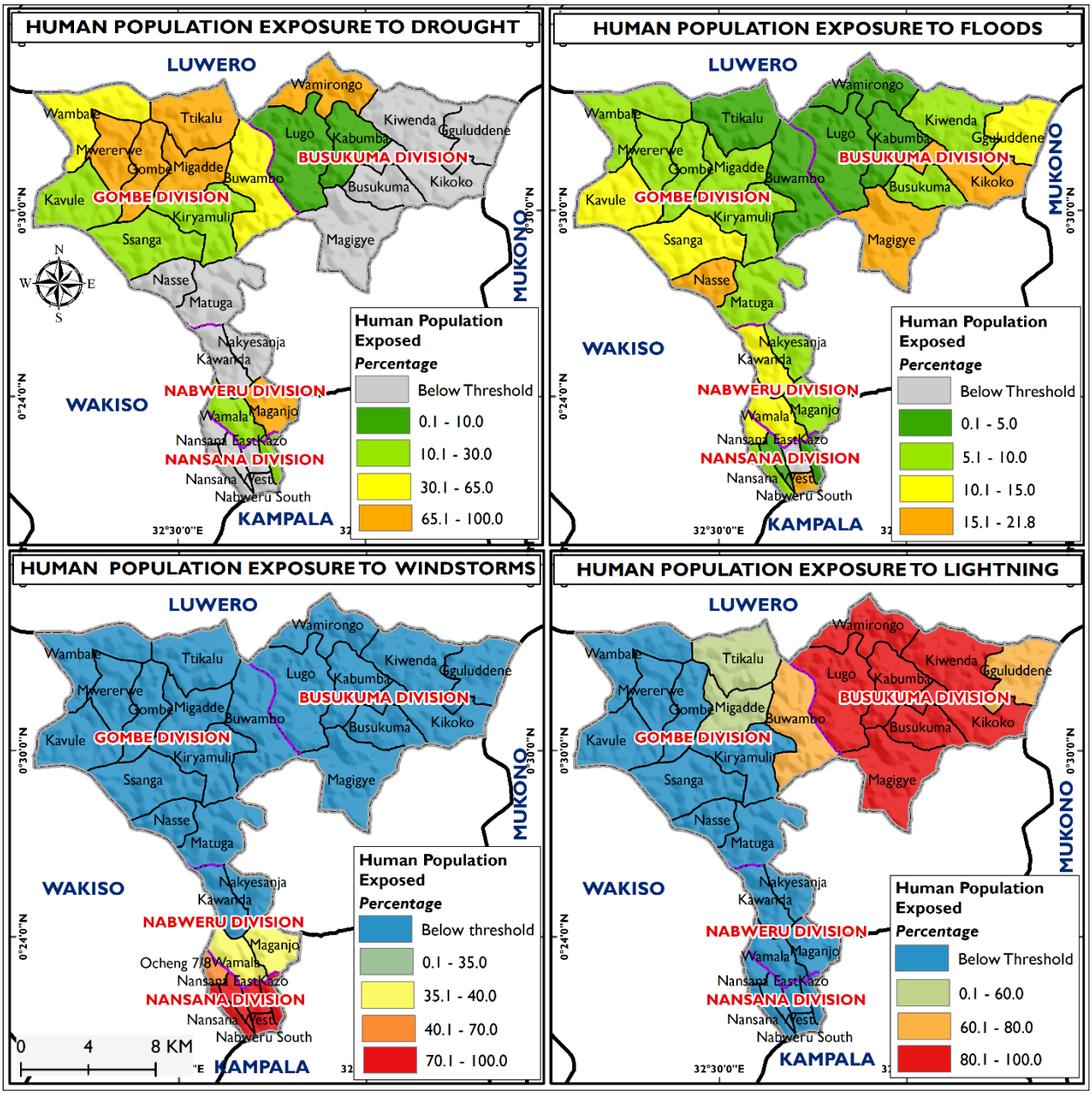


Figure 21: Human population exposure to drought, floods, lightning, and windstorms in Nansana Municipality

All the people (100%) in Nansana Municipality are exposed to hailstorm hazard. The wards with the biggest population exposed to hailstorms include Maganjo, Kazo, Matugga, Nansana East, Nansana West, Nabweru North, Nabweru South, and Ochieng (**Figure 22**).

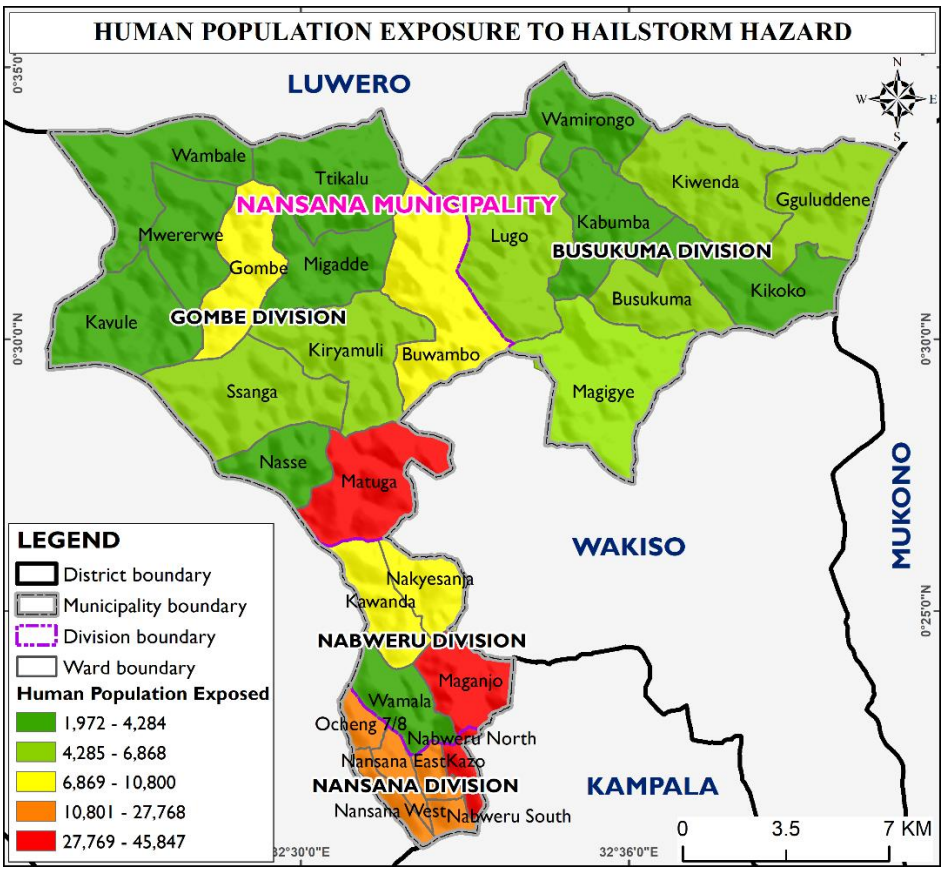


Figure 22: Human population exposed to hailstorm hazard in Nansana Municipality

3.3.7 Exposure of the transportation sector to floods

The transportation sector element exposed to floods in Nansana Municipality is roads.

The assessment showed that 14.4 kilometers (3%) of roads in Nansana Municipality are exposed to floods whereas 461.5 kilometers (97%) of roads are not exposed to this hazard (**Table 13**). Nabweru (3.9%) and Busukuma (3.0%) divisions have the biggest proportion of roads exposed to floods in Nansana Municipality. Some of the road sections that are highly exposed to floods include Bukemba-Nabutiiti road in Magigye ward; Kabumba-Busukuma road in Busukuma ward; Kakoligo road in Matugga and Kawanda wards; Kasana-Guludene-Balita road in Kiwenda and Gguluddene wards; Kiryagonja-Nasse-Ssanga road in Nasse and Ssanga wards; Serunjogi road in Wamala ward; Wabitembe road in Nakyesanja ward; and Nakiduduma-Mabanda road in Matugga ward among others.

Table 13: Exposure of roads to floods in Nansana Municipality

Division	Exposed		Not Exposed		Total	
	Length (Km)	%	Length (Km)	%	Length (Km)	%
Busukuma	3.0	3.0	96.6	97.0	99.6	20.9
Gombe	7.8	2.9	257.4	97.1	265.2	55.7
Nabweru	2.6	3.9	62.9	96.1	65.4	13.7
Nansana	1.0	2.3	44.6	97.7	45.7	9.6

Total	**14.4**	**3.0**	**461.5**	**97.0**	**475.9**	**100**

The exposure of roads to floods in Nansana Municipality is shown in **Figure 23**.

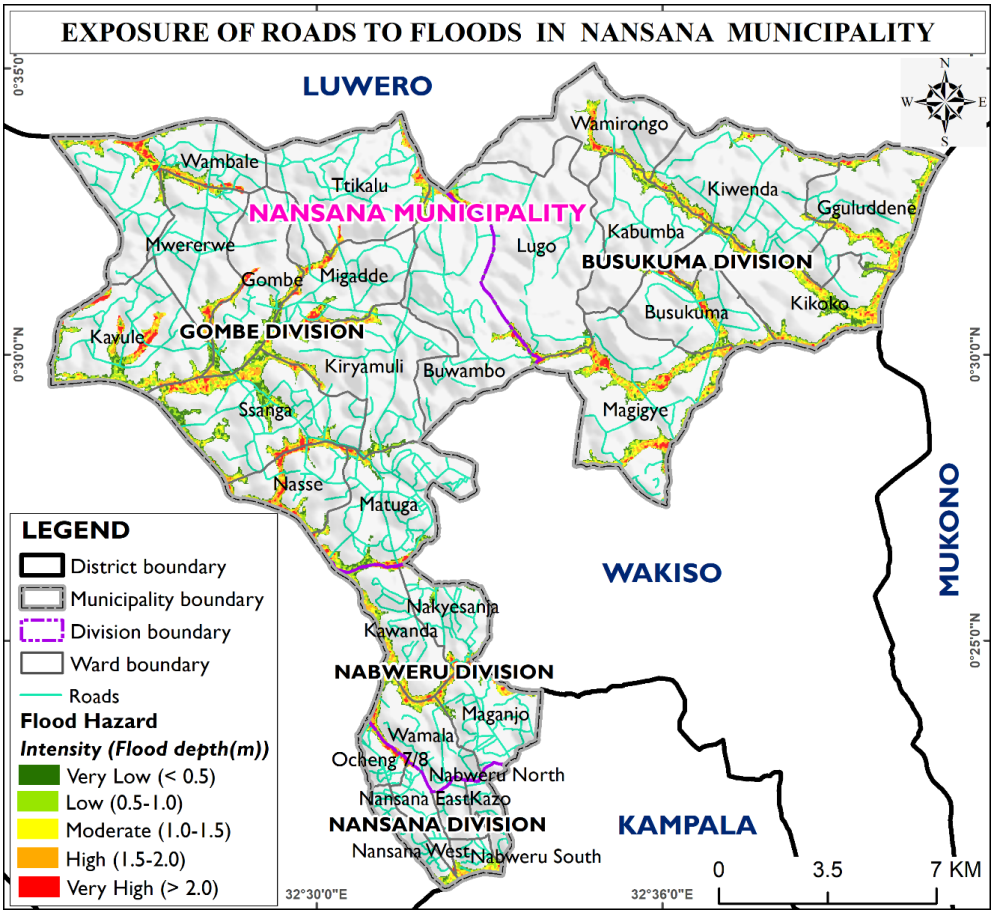


Figure 23: Exposure of roads to flood hazard in Nansana Municipality

3.3.8 Exposure of the water and environment sector to climate hazards

The water and environment sector elements exposed to climate hazards in Nansana Municipality include forests, wetlands, and water sources.

3.3.8.1 Exposure of forests to drought and flood hazards

The assessment showed that 2.8 sq.km (27.3%) of forests are exposed to drought whereas 7.4 sq.km (72.7%) of forests are not exposed to drought hazard (**Table 14**). The biggest percentage of forests exposed to drought hazard in Nansana Municipality is located in Gombe (52.1%) and Busukuma (9.8%) divisions.

A total of 0.7 sq.km (7.1%) of forests are exposed to floods while 9.5 sq.km (92.9%) of forests are not exposed to flood hazard (**Table 14**). The biggest proportion of forests exposed to floods is located in Nabweru (32.5%) and Gombe (9.1%) divisions.

Table 14: Exposure of forests to drought and floods in Nansana Municipality

Climate Hazards	Drought				Floods			
Division	Exposed		Not Exposed		Exposed		Not Exposed	
	Area (Km²)	%	Area (Km²)	%	Area (Km²)	%	Area (Km²)	%
Busukuma	0.6	9.8	5.4	90.2	0.3	5.5	5.6	94.5
Gombe	2.2	52.1	2.0	47.9	0.4	9.1	3.9	90.9
Nabweru	0.0004	1.4	0.03	98.6	0.01	32.5	0.02	67.5
Nansana	0.0	0.0	0.0001	100	0.0	0.0	0.0001	100
Total	**2.8**	**27.3**	**7.4**	**72.7**	**0.7**	**7.1**	**9.5**	**92.9**

The exposure of forests to drought and flood hazards in Nansana Municipality is shown in **Figure 24**.

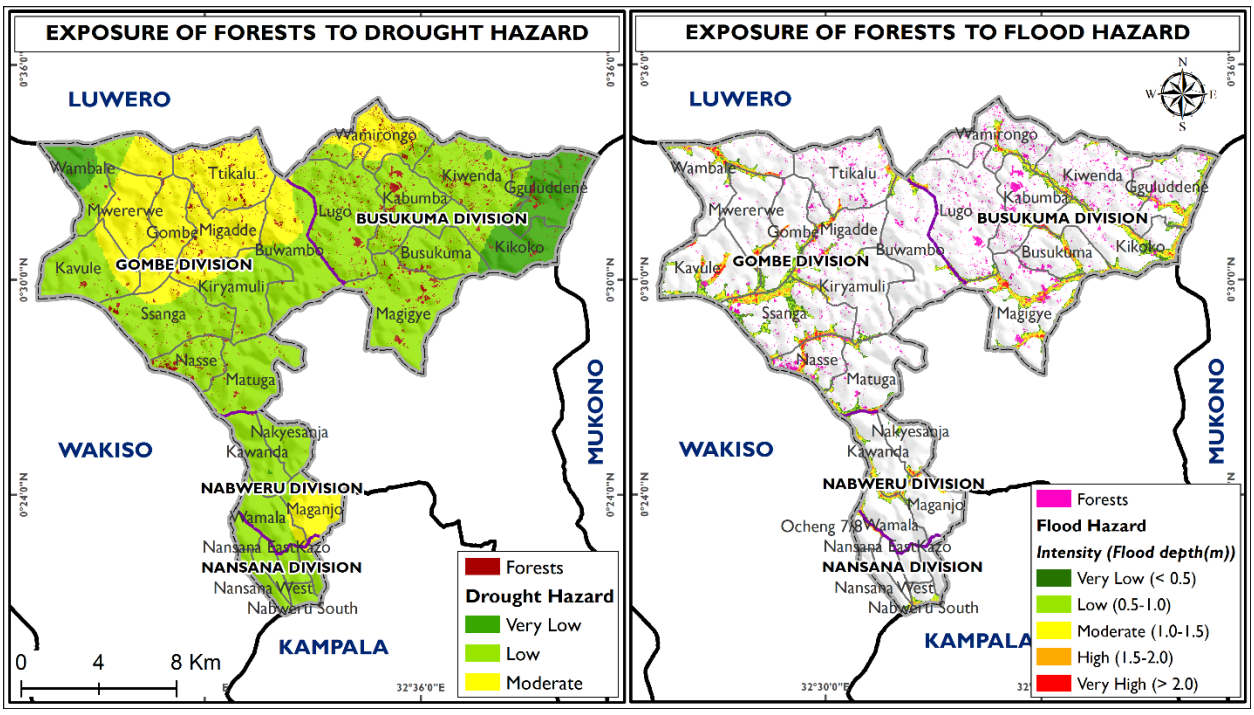


Figure 24: Exposure of forests to drought and flood hazards in Nansana Municipality

3.3.8.2 Exposure of wetlands to drought and flood hazards

The analysis showed that 15.5 sq.km (25.8%) of wetlands are exposed to drought whereas 44.7 sq.km (74.2%) of wetlands are not exposed to drought hazard (**Table 15**). The biggest percentage of wetlands exposed to drought hazard in Nansana Municipality is located in Gombe (44.9%) and Nabweru (21.6%) divisions.

A total of 18.7 sq.km (30.6%) of wetlands are exposed to floods while 42.5 sq.km (69.4%) of wetlands are not exposed to flood hazard (**Table 15**). The biggest proportion of wetlands exposed to floods is located in Busukuma (34.0%) and Nabweru (35.4%) divisions.

Table 15: Exposure of wetlands to drought and floods in Nansana Municipality

Climate Hazards	Drought	Floods

Division	Exposed		Not Exposed		Exposed		Not Exposed	
	Area (Km²)	%	Area (Km²)	%	Area (Km²)	%	Area (Km²)	%
Busukuma	1.5	6.3	22.8	93.7	8.4	34.0	16.3	66.0
Gombe	12.7	44.9	15.7	55.1	7.8	27.1	21.0	72.9
Nabweru	1.2	21.6	4.5	78.4	2.1	35.4	3.8	64.6
Nansana	0.0	0.0	1.8	100.0	0.5	24.3	1.4	75.7
Total	**15.5**	**25.8**	**44.7**	**74.2**	**18.7**	**30.6**	**42.5**	**69.4**

The exposure of wetlands to drought and flood hazards in Nansana Municipality is shown in **Figure 25**.

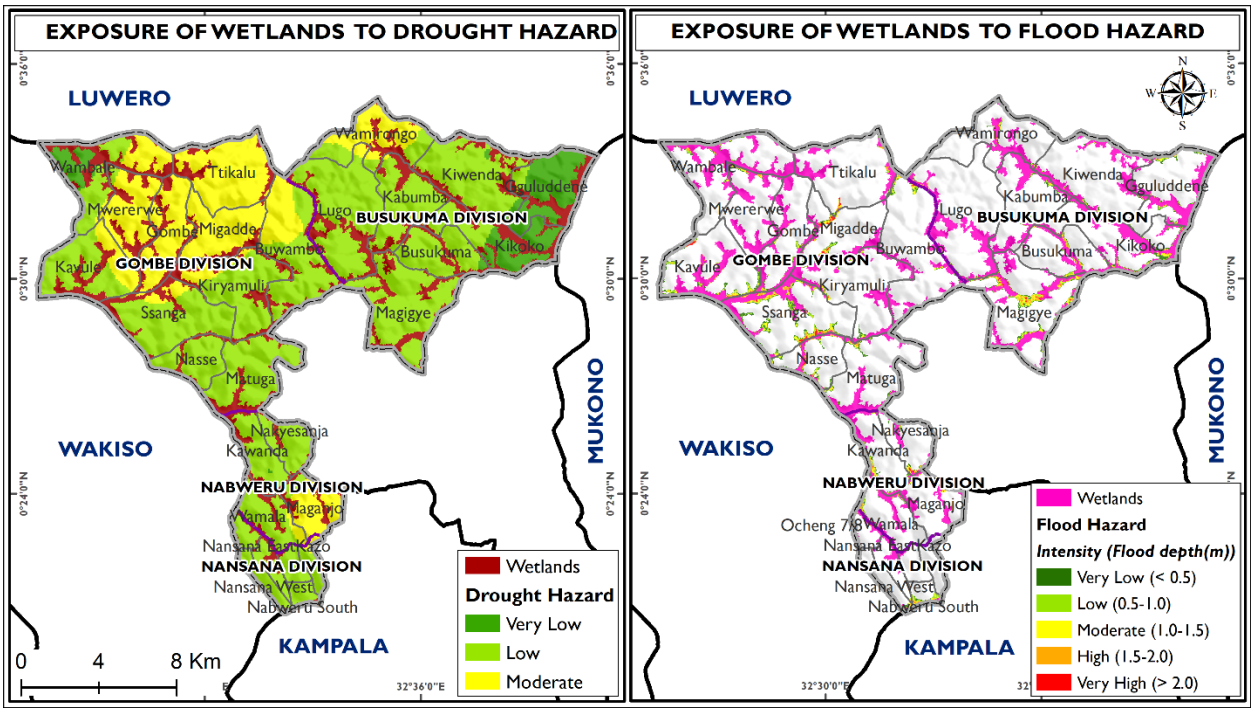


Figure 25: Exposure of wetlands to drought and flood hazards in Nansana Municipality

3.3.8.3 Exposure of water sources to drought and flood hazards

The assessment showed that 253 water sources (37.2%) are exposed to drought hazard in Nansana Municipality (**Table 16**). Nabweru (59.8%) and Gombe (40.1%) divisions have the biggest proportion of water sources exposed to drought hazard.

A total of 20 water sources (2.9%) are exposed to floods whereas 663 water sources (97.1%) are not exposed to flood hazard (**Table 16**). The biggest percentage of water sources exposed to floods in Nansana Municipality is located in Gombe (5.3%) and Nabweru (2.1%) divisions.

Table 16: Exposure of water sources to drought and floods in Nansana Municipality

Climate Hazard	Drought				Floods			
Divisions	Exposed		Not Exposed		Exposed		Not Exposed	
	Number	%	Number	%	Number	%	Number	%

Busukuma	10	5.2	182	94.8	2	1.0	192	99.0
Gombe	99	40.1	148	59.9	13	5.3	234	94.7
Nabweru	143	59.8	96	40.2	5	2.1	234	97.9
Nansana	1	33.3	2	66.7	0	0.0	3	100
Total	**253**	**37.2**	**428**	**62.8**	**20**	**2.9**	**663**	**97.1**

In terms of exposure by water source type; dam (100%), yard taps for public use (53.9%), rainwater harvest tanks (35.3%), shallow wells (31.8%), and protected springs (26.7%) have the biggest percentages exposed to drought hazard in Nansana Municipality (**Table 17**). On the other hand, protected springs (8.2%), and shallow wells (4.9%) have the biggest proportional exposure to floods in Nansana Municipality (**Table 17**).

Table 17: Exposure of the different types of water sources to drought and floods in Nansana Municipality

Climate Hazard	**Drought**				**Floods**			
Types of water sources	Exposed		Not Exposed		Exposed		Not Exposed	
	Number	%	Number	%	Number	%	Number	%
Dam	1	100.0	0	0.0	0	0.0	1	100
Deep borehole	15	24.2	47	75.8	1	1.6	61	98.4
Protected spring	16	26.7	44	73.3	5	8.2	56	91.8
Public Stand Post	0	0.0	2	100.0	0	0.0	2	100
Rainwater Harvest Tank	47	35.3	86	64.7	2	1.5	131	98.5
Shallow well	78	31.8	167	68.2	12	4.9	234	95.1
Yard tap for public use	96	53.9	82	46.1	0	0.0	178	100
Total	**253**	**37.2**	**428**	**62.8**	**20**	**2.9**	**663**	**97.1**

The exposure of water sources to drought and floods is presented in **Figure 26**.

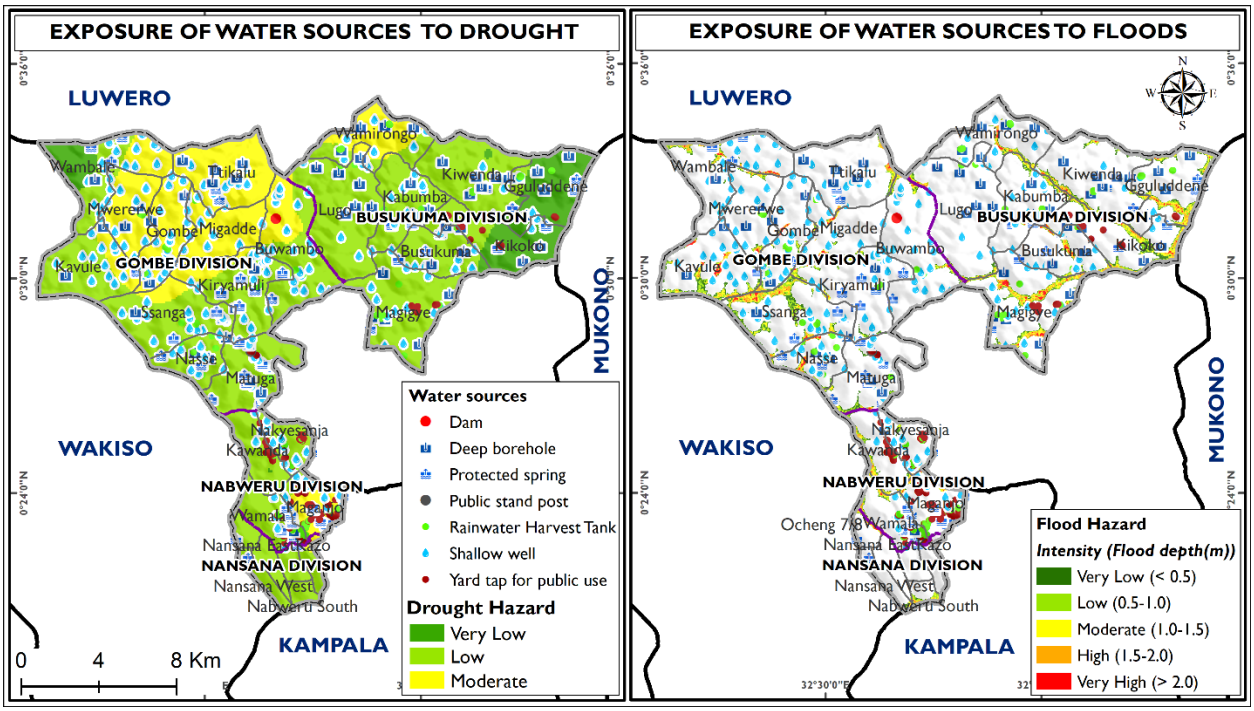


Figure 26: Exposure of water sources to drought and floods in Nansana Municipality

3.4 Vulnerability Assessment

This section presents the exposure, sensitivity, adaptive capacity, and risk of communities to multi-hazards in Nansana Municipality.

3.4.1 Exposure of communities to multi-hazards

Exposure refers to the extent to which a system is exposed to climate change-related hazards. Nansana Municipality is mostly exposed to drought, floods, hailstorms, lightning, and windstorms. These hazards were ranked, weighed and normalized to produce the exposure index. The assessment showed that the wards that have a high level of exposure (more than 80 percent) to drought, floods, hailstorms, lightning, and windstorms in Nansana Municipality include Magigye, Wamirongo, Ttikalu, Maganjo, Wamala, Nansana West, Nabweru South, Migadde, and Busukuma (**Figure 27**).

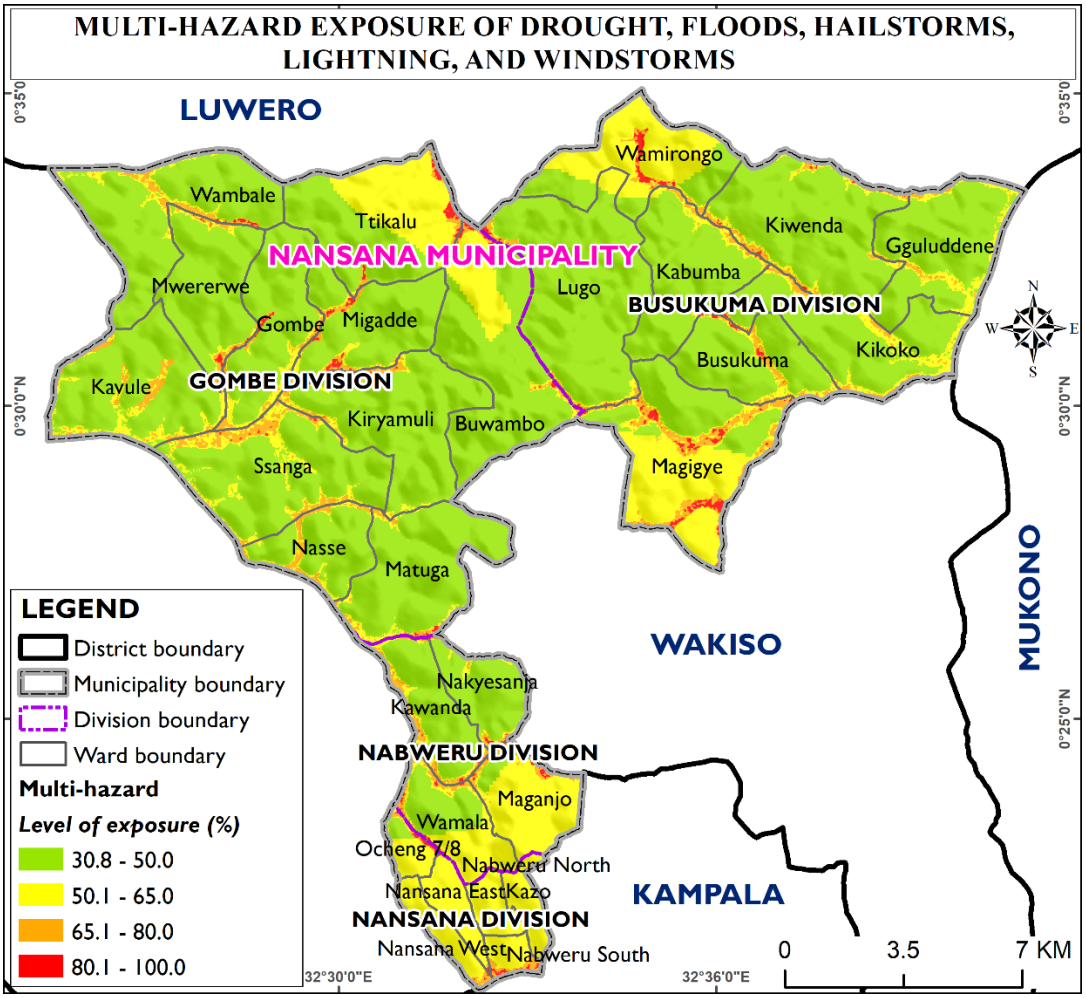


Figure 27: Multi-hazard exposure of communities to drought, floods, hailstorms, lightning, and windstorms in Nansana Municipality

3.4.2 Sensitivity of communities to multi-hazards

Sensitivity describes the socio-economic or demographic characteristics that can make people susceptible to the negative effects of exposure (Declet-Barreto et al., 2020). The sensitivity indicators that were assessed at ward level are presented in **Table 18**.

Table 18: Sensitivity indicators to multi-hazards in Nansana Municipality

No	Sensitivity indicators	Description	Data source	Hotspot wards
1.	Access to health services	Access to health services reflects a community's ability to prevent, respond to, and recover from climate-related health impacts such as heat stress, disease outbreaks, and injuries from extreme weather.	Key Informant Interviews, 2025	Kabumba, Kikoko, Wamirongo, Mwererwe, Ssanga, and Wambale
2.	Community awareness and preparedness	Community awareness and preparedness reflects how well individuals and groups understand climate risks and their capacity to take timely action.	Key Informant Interviews, 2025	Moderate in the entire municipality

No	Sensitivity indicators	Description	Data source	Hotspot wards
3.	Degradation of rivers	Degradation of rivers signifies the reduced ability of freshwater ecosystems to absorb and adapt to climate impacts, thereby increasing the vulnerability of communities that rely on these rivers for water, food, and livelihoods.	Key Informant Interviews, 2025	Magigye, Ssanga, Maganjo, Kiwenda, and Lugo
4.	Dependency on climate-sensitive sectors e.g., agriculture	Dependency on climate-sensitive sectors highlights how heavily communities rely on industries like agriculture, fisheries, and tourism, which are directly affected by climate variability, making them more vulnerable to disruptions caused by extreme weather events, changing temperatures, and shifting ecosystems.	Key Informant Interviews, 2025	Magigye, Ssanga, Lugo, Wamirongo, Wambale, Mwererwe, Kavule, Kiryamuli, Gombe, and Ttikalu
5.	Dependence on surface water	Dependency on surface water reveals how reliant communities are on rivers, wetlands, and reservoirs that are highly vulnerable to changing climate, increasing their risk of water scarcity and reduced water quality under climate stress.	Key Informant Interviews, 2025	Wamirongo, Kikoko, and Ocheng 7/8
6.	Drainage systems	The design and capacity of drainage systems determine how well a community can manage increased rainfall, flooding, and storm surges, with inadequate or poorly maintained systems heightening vulnerability to climate-induced water-related hazards.	Key Informant Interviews, 2025	Kiwenda, Busukuma, Ocheng 7/8, Lugo, Kabumba, Nansana East, Nansana West, and Maganjo
7.	Housing quality	Housing quality reflects how well homes can protect occupants from climate-related hazards like floods, with poor-quality housing increasing the risk of damage, displacement, and health impacts during climate shocks.	Key Informant Interviews, 2025	Ocheng 7/8, Wamirongo, Kikoko, Nabweru North, and Nabweru South
8.	Income levels	Income levels influence a community's ability to prepare for, respond to, and recover from climate impacts, with lower-income populations often lacking the resources needed for adaptation, making them more vulnerable to climate-related risks.	UBOS, 2021	Wamirongo, Kabumba, Gguluddene, Wambale, Mwererwe, Kavule, Gombe, Ttikalu, Nasse, and Migadde
9.	Population density	High-density areas can amplify the impacts of climate hazards such as heatwaves, and disease spread while straining infrastructure and emergency response systems, increasing overall community vulnerability.	UBOS, 2024	Nabweru North, Nabweru South, Nansana West, Kazo, Ocheng 7/8, Maganjo, Matugga, and Nansana East

No	Sensitivity indicators	Description	Data source	Hotspot wards
10.	Unemployment	Unemployment reflects limited economic resilience and reduced access to resources, making individuals and communities less able to adapt to or recover from climate-related events such as floods	Key Informant Interviews, 2025	Nabweru North, Nabweru South, Nansana West, Kazo, Ocheng 7/8, Matugga, Ssanga, Buwambo, Ttikalu, Nasse, and Kiryamuli
11.	Wetland degradation	Wetland degradation weakens the natural buffers that wetlands provide against climate impacts like flooding, storm surges, and droughts, reducing ecosystem resilience and increasing the vulnerability of both human and ecological communities that depend on them.	WMD, 2021	Nabweru North, Ocheng 7/8, Ttikalu, Kiryamuli, Nansana East, Gombe, Kiwenda, Busukuma, Wamirongo, Kabumba, Wambale, Mwererwe, Migadde, Lugo, Matugga, Buwambo, Maganjo, Magigye, Nakyesanja, Kikoko, and Wamala

The wards that have a high sensitivity to multi-hazards (i.e., drought, floods, hailstorms, lightning, and windstorms) include Lugo, Magigye, Busukuma, Kiwenda, Nakyesanja, Maganjo, Wamala, Nansana North, and Nansana East.

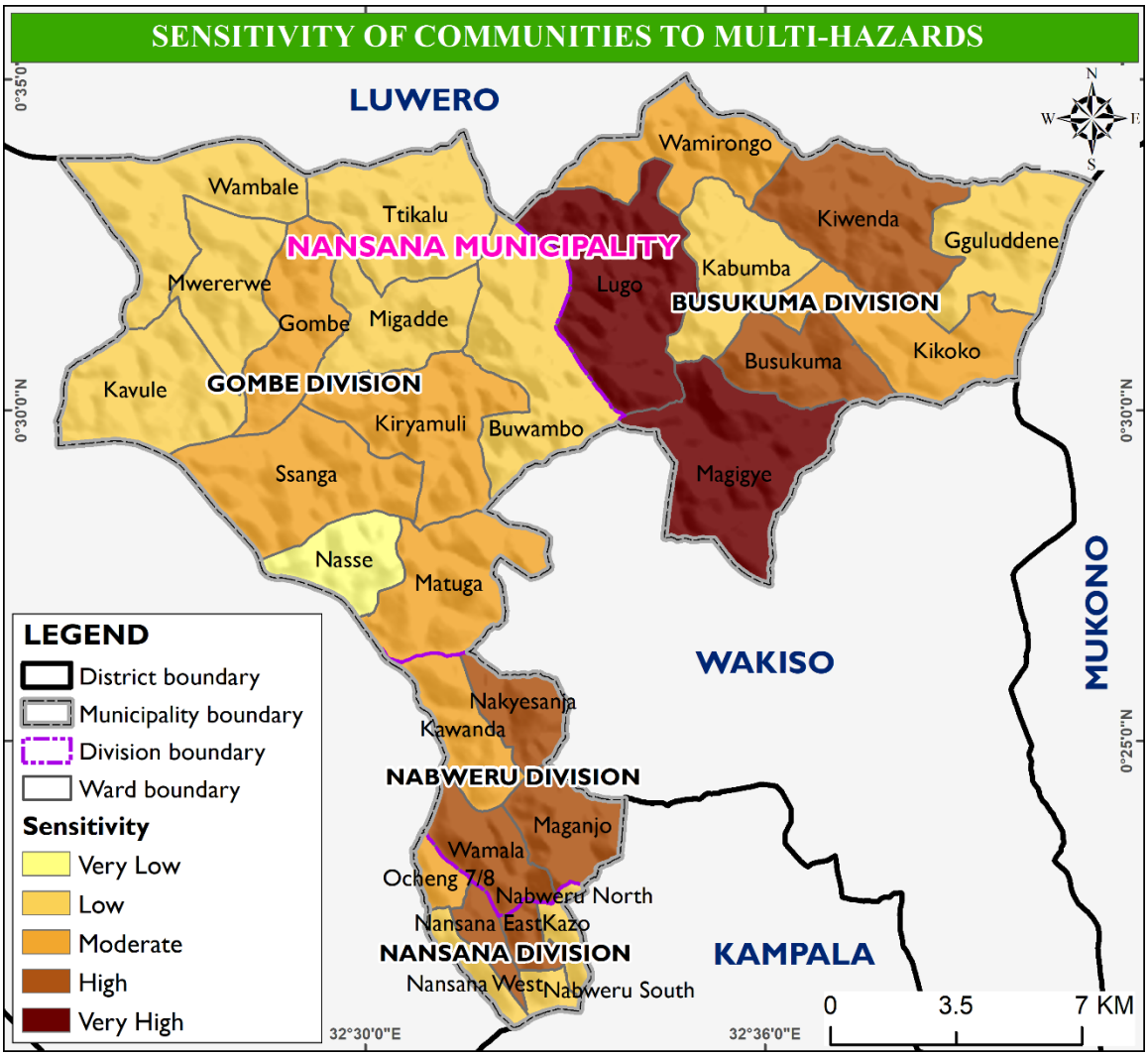


Figure 28: Sensitivity of communities to multi-hazards in Nansana Municipality

3.4.3 Adaptive capacity of communities to multi-hazards

Adaptive capacity is defined as the ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences of climate change (IPCC, 2023). The adaptive capacity indicators that were assessed at the ward level are shown in **Table 19**.

Table 19: Adaptive capacity indicators to multi-hazards in Nansana Municipality

No	Adaptive capacity indicators	Description	Data source	Hotspot wards
1.	Access to clean water and sanitation	Access to clean water and sanitation ensures that communities can maintain good health and hygiene, reducing the risk of waterborne diseases during extreme weather events, and	Key Informant Interviews, 2025	Nabweru North, Nabweru South, Ocheng 7/8, Gguluddene, Kabumba, Lugo, Wamirongo, and Matugga

No	Adaptive capacity indicators	Description	Data source	Hotspot wards
		enabling better resilience to climate-induced health challenges.		
2.	Access to credit	Access to credit allows individuals and communities to invest in resilience-building measures, such as climate-smart agriculture, infrastructure improvements, or emergency preparedness, providing the financial resources needed to recover and adapt to climate-related disruptions.	Key Informant Interviews, 2025	Gguluddene, Kabumba, and Wamirongo
3.	Access to early warning information	Access to early warning information enables communities to prepare for and respond effectively to climate-related hazards, such as storms, floods, or heatwaves, by providing timely alerts and guidance that help reduce risks, protect lives, and minimize damage.	Key Informant Interviews, 2025	Ocheng 7/8, Nansana East, Nansana West, Gguluddene, Wamirongo, Nabweru North, Nabweru South, Lugo, Matugga, Kazo, Kikoko, Gombe, Kavule, Kiryamuli, Migadde, Mwererwe, Nasse, Ssanga, Ttikalu, Wambale, and Buwambo
4.	Access to renewable energy e.g., solar	Access to renewable energy provides communities with a sustainable and reliable energy source, reducing dependence on fossil fuels, minimizing greenhouse gas emissions, and enhancing resilience by ensuring energy availability during climate-related disruptions like storms or power outages.	Key Informant Interviews, 2025	Ocheng 7/8, Gguluddene, Wamirongo, Lugo, Matugga, Kikoko, Gombe, Kavule, Kiryamuli, Migadde, Mwererwe, Nasse, Ssanga, Ttikalu, Wambale, Buwambo, Kabumba, Busukuma, Kiwenda, Kawanda, and Maganjo
5.	Awareness of climate risks and adaptation practices	Awareness of climate risks and adaptation practices reflects how well individuals and communities understand climate-related challenges and the actions they can take to mitigate risks, enabling them to make informed decisions and implement strategies that enhance resilience to changing climate conditions.	Key Informant Interviews, 2025	Gguluddene, Wamirongo, Lugo, Kikoko, Kabumba, Busukuma, Kiwenda, and Magigye
6.	Diverse livelihood options	Diverse livelihood options provide communities with multiple sources of income and resources, allowing them to better withstand climate shocks, and adapt by shifting to more resilient economic activities when needed.	Key Informant Interviews, 2025	Lugo, Ocheng 7/8, Wambale, Nabweru North, Nabweru South, Kazo, and Nakyesanja
7.	Education levels	Higher levels of education enable individuals and communities to better understand climate risks,	Key Informant Interviews, 2025	Nabweru North, Nabweru South, Kazo,

No	Adaptive capacity indicators	Description	Data source	Hotspot wards
		access information, and adopt effective adaptation strategies, thereby enhancing their ability to respond to and recover from climate-related challenges.		Gguluddene, Wamirongo, and Busukuma
8.	Extension services	Extension services provide farmers, communities, and local businesses with essential knowledge, skills, and resources to adopt climate-resilient practices, improve productivity, and enhance the ability to cope with changing climate conditions.	Key Informant Interviews, 2025	Wamirongo, Gguluddene, Busukuma, and Ocheng 7/8
9.	Good environmental management practices	Good environmental management practices promote sustainable resource use, reduce environmental degradation, and enhance ecosystem resilience, enabling communities to better withstand and adapt to climate impacts.	Key Informant Interviews, 2025	Nabweru South, Ocheng 7/8, Nabweru North, Kazo, Nansana East, Nansana West, Kawanda, and Maganjo
10.	Healthcare infrastructure	Robust and well-maintained healthcare systems improve a community's ability to respond to climate-related health challenges, such as heatwaves, disease outbreaks, and extreme weather events, by providing timely medical care, disease prevention, and emergency services.	Key Informant Interviews, 2025	Nabweru South, Ocheng 7/8, Kazo, Nabweru North, Nansana East, Nansana West, Wamirongo, Gguluddene, Kikoko, Wambale, Mwererwe, Nasse, Kavule, Kiryamuli, Ssanga
11.	Proper waste disposal	Proper waste disposal helps prevent environmental degradation, reduces the risk of disease outbreaks, and ensures cleaner, healthier living conditions, enabling communities to better withstand the health and environmental impacts of climate change, such as flooding	Key Informant Interviews, 2025	Ssanga, Nabweru South, Ocheng 7/8, Kazo, Nabweru North, Nansana East, Nansana West, Wamirongo, Gguluddene, Kikoko, Kavule, Nakyesanja, Kabumba, Wamala, Matugga, Migadde, and Buwambo
12.	Rainwater harvesting	Rainwater harvesting provides an alternative and supplemental water source, reducing dependence on traditional sources such as rivers especially during the dry season.	Key Informant Interviews, 2025	Ocheng 7/8, Wamirongo, Nabweru South, Nabweru North, Nansana East, Nansana West, Gguluddene, Kikoko, Kabumba, and Lugo
13.	Social networks	Strong, connected communities are better able to share resources, information, and support during climate events, helping individuals and groups recover more quickly and effectively from climate impacts	Key Informant Interviews, 2025	Ocheng 7/8, Wamirongo, Gguluddene, Kikoko, Kabumba, and Kiwenda

No	Adaptive capacity indicators	Description	Data source	Hotspot wards
14.	Urban greening initiatives	Urban greening initiatives enhance cities' resilience by increasing green spaces, improving air quality, reducing heat island effects, and providing natural buffers against extreme weather, all of which help communities better cope with climate-related challenges.	Key Informant Interviews, 2025	Kazo, Matugga, Ocheng 7/8, Wamirongo, Gguluddene, Kikoko, Kabumba, Kiwenda, Nabweru South, Nabweru North, Nansana East, Nansana West, Lugo, Busukuma, Magigye, Ssanga, and Nasse
15.	Wetland and ecosystem restoration	Wetland and ecosystem restoration enhances the natural ability of wetlands to absorb climate impacts such as flooding, while supporting biodiversity, improving water quality, and strengthening the resilience of communities that rely on these ecosystems.	Key Informant Interviews, 2025	Kazo, Ocheng 7/8, Nabweru South, Nabweru North, Nansana East, Nansana West, Matugga, Wamirongo, Gguluddene, Kikoko, Kabumba, Kiwenda, Lugo, Busukuma, Magigye, Ssanga, Maganjo, Nakyesanja, Wamala, and Kawanda

The wards that have a very high adaptive capacity to multi-hazards (i.e., drought, floods, hailstorms, lightning, and windstorms) include Gombe, Buwambo, Kawanda, and Maganjo (**Figure 24**). On the other hand, Ocheng 7/8, Nansana East, Kazo, Nabweru South, Wamirongo, and Gguluddene have a very low adaptive capacity to multi-hazards.

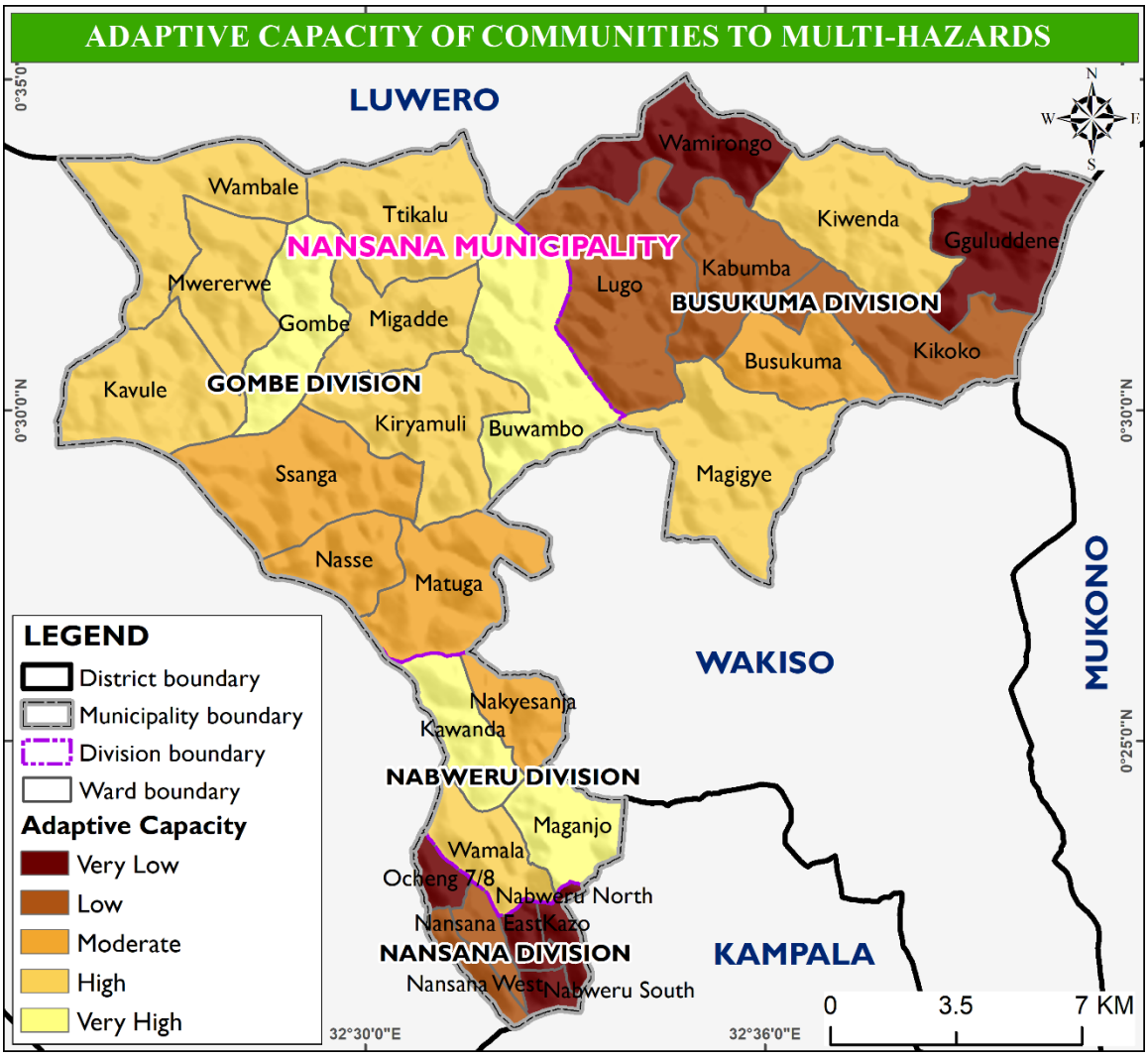


Figure 29: Adaptive capacity of communities to multi-hazards in Nansana Municipality

3.4.4 Vulnerability of communities to multi-hazards

The communities that are highly vulnerable to multi-hazards (i.e., drought, floods, hailstorms, lightning, and windstorms) in Nansana Municipality are found in Nabweru South, Kazo, Nabweru East, Wamirongo, Lugo, Ocheng 7/8, and Magigye (**Figure 30**).

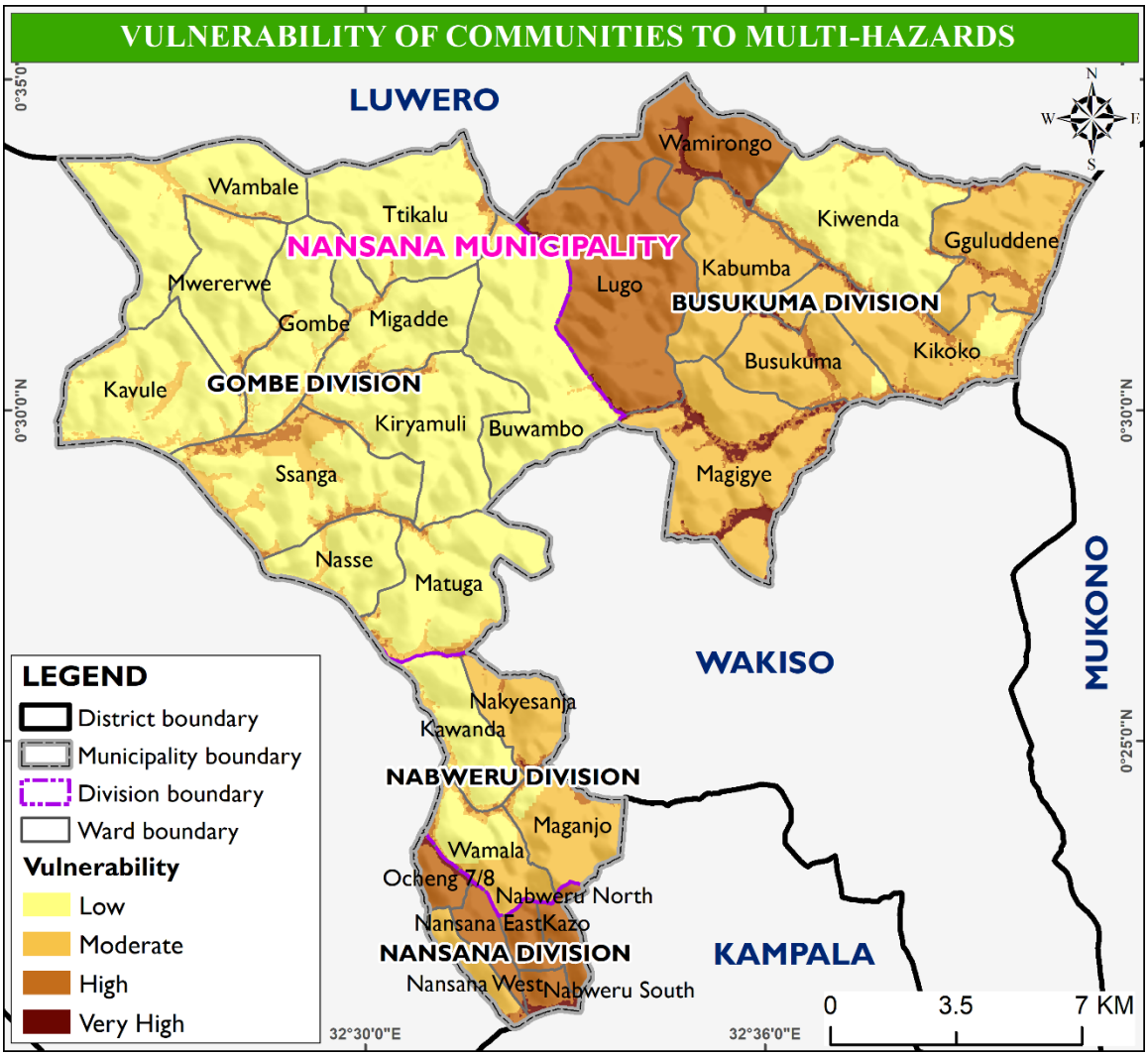


Figure 30: Vulnerability of communities to multi-hazards in Nansana Municipality

3.4.5 Risk of communities to multi-hazards

The communities that are at high risk of multi-hazards (i.e., drought, floods, hailstorms, lightning, and windstorms) in Nansana Municipality are found in Maganjo, Nansana East, Nansana West, Nabweru North, Nabweru South, Kazo, and Ocheng 7/8 (**Figure 31**).

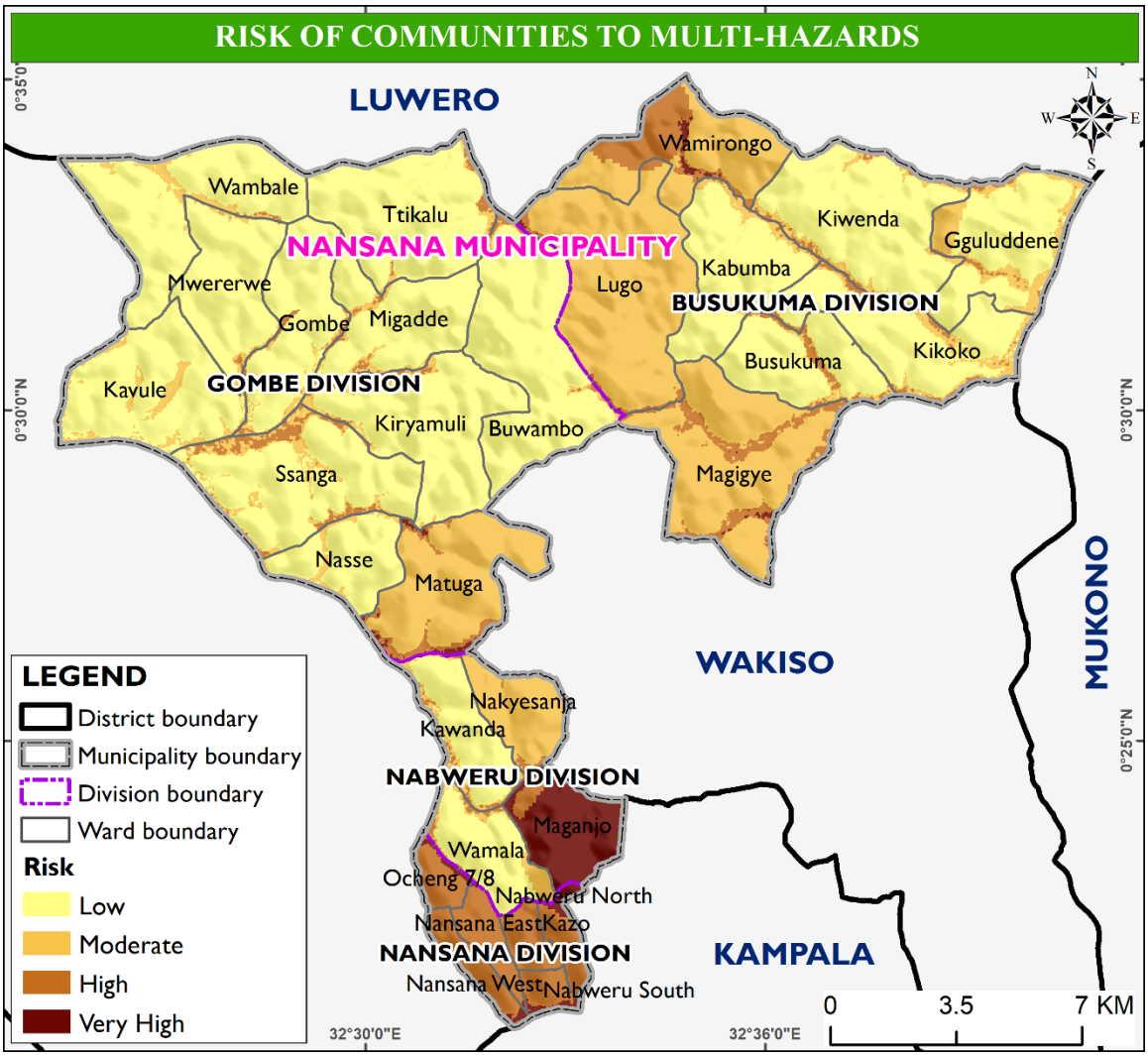


Figure 31: Risk of communities to multi-hazards in Nansana Municipality

3.5 Impacts of climate change on the different sectors

Climate change has significantly impacted the agriculture, education, energy, health, land and housing, manufacturing, social development, trade, transportation, water and environment, and waste management sectors of Nansana Municipality (**Table 20**).

Table 20: Impacts of climate change by sector in Nansana Municipality

Sectors	Impacts of climate change by sector
Agriculture	• Reduced crop yield • Reduced livestock productivity • Destruction of croplands • Increased prevalence of pests, parasites, and diseases • Reduced quality of forage available to grazing livestock
Education	• Damage to school buildings, rendering them unsafe or unusable • Displacement disrupts children's education and causes psychosocial stress • Disruption of academic calendars, leading to increased absenteeism and dropout rates

Sectors	Impacts of climate change by sector
Energy	• Power shortages due to reduced hydropower generation in hydroelectric plants • Damage to energy infrastructure • Higher energy consumption, especially for cooling
Health	• Increased prevalence of malaria • Reduced water quality and sanitation leads to outbreak of waterborne diseases such as typhoid • Food insecurity contributes to higher rates of malnutrition, particularly among children, pregnant women, and individuals with compromised immune systems
Land and housing	• Damage to homesteads • Displacement of communities • Loss of lives • Land degradation through increased soil erosion
Manufacturing	• Reduced agricultural outputs affect the availability of raw materials for manufacturing processes • Damage to the manufacturing facilities and related infrastructure such as factories, warehouses, and transportation networks • Power shortages affect manufacturing operations and increases reliance on alternative, often more expensive energy sources
Social development	• Displacement of communities • Destruction of school and health facilities infrastructure • Loss of lives • Changing climate patterns contribute to the spread of diseases, such as malaria and waterborne illnesses, due to increased temperatures and flooding
Trade	• Reduced export of key commodities such as coffee, tea, and cocoa • Damage to infrastructure such as roads and bridges disrupts supply chains, increases transportation costs, and hampers the timely delivery of goods to both domestic and international markets • Exporters face challenges meeting stringent environmental and sustainability standards imposed by trading partners, potentially limiting market access for non-compliant products
Transportation	• Erosion and degradation of roads, bridges, and culverts • Flooded or damaged roads hinder the movement of goods and people, affecting trade and access to essential services • Transport disruptions increase the cost of goods and services due to delays and the need for alternative, often longer, routes • Damaged infrastructure and congestion lead to longer travel times and increased fuel consumption, contributing to higher greenhouse gas emissions
Water and environment	• Degradation of ecosystems such as wetlands, and forests • Habitat loss and a decline in biodiversity • Reduced availability of water resources • Deterioration of water quality • Soil degradation through erosion and nutrient depletion
Waste management	• Inadequate waste disposal practices result in solid waste clogging drainage systems, reducing their capacity to channel stormwater effectively • Organic waste decomposition in landfills emits methane, a potent greenhouse gas contributing to global warming • Poor waste management practices, such as open dumping and inadequate landfill operations, increase the emission of greenhouse gases

Sectors	Impacts of climate change by sector
	• Increased use of plastics in agriculture, driven by changing climate, leads to microplastics infiltrating soils, posing risks to ecosystems and human health.

CHAPTER FOUR: RISK REDUCTION MEASURES TO CLIMATE HAZARDS

4.1 Introduction

This chapter provides disaster risk reduction measures that are implemented by communities in Nansana Municipality to cope or mitigate the negative impacts of disasters. The measures are aimed at improving the resilience of communities to disaster impacts and enhance their livelihoods.

Disaster Risk Reduction (DRR) measures are referred to as a combination of activities that mitigate the adverse impacts of natural hazards and increases community resilience by:

I. Identifying and analyzing hazards and threats: Supporting vulnerable communities to understand major hazards they face.
II. Reducing exposure and vulnerabilities: Addressing the conditions that make communities susceptible to those hazards and shocks they have identified.
III. Controlling and treating risks: helping communities address the potential damage and losses caused by the hazards and threats and preventing hazardous events from becoming disasters to the communities.
IV. Enhancing capacities: building capacity of individuals, communities and institutions to reduce risk and build greater resilience.

DRR measures can be broadly classified as those that are policy and planning related (non-structural) and physical measures (structural).

I. Policy and planning measures are implemented at the national and sub-national levels and help to integrate DRR into the policy and institutional frameworks.
II. Physical measures are designed to reduce the exposure and vulnerability of infrastructure to natural hazards (prevention) as well as to provide coping and adaptive infrastructure in case of a disaster event (coping/adaptive).

4.2 Hazard-specific Disaster Risk Reduction Measures

The structural and non-structural disaster risk reduction measures for each climate hazard in Nansana Municipality are highlighted in **Table 21** below.

Table 21: Structural and non-structural DRR measures in Nansana Municipality

No	Hazard	Structural Measures	Non-Structural Measures
1	Drought	1. Plant drought-resistant and quick-maturing crop varieties. 2. Implement small-scale irrigation systems.	1. Sensitize communities about water-saving technologies, water and soil conservation practices, and environmental degradation.

No	Hazard	Structural Measures	Non-Structural Measures
		3. Demarcate wetlands to reduce encroachment. 4. Promote urban greening (tree planting, green corridors) to reduce heat and erosion. 5. Adopt alternative sources of livelihood such as cultural tourism, crafts and apiary 6. Construct community water reservoirs and underground tanks.	2. Implement good environmental management practices 3. Encourage use of drought-tolerant crops 4. Promote rainwater harvesting systems on schools, health centers, and households 5. Encourage farmers to purchase crop insurance.
2	Floods	1. Relocate vulnerable communities to safer areas. 2. Reforest and replant native vegetation in degraded wetland areas. 3. Limit or restrict development in floodplains. 4. Construct large drainage channels especially in flood-prone areas. 5. Desilt and expand existing drainage channels. 6. Promote raised foundations and water-resistant building materials 7. Develop, design and implement urban settlement plans. 8. Implement community-led solid waste management to prevent drain blockages	1. Develop and implement an ordinance on River bank management to regulate human activities along river banks. 2. Sensitize communities about flood risk and safety as well as sustainable land management. 3. Develop and implement catchment and community-based wetland management plans. 4. Incorporate flood mitigation in local planning. 5. Protect and restore flood natural mitigation features such as wetlands, river banks and hill/mountain slopes 6. Use indigenous knowledge in planning and management of floods. 7. Use low-cost sensors and community reporting to monitor water levels. 8. Restoration of watersheds through FMNR.
3	Windstorms	1. Plant windbreaks (trees and shrubs) around vulnerable settlements and open areas. 2. Implement climate smart agriculture practices like agroforestry. 3. Provide technical guidance for retrofitting existing structures.	1. Increase awareness about severe windstorms. 2. Support enforcement of building codes to strengthen roof anchoring and wall bracing 3. Install an effective monitoring and early warning system about windstorms. 4. Enforce use of safety gears like life jackets and use motorised boats
4	Hailstorms	1. Use strong roofing materials 2. Maintain good drainage for road networks 3. Plan early to escape the hailstorms. 4. Create a local contingency fund for agricultural recovery	1. Install an effective monitoring and early warning system about hailstorms. 2. Avoid walking out of the house during hailstorms. 3. Increase hail risk awareness

No	Hazard	Structural Measures	Non-Structural Measures
			4. Encourage mixed cropping and agroforestry to reduce impact
5	Lightning	1. Install lightning arresters on critical buildings. 2. Enhance building codes. 3. Plant trees	1. Conduct lightning awareness programs and education (e.g., avoiding shelter under trees). 2. Install an effective monitoring and early warning system about lightning. 3. The government should subsidize lightning arrestors.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Over time, Nansana Municipality has experienced climate hazards. These include drought, floods, windstorms, hailstorms, and lightning. However, the frequency and severity of these hazards has increased in the past years due to changes in climate. This has increased the vulnerability and risk of elements and communities to multi-hazards. The wards that are highly vulnerable and at risk of multi-hazards in Nansana Municipality include Nabweru South, Kazo, Nabweru East, Wamirongo, Maganjo, Nansana West, Nabweru North, Lugo, Ocheng 7/8, and Magigye. Therefore, the Government with support from partners should design innovative approaches to reduce the vulnerability and risk of these communities to multi-hazards and also increase their resilience and livelihoods.

5.2 Recommendations

The recommendations are categorized into four themes and these include understanding disaster risk; improving disaster risk governance; investing in disaster risk reduction, preparedness, and early warning; and building back better in the aftermath of disaster.

Understanding disaster risk

- Create a centralized GIS-based platform for mapping local climate hazards
- Conduct participatory risk mapping and engage communities to validate and update local hazard data using indigenous knowledge.
- Regularly monitor and update hazard data e.g., through routine post-disaster data reviews and assessments
- Use schools, radio, and local leaders to educate residents about climate-related risks and safety practices.

Improving disaster risk governance

- Use hazard-specific information to guide land use, zoning, and infrastructure investments.
- Train local government staff (e.g., planners, engineers, and councilors) in climate risk analysis and resilient urban planning.
- Establish a local disaster risk coordination committee that facilitates cross-sectoral coordination and accountability for risk reduction efforts.
- Align budgets with risk priorities. This can include allocating local funds based on identified vulnerability hotspots and community needs.

Investing in disaster risk reduction, preparedness, and early warning

- Upgrade and regularly maintain flood-prone drainage systems and culverts.
- Use ecosystem-based adaptation to mitigate flood impacts and recharge water sources.
- Install lightning arrestors on public facilities such as schools, health centers, and markets.
- Promote water harvesting structures (such as rooftop tanks, underground reservoirs, and community water banks) for drought resilience.
- Develop effective localized flood and storm alert systems via SMS, radio, and community leaders.
- Enforce building codes for wind- and flood-resilient construction and retrofitting.
- Equip local response units with tarpaulins, tools, and essential items for rapid deployment.

Building back better in the aftermath of disasters

- Provide fast-track access to seeds and tools after hailstorm or drought events.
- Promote stronger building materials, elevated housing, and storm-resistant roofing.
- Train local teams to evaluate damage, estimate needs, and coordinate response.
- Ensure that rebuilding also addresses social protection such as water access, secure housing, and livelihood support.

REFERENCES

1. Agrawal, S., & Nigam, M. K. (2014). Lightning phenomena and its effect on transmission line. Recent Research in Science and Technology, 6(1).
2. Declet-Barreto, J., Ramirez, M. J., & Fedinick, K. P. (2020). Guide to community climate vulnerability assessments. Pages 1-25. https://www.nrdc.org/sites/default/files/guide-community-climate-vulnerabilityassessments-report.pdf
3. Farida, N., & Maswanku, L. M. (2022). A Panoramic View of The Flood Problem in Eastern Uganda: Lessons from Pakistan and India. Islamic University Journal of Social Sciences, 3(1).
4. Guttman, N. B. (1999). Accepting the standardized precipitation index: a calculation algorithm 1. JAWRA Journal of the American Water Resources Association, 35(2), 311-322.
5. Intergovernmental Panel on Climate Change. (2014). Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, & L. L. White, Eds.). Cambridge University Press.
6. IPCC (2023): Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, 184 pp., doi: 10.59327/IPCC/AR6-9789291691647.
7. McKee, T. B., Doesken, N. J., & Kleist, J. (1993, January). The relationship of drought frequency and duration to time scales. In Proceedings of the 8th Conference on Applied Climatology (Vol. 17, No. 22, pp. 179-183).
8. Morjani, D. Z. E. A. E., 2011. Wind Speed Modelling, Ibn Zohr University of Agadir. Morocco: s.n.
9. OPM (2019). National Risk and Vulnerability Atlas of Uganda. Department of Relief, Disaster Preparedness and Management. Vol.1.
10. Sivakumar, M. V. K., & Wilhite, D. A. (2002). Drought preparedness and drought management. Drought Mitigation and Prevention of Land Desertification, University of Ljubljana, Slovenia, 21-25.
11. Uganda Bureau of Statistics (UBOS) 2024: The National Population and Housing Census 2024 – Final Report - Volume 1 (Main), Kampala, Uganda.
12. Uganda Bureau of Statistics (UBOS), 2021. Uganda National Household Survey 2019/2020. Kampala, Uganda; UBOS
13. UNISDR (2017). UNISDR Terminology on Disaster Risk Reduction.

ANNEXES

Annex 1: Key informant interview guide

Introduction

Dear respondent,

My name is……. from Ardent Services International Limited, Kampala, Uganda. Ardent was hired by Nansana Municipal Council to develop a Climate Action Plan and a Disaster Risk Management Plan. The plans aim to increase the resilience of communities and ecosystems to the impacts of climate change. You have been identified as a key informant for data collection to support the development of the mentioned plans. Your guidance in understanding climate change and DRM in this area will be highly appreciated.

Situational Analysis

1. Which climate extreme events (e.g., drought, floods) affect this municipality?
2. What are the previous efforts undertaken to document disasters?
3. How are climate disasters managed in this municipality?
4. How has climate change impacted the local livelihoods and ecosystems in this area?
5. Describe the capacity of the municipality to manage these disasters in terms of?
   a. *Human resource availability*
   b. *Budgetary allocation*
   c. *Infrastructure*
   d. *Availability of equipment*
   e. *Existence of early warning systems*
6. What are the challenges faced in disaster risk management in the municipality?
7. What are the strengths, weaknesses, opportunities and threats (SWOT) of disaster risk management in the municipality?

Hazard Profiling

1. What are the causes and impacts of the climate hazards identified above? Identify hotspots and feasible DRR interventions.

Hazards	Causes	Impacts	Hotspots (Division and Ward)	Disaster risk reduction measures
Drought	•	•		•
Floods	•	•		•

Vulnerability Assessment- Division level

1. Rank the following sensitivity indicators to climate change in the different wards/parishes of Nansana municipality? (0= Not Available, 1= Very Low, 2= Low, 3= Moderate, 4= High, 5= Very High)

Nansana division

Sensitivity indicators	Kazo	Nabweru North	Nabweru South	Nansana East	Nansana West	Ocheng 7/8
Access to health services						
Community awareness and preparedness						
Degradation of rivers						
Dependency on climate-sensitive sectors e.g., agriculture						
Dependency on surface water						
Drainage systems						
Housing quality						
Income levels						
Population density						
Unemployment						
Wetland degradation						

Nabweru division

Sensitivity indicators	Kawanda	Maganjo	Nakyesanja	Wamala
Access to health services				
Community awareness and preparedness				
Degradation of rivers				
Dependency on climate-sensitive sectors e.g., agriculture				
Dependency on surface water				
Drainage systems				
Housing quality				
Income levels				
Population density				
Unemployment				

Sensitivity indicators	Kawanda	Maganjo	Nakyesanja	Wamala
Wetland degradation				

Busukuma division

Sensitivity indicators	Busukuma	Gguluddene	Kabumba	Kikoko	Kiwenda	Lugo	Magigye	Wamirongo
Access to health services								
Community awareness and preparedness								
Degradation of rivers								
Dependency on climate-sensitive sectors e.g., agriculture								
Dependency on surface water								
Drainage systems								
Housing quality								
Income levels								
Population density								
Unemployment								
Wetland degradation								

Gombe division

Sensitivity indicators	Buwambo	Gombe	Kavule	Kiryamuli	Matugga	Miggadde	Mwererwe	Nasse	Ssanga	Ttikalu	Wambale
Access to health services											
Community awareness and preparedness											
Degradation of rivers											
Dependency on climate-sensitive sectors e.g., agriculture											
Dependency on surface water											
Drainage systems											
Housing quality											
Income levels											
Population density											
Unemployment											

Sensitivity indicators	Buwambo	Gombe	Kavule	Kiryamuli	Matugga	Miggadde	Mwererwe	Nasse	Ssanga	Ttikalu	Wambale
Wetland degradation											

2. Rank the following adaptive capacity indicators to climate change in the different wards/parishes of Nansana municipality? (0= Not Available, 1= Very Low, 2= Low, 3= Moderate, 4= High, 5= Very High)

Nansana division

Adaptive capacity indicators	Kazo	Nabweru North	Nabweru South	Nansana East	Nansana West	Ocheng 7/8
Access to clean water and sanitation						
Access to credit						
Access to early warning information						
Access to renewable energy e.g., solar						
Awareness of climate risks and adaptation practices						
Diverse livelihood options						
Education levels						
Extension services						
Good environmental management practices						
Healthcare infrastructure						
Proper waste disposal						
Rainwater harvesting						
Social networks						
Urban greening initiatives						
Wetland and ecosystem restoration						

Nabweru division

Adaptive capacity indicators	Kawanda	Maganjo	Nakyesanja	Wamala
Access to clean water and sanitation				
Access to credit				
Access to early warning information				
Access to renewable energy e.g., solar				
Awareness of climate risks and adaptation practices				
Diverse livelihood options				
Education levels				

Adaptive capacity indicators	Kawanda	Maganjo	Nakyesanja	Wamala
Extension services				
Good environmental management practices				
Healthcare infrastructure				
Proper waste disposal				
Rainwater harvesting				
Social networks				
Urban greening initiatives				
Wetland and ecosystem restoration				

Busukuma division

Adaptive capacity indicators	Busukuma	Gguluddene	Kabumba	Kikoko	Kiwenda	Lugo	Magigye	Wamirongo
Access to clean water and sanitation								
Access to credit								
Access to early warning information								
Access to renewable energy e.g., solar								
Awareness of climate risks and adaptation practices								
Diverse livelihood options								
Education levels								
Extension services								
Good environmental management practices								
Healthcare infrastructure								
Proper waste disposal								
Rainwater harvesting								
Social networks								
Urban greening initiatives								

Adaptive capacity indicators	Busukuma	Gguluddene	Kabumba	Kikoko	Kiwenda	Lugo	Magigye	Wamirongo
Wetland and ecosystem restoration								

Gombe division

Adaptive capacity indicators	Buwambo	Gombe	Kavule	Kiryamuli	Matugga	Migadde	Mwererwe	Nasse	Ssanga	Ttikalu	Wambale
Access to clean water and sanitation											
Access to credit											
Access to early warning information											
Access to renewable energy e.g., solar											
Awareness of climate risks and adaptation practices											
Diverse livelihood options											
Education levels											
Extension services											
Good environmental management practices											
Healthcare infrastructure											
Proper waste disposal											
Rainwater harvesting											
Social networks											
Urban greening initiatives											
Wetland and ecosystem restoration											

Vision and Goals

1. What is the vision of climate resilience and sustainability in Nansana municipality?
    a. What are the goals to achieve this vision?

2. What is the vision of disaster risk management in Nansana municipality?
    a. What are the goals to achieve this vision?

Result Areas

1. What actions can be done in the following result areas to reduce the emission of greenhouse gases and improve the community resilience to climate change?

Result Area	Climate actions to reduce GHGs	Priority areas (Division and parishes)	Implementation Period (S= 0-2 years; M= 3-4 years; L= 5 years and above)	Responsibility
Agriculture				
Energy				
Environment				
Housing				
Manufacturing				
Social development (communities)				
Trade				
Transportation				
Waste management				

2. What actions can be done in the following result areas to manage or reduce disaster risks in Nansana municipality?

Result Area	Disaster risk reduction (DRR) measures	Priority areas (Division and parishes)	Implementation Period (S= 0-2 years; M= 3-4 years; L= 5 years and above)	Responsibility
Enhancing environmental protection to mitigate disasters				
Profiling of disaster risks, vulnerability and losses/damages				
Promoting disaster preparedness, response and recovery measures				
Strengthening disaster early warning systems				
Strengthening disaster governance structures				

Result Area	Disaster risk reduction (DRR) measures	Priority areas (Division and parishes)	Implementation Period (S= 0-2 years; M= 3-4 years; L= 5 years and above)	Responsibility
Supporting community resilience to manage disasters				

Implementation

1. Describe how the implementation of the climate action and disaster risk management plans should be coordinated?
2. Who are the major and minor stakeholders in the implementation of this plan?
3. How should early warning systems be strengthened? And which early warning information is passed on to the communities and which modes of communication are used?
4. Describe the major sources of climate/disaster funding in the municipality?

Annex 2: Focus group discussion checklist

Dear respondent,

My name is……. from Ardent Services International Limited, Kampala, Uganda. Ardent was hired by Nansana Municipal Council to develop a Climate Action Plan and a Disaster Risk Management Plan. The plans aim to increase the resilience of communities and ecosystems to the impacts of climate change. Your guidance in understanding climate change and DRM in this area will be highly appreciated.

Location

a	Division	
b	Parish/Ward	
c	Village/Cell	

Section 1: Climate change and early warning information to communities

1. What are the indicators of climate change in this area?
2. What are the drivers of climate change in this area?
3. How has climate change impacted the local livelihoods and ecosystems in this area?
4. What strategies are employed by communities to respond to climate change?
5. What are the barriers for climate change adaptation in communities?
6. What should be done to improve community resilience to climate change?
7. What methods have been used to share climate information in your community, and how effective have they been?
8. What roles has the municipal council played in relaying climate information to the community, and how effective has this been?
9. How have farming practices or daily activities in your community changed based on the climate information shared?
10. What challenges have emerged in accessing, understanding, or using climate information in your community?

11. What improvements could be made to the climate information system or the way information is shared to make it more effective for your community?
12. What is the long-term vision for climate resilience and sustainability in the community?
13. What will the climate look like 5 years after implementing adaptation and mitigation measures?

Annex 3: Photographs of stakeholder engagements

FGD held in Nabweru Division

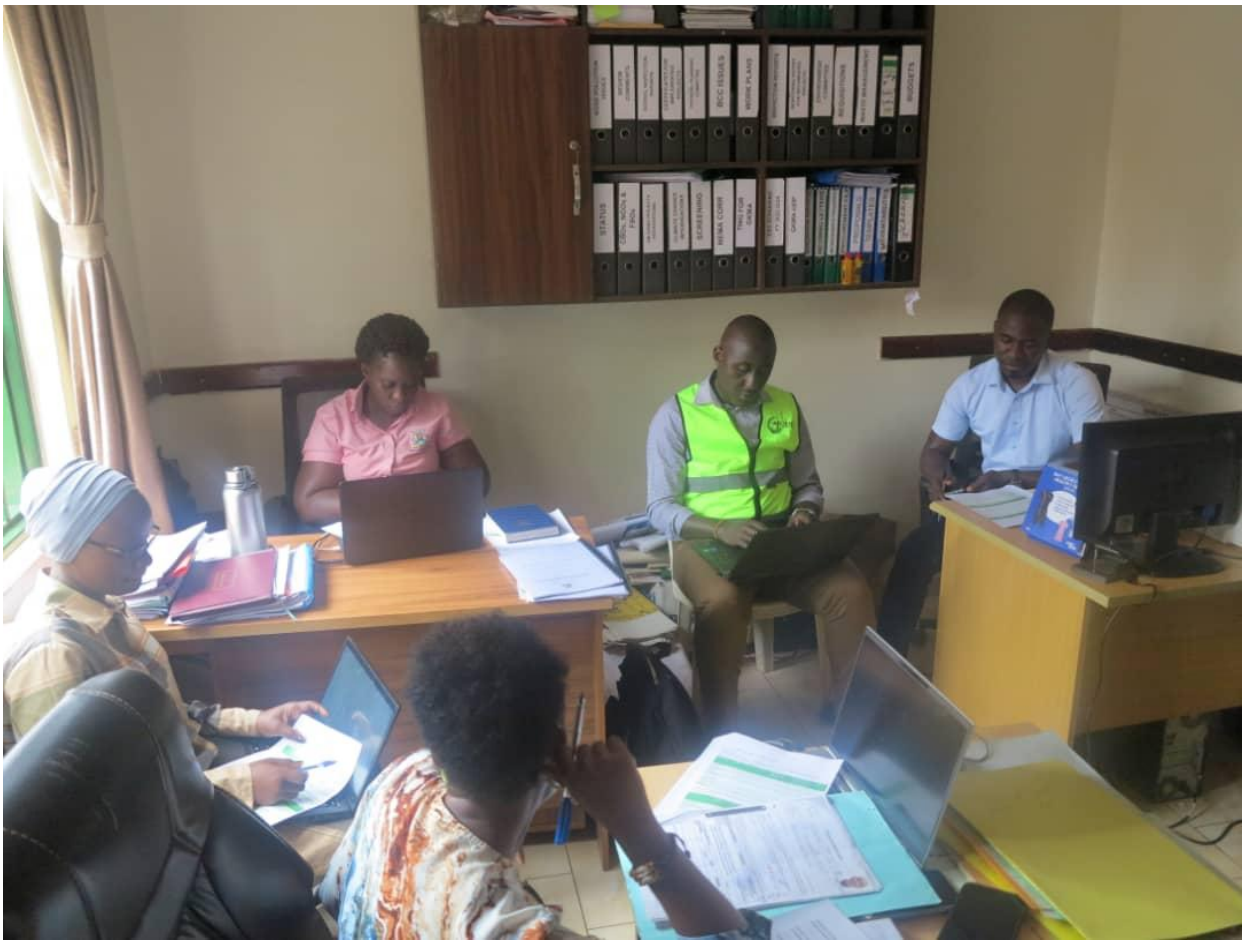
FGD held in Nansana Division

FGD held in Busukuma Division

FGD held in Gombe Division

Engagement with local leaders in Busukuma Division

Engagement with local leaders in Gombe Division

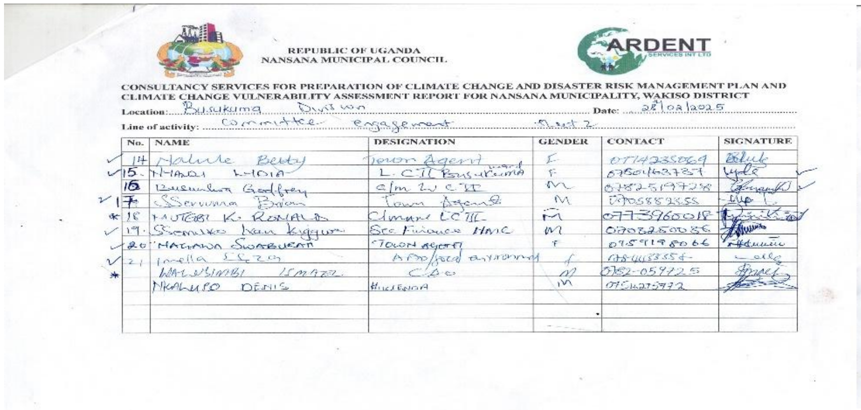


KII with senior environmental officer, Nansana Municipality

KII with CDO, Nansana division

Annex 4: Attendance of stakeholder engagements

Busukuma Division



REPUBLIC OF UGANDA
NANSANA MUNICIPAL COUNCIL

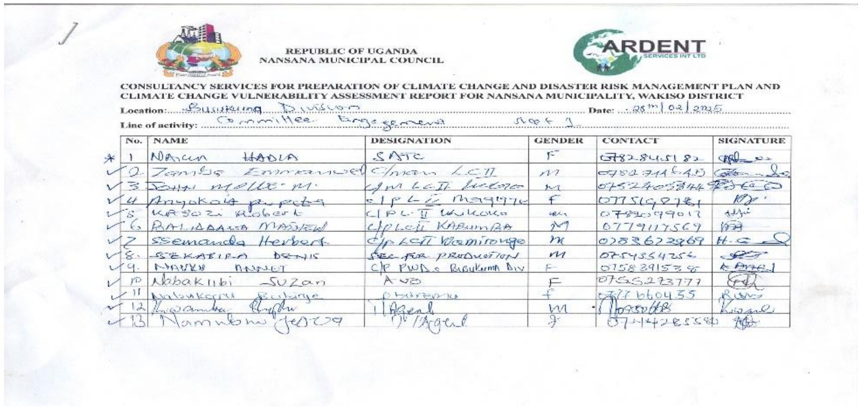
ARDENT SERVICES INT LTD

CONSULTANCY SERVICES FOR PREPARATION OF CLIMATE CHANGE AND DISASTER RISK MANAGEMENT PLAN AND CLIMATE CHANGE VULNERABILITY ASSESSMENT REPORT FOR NANSANA MUNICIPALITY, WAKISO DISTRICT

Location: Busukuma Division Date: 28/02/2025

Line of activity: Committee engagement Sheet 2

No.	NAME	DESIGNATION	GENDER	CONTACT	SIGNATURE
14	Nalule Betty	Town Agent	F	0774235069	
15.	NAKAZI LYDIA	L.C III Busukuma ward	F	0750463737	
16	Busuulwa Godfrey	c/m LC III	M	0782519728	
17	Ssevuma Brian	Town Agent	M	0705882355	
18	MUTEBI K. RONALD	Chairman LC III	M	0773960018	
19.	Ssemujju Ivan Kiggundu	Sec Finance NMC	M	0703250086	
20	NAGAWA SWABURAH	TOWN AGENT	F	0759198066	
21	Imelda Ssozi	Agro/food agronomy	F	0784453354	
	WALUSIMBI ISMAEL	CDO	M	0782-059725	
	NKALUBO DENIS	Kiwenda	M	0754275772	



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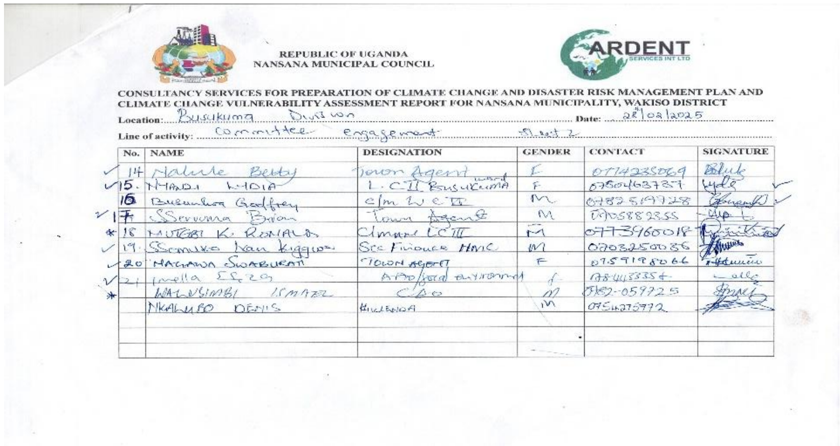
CONSULTANCY SERVICES FOR PREPARATION OF CLIMATE CHANGE AND DISASTER RISK MANAGEMENT PLAN AND CLIMATE CHANGE VULNERABILITY ASSESSMENT REPORT FOR NANSANA MUNICIPALITY, WAKISO DISTRICT

Location: Busukuma Division Date: 28th/02/2025

Line of activity: Committee Engagement Sheet 1

No.	NAME	DESIGNATION	GENDER	CONTACT	SIGNATURE
1	NAKU HADIA	SATC	F	0782845182	
2.	Jambo Emmanuel	Chairman LC II	M	0782711645	
3	John Melle M.	c/m LC II Kitemo	M	0752405844	
4	Anyokoit Puspeta	c/p LC II Magigye	F	0775192781	
5	KASOZI Robert	c/p LC II Wakoko	M	0782099017	
6	BALIDAWA MATHEW	c/p LC II KABUMBA	M	0779117569	
7	Ssemanda Herbert	c/p LC II Wamirongo	M	0783623269	
8.	SSEKABIRA DENIS	SEC FOR PRODUCTION	M	0754354256	
9.	NANYU ANNET	C/P PWDs Busukuma Div	F	0758391538	
10	Nabakiibi Suzan	AVO	F	0755273777	
11	Nabukeera Bulinge	Dharemu	F	0777660455	
12	Kwamba Ruth	T/Agent	M	0[illegible]	
13	Namukwaya Georgia	T/Agent	F	0744428558	



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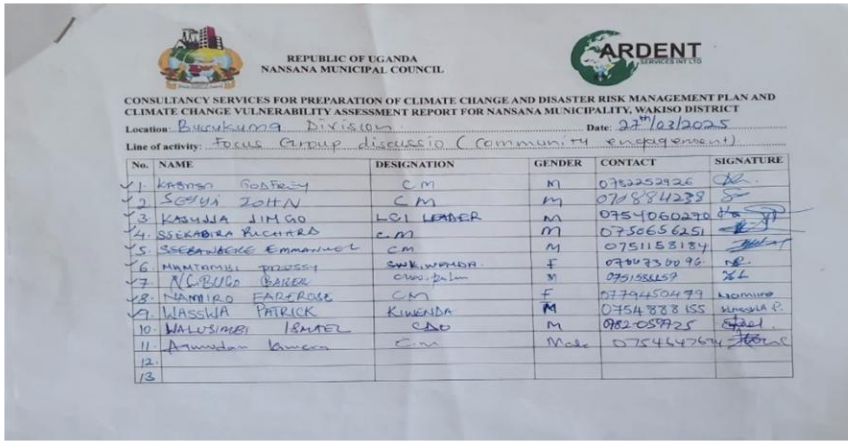
CONSULTANCY SERVICES FOR PREPARATION OF CLIMATE CHANGE AND DISASTER RISK MANAGEMENT PLAN AND CLIMATE CHANGE VULNERABILITY ASSESSMENT REPORT FOR NANSANA MUNICIPALITY, WAKISO DISTRICT

Location: Busukuma Division Date: 28/02/2025

Line of activity: Committee engagement Sheet 2

No.	NAME	DESIGNATION	GENDER	CONTACT	SIGNATURE
14	Nalule Betty	Town Agent	F	0774235069	
15.	NAKAZI LYDIA	L.C III Busukuma ward	F	0750463737	
16	Busuulwa Godfrey	c/m LC III	M	0782519728	
17	Ssevuma Brian	Town Agent	M	0705882355	
18	MUTEBI K. RONALD	Chairman LC III	M	0773960018	
19.	Ssemujju Ivan Kiggundu	Sec Finance NMC	M	0703250086	
20	NAGAWA SWABURAH	TOWN AGENT	F	0759198066	
21	Imelda Ssozi	Agro/food agronomy	F	0784453354	
	WALUSIMBI ISMAEL	CDO	M	0782-059725	
	NKALUBO DENIS	Kiwenda	M	0754275772	



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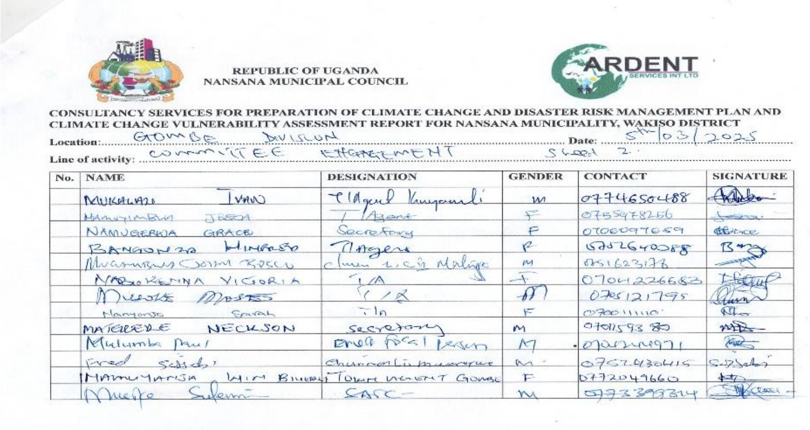
CONSULTANCY SERVICES FOR PREPARATION OF CLIMATE CHANGE AND DISASTER RISK MANAGEMENT PLAN AND CLIMATE CHANGE VULNERABILITY ASSESSMENT REPORT FOR NANSANA MUNICIPALITY, WAKISO DISTRICT

Location: Busukuma Division Date: 27th/03/2025

Line of activity: Focus Group discussio (community engagement)

No.	NAME	DESIGNATION	GENDER	CONTACT	SIGNATURE
1.	KABIRA GODFREY	CM	M	0752252926	
2	SEGUYA JOHN	CM	M	0708884238	
3.	KASUJJA JIMGO	LCI LEADER	M	0754060290	
4.	SSEKABIRA RICHARD	CM	M	0750656251	
5.	SSEBANENKE EMMANUEL	CM	M	0751158184	
6.	NAMATAMBI PROSSY	SWK, WAMALA	F	0704730096	
7.	NGOBUGO BAKER	CWO, Palm	M	0751588159	
8.	NAMIIRO FAREROSE	CM	F	0779450479	
9.	WASSWA PATRICK	KIWENDA	M	0754888155	
10.	WALUSIMBI ISMAEL	CDO	M	0782-059725	
11.	Amunda Kimera	C.M	Male	0754647674	
12.					
13					

Gombe Division



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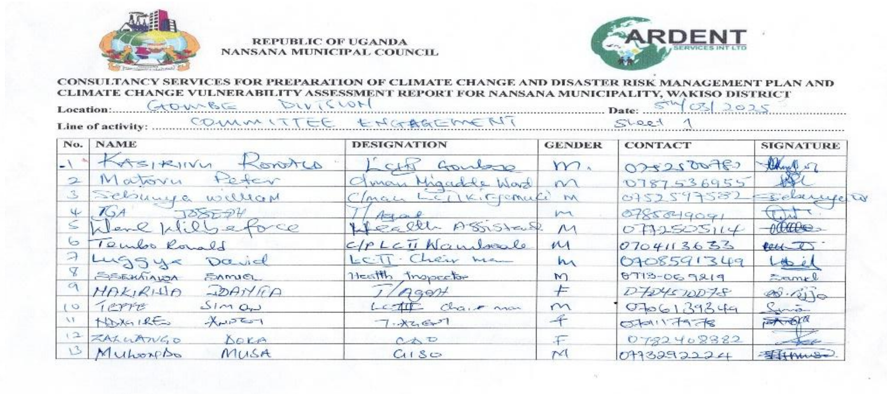
Location: GOMBE DIVISION Date: 5th/03/2025

Line of activity: COMMITTEE ENGAGEMENT Sheet 2

No.	NAME	DESIGNATION	GENDER	CONTACT	SIGNATURE
	MUKALAZI IVAN	T/Agent Kungemuli	M	0774650488	[illegible]
	NAMUYIMBWA JESCA	T/Agent	F	0755978256	Jesca
	NAMUGERWA GRACE	Secretary	F	0706097659	Grace
	BANGONZA HIMBASO	T/Agent	F	0752640088	B
	Mwambwa John Bosco	Chair L.C.II Malige	M	0751623178	[illegible]
	NABUKENYA VICTORIA	T/A	F	0704226683	[illegible]
	Mwesige Moses	T/A	M	0705121795	[illegible]
	Nanyonjo Sarah	T/A	F	0700111110	[illegible]
	MATEKERE NECKSON	Secretary	M	0701159380	[illegible]
	Mulumba Paul	Envt focal person	M	0702249971	[illegible]
	Fred Sebide	Chairman LC Muwerere	M	0757430415	S.Sebi
	MAMUMARISA WIM BWAMI	Town Agent Gombe	F	0772049660	[illegible]
	Mwesige Sulaiman	SASC	M	0773399314	[illegible]



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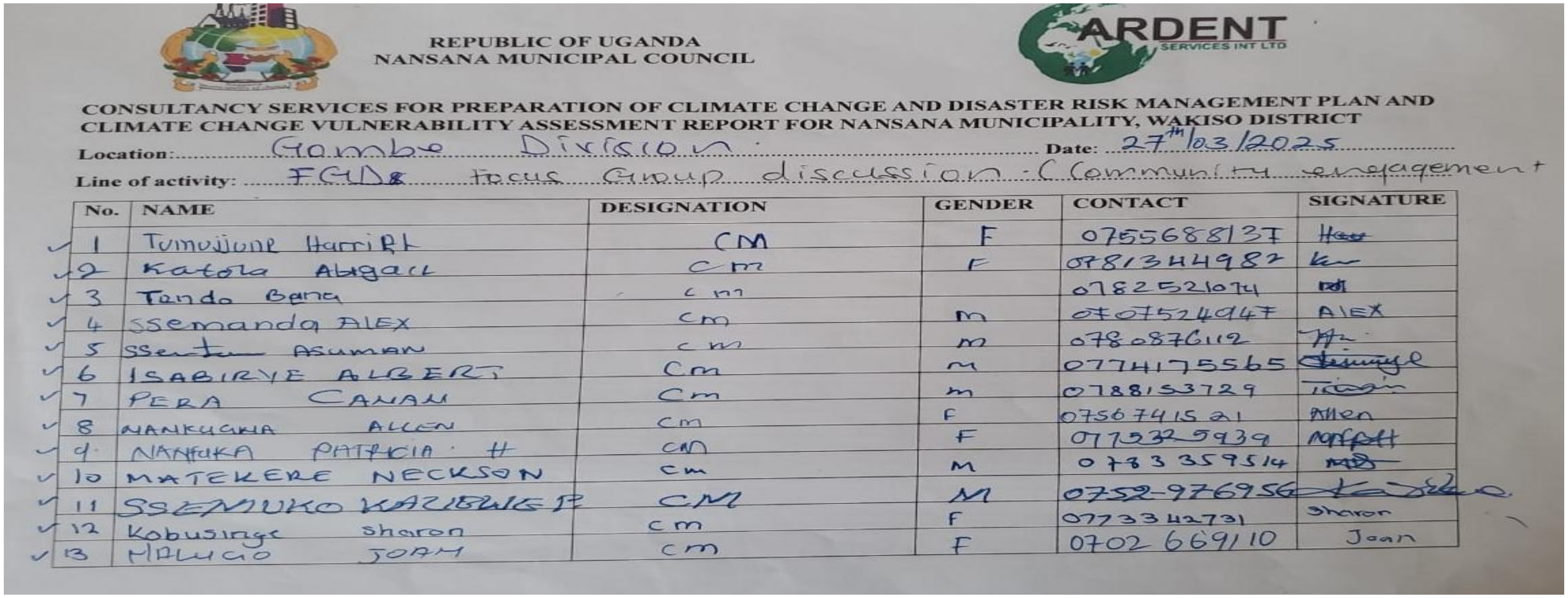
CONSULTANCY SERVICES FOR PREPARATION OF CLIMATE CHANGE AND DISASTER RISK MANAGEMENT PLAN AND CLIMATE CHANGE VULNERABILITY ASSESSMENT REPORT FOR NANSANA MUNICIPALITY, WAKISO DISTRICT

Location: GOMBE DIVISION Date: 5th/03/2025

Line of activity: COMMITTEE ENGAGEMENT Sheet 1

No.	NAME	DESIGNATION	GENDER	CONTACT	SIGNATURE
1	Kasiriivu Ronald	LCIII Gombe	M.	0752500780	[illegible]
2	Matovu Peter	Chman Migadde Ward	M	0787536955	[illegible]
3	Sebunya William	Chman LC I Kirigemuki	M	0752597582	Sebunya
4	IGA JOSEPH	T/Agent	M	0785849091	[illegible]
5	Were Wilberforce	Health Assistant	M	0772505114	[illegible]
6	Tembo Ronald	C/P LC II Wambale	M	0704113633	[illegible]
7	Luggya David	LC II Chairman	M	0708591349	[illegible]
8	SSEKITALWA SAMUEL	Health Inspector	M	0713-069219	Samuel
9	MAKIRIHA IDAMIRA	T/Agent	F	0724500778	[illegible]
10	TEPPE SIMON	LC III Chairman	M	0706139349	Simon
11	NDAGIRE ANNET	T.Agent	F	0701179978	[illegible]
12	ZALWANGO DORA	CAO	F	0782408882	[illegible]
13	Muhonda MUSA	GISO	M	0773292224	[illegible]



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CONSULTANCY SERVICES FOR PREPARATION OF CLIMATE CHANGE AND DISASTER RISK MANAGEMENT PLAN AND CLIMATE CHANGE VULNERABILITY ASSESSMENT REPORT FOR NANSANA MUNICIPALITY, WAKISO DISTRICT

Location: Gombe Division Date: 27th/03/2025

Line of activity: FGDs focus Group discussion (Community engagement

No.	NAME	DESIGNATION	GENDER	CONTACT	SIGNATURE
1	Tumusiime Harriet	CM	F	0755688137	[illegible]
2	Katola Abigail	CM	F	0781344982	[illegible]
3	Tendo Bena	CM		0782521074	[illegible]
4	Ssemanda ALEX	CM	M	0707524947	ALEX
5	Ssentamu ASUMAN	CM	M	0780876112	[illegible]
6	ISABIRYE ALBERT	CM	M	0774175565	[illegible]
7	PERA CANAAN	CM	M	0788153729	[illegible]
8	NANKUGWA ALLEN	CM	F	0756741521	Allen
9	NANFUKA PATRICIA	CM	F	0772325939	[illegible]
10	MATEKERE NECKSON	CM	M	0783359514	[illegible]
11	SSEMUKO KAZIBWE P	CM	M	0752-976956	[illegible]
12	Kobusinge Sharon	CM	F	0773342731	Sharon
13	HALUGO JOAN	CM	F	0702 669110	Joan

Nabweru Division

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CONSULTANCY SERVICES FOR PREPARATION OF CLIMATE CHANGE AND DISASTER RISK MANAGEMENT PLAN AND CLIMATE CHANGE VULNERABILITY ASSESSMENT REPORT FOR NANSANA MUNICIPALITY, WAKISO DISTRICT

Location: NABWERU DIVISION OFFICES Date: 27th/02/2025

Line of activity: COMMITTEE ENGAGEMENT Sheet 1

No.	NAME	DESIGNATION	GENDER	CONTACT	SIGNATURE
01	Kiwewa Jakes Ssemakaaya	NVO Focal P environment	Male	0774621929	[illegible]
02	Nambasa Proscovia	ATC	Female	0782300882	[illegible]
3	Namusoke Racheal	CDO	Female	0782314771	[illegible]
4	KASULE FRED	TIA	MALE	0704891517	[illegible]
5	SEBINA SIMON	T/A	MALE	0776228095	[illegible]
6	MUKOSE SOWALI	LC2 C/P MAGANJO	M	0772484999	[illegible]
7.	NKATA STEPHEN -K	LC II C/P NAKY.	M	0789182746	[illegible]
8	Nabuuma Milly	GISO Nabweru	F	0781535500	[illegible]
9.	NAKIMULI LYDIA	HIA	Female	0701043037	[illegible]
10	MATSIKO NICHOLAS	LCII Wamala	M	0752625663	[illegible]
11	Namuyomba Ritah	T/Agent	F	0706273010	[illegible]
12	NABUGEERA PROSSY	T/Agent	F	0757870854	[illegible]
13	MUYOYO TOM	D.P MAYOR	M	0754143373	[illegible]

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CONSULTANCY SERVICES FOR PREPARATION OF CLIMATE CHANGE AND DISASTER RISK MANAGEMENT PLAN AND CLIMATE CHANGE VULNERABILITY ASSESSMENT REPORT FOR NANSANA MUNICIPALITY, WAKISO DISTRICT

Location: Nabweru Division Date: 26/03/25

Line of activity: FGD. Community engagement.

No.	NAME	DESIGNATION	GENDER	CONTACT	SIGNATURE
1.	ARINAITWE RUTH	C.M	F	0707472314	AR
2.	NAKYAGABA ROSE	C.M	F	0753527726	rose
3.	NABULOLI ALLEN	C.M	F	0701815744	allen
4	MUGANZI TENDO	C.M	F	0706893438	[illegible]
5	Nyakato Winnie	C.M	f	0765159177	[illegible]
6	NAMUTEBI BETTY	C.M	F	0782152077	[illegible]
7	Kyabaasa ROSE	C.M	f	0783084459	K.R
8	Nalumansi Immaculate	C.M	F	0756161319	[illegible]
9	Ssebuliba Alex	C.M	M	0707260774	[illegible]
10	Namulinga Hamidah	C.M	F	0706525760	Namulinga
12	Kizito JUNIOR	C.M	M	0752174985	[illegible]
13	Kansazze Agnes	C.M	M	075115707	K.A
14	NAMBIRO Getru	C.M	M	0757437627	NG

Nansana Division

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CONSULTANCY SERVICES FOR PREPARATION OF CLIMATE CHANGE AND DISASTER RISK MANAGEMENT PLAN AND CLIMATE CHANGE VULNERABILITY ASSESSMENT REPORT FOR NANSANA MUNICIPALITY, WAKISO DISTRICT

Location: Nansana Municipality Date: 28/04/25

Line of activity: Nansana with Nansana Municipal Environment & Natural Resource Committee

No.	NAME	DESIGNATION	GENDER	CONTACT	SIGNATURE
1.	Anthony Tenywa	Consultant · VAAL	M	0782616879	[illegible]
2.	NAKUBULWA RITAH	VICE C/P BUR LC III	F	0771954352	[illegible]
3.	KAVUMA MUSA	Asst. T clerk Council	M	0703512993	[illegible]
4.	MATOVU BRIAN	Environment officer	M	0776418009	[illegible]
5.	Nanduga Dorothy	Agriculture officer	F	0779206624	[illegible]
6	NAKIRA HADIJA	SATE	F	0782845182	[illegible]
7.	Nabalime Hellen V	P.P	F	0782896300	Helen
	Namirembe Rebecca	SATC	F	0703200205	[illegible]
	Zimula Hassan	PHI	M	0700161069	[illegible]
	MBAGIRE LILLIAN	PCDO	F	0704-216899	[illegible]
	Nambasa Prossy	ATC Nabweru	F	0782300882	[illegible]
	H/W Regina Barilla MM	Mayor/Chairperson	F	0752655178	[illegible]
	Tandeka Festo	MM / MCARE TC	M	0782408022	[illegible]

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CONSULTANCY SERVICES FOR PREPARATION OF CLIMATE CHANGE AND DISASTER RISK MANAGEMENT PLAN AND CLIMATE CHANGE VULNERABILITY ASSESSMENT REPORT FOR NANSANA MUNICIPALITY, WAKISO DISTRICT

Location: Nansana Division Date: 28th/03/2025

Line of activity: Focus Group discussion (Community engagement

Nakyandibo Jengo CBO 0772424686

No.	NAME	DESIGNATION	GENDER	CONTACT	SIGNATURE
1	NABUKEERA ZAITUNI	NABWERU	F	0748803381	[illegible]
2	Kakooza Gideon	Nabweru	M	0703676262	[illegible]
3	KASUMBA JOSEPHINE	NABWERU	F	0701756235	Josephine
4	Namutebi Gatrude	Nabweru	F	0704830864	[illegible]
5	Nabwato Annastina	Nabweru	F	0758522070	Anna
6	Namanda mary	Nabweru	F	0751855554	mary
7	Apollo Tumwikirize	Educationist	M	0701610400	[illegible]
8	HATITUME RUTH	Educationist	F	0786787956	[illegible]
9	Komuhumbo Justene	Teacher	F	0704901077	[illegible]
10	Kirene Betty	Local leader	F	0753519407	Betty
11	MUTEBI DANIEL	NABWERU	M	0702048108	[illegible]
12.	NAKAJIRI MAXERIA	NABWERU	F	0753139430	[illegible]
13.	ASIIMWE SPECIOZA	Nabweru	F	0786844331	[illegible]
14	Namawanda Lydia	Nabweru	F	0756277788	[illegible]
15.	Namiiro Maurisia	Nabweru	F	0755953436	Namiiro
16.	Lwanga Simon Peter	Nansana	M	0787503338	[illegible]
17	Nampeera Annet	Nansana	F	0751571713	[illegible]
18	[illegible] James	Nansana	M	0744669[illegible]	