



THE REPUBLIC OF UGANDA

Sembabule District

Hazard, Risk and Vulnerability profile



2016

Acknowledgment

On behalf of office of the Prime Minister, I wish to express my sincere appreciation to all of the key stakeholders who provided their valuable inputs and support to this Multi-Hazard, Risk and Vulnerability mapping exercise that led to the production of comprehensive District Hazard, Risk and Vulnerability (HRV) profiles.

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3. Mr. Byaruhanga Remegeo K - District Agricultural Officer
4. Mr. Byarugaba Francis - Senior Environment Officer
5. Mr. Byarugaba Simon - Senior Agricultural Officer
6. Ms. Namuddu Amina - Information Officer

The entire body of stakeholders who in one way or another yielded valuable ideas and time to support the completion of this exercise.

Hon. Hilary O. Onek

Minister for Relief, Disaster Preparedness and Refugees

Executive summary

Vulnerability assessment, hazard and risk mapping is an important exercise carried out by OPM in response to The National Policy for Disaster Preparedness and Management (Section 4.1.1) and also targeting to reduce vulnerability at community and local government levels by reducing the impact of the hazards where possible through; mitigation, prediction, early warning and preparedness.

This report has been prepared in close collaboration and coordination with OPM as well as other stakeholders. The report is presented in 3 chapters with chapter one detailing the background of the report which comprises of the Government of Uganda shifting the disaster management paradigm from the traditional emergency response focus towards one of prevention and preparedness. Here the report highlights the objectives of the exercise as to Collect and analyze the field data using GIS and Develop specific multi-hazard, risk and vulnerability profiles using a standard methodology.

Chapter two highlights the overview of the District and its location where the District is located approximately 31°1'–31°36' East, and 0°22'S – 0°12'N in the central part of Uganda. Sembabule District has unfavourable climate with the weather conditions characterized by bi-modal rain distribution. About 86.2% of the people of Sembabule are engaged in peasantry agriculture. The total area of land gazetted under forestry within the District is about 125.47 km².

Chapter three clearly explains the materials and methods applied in conducting the assessment and here a multidisciplinary approach was adopted for the assessment of multi-hazard, risk and vulnerability profiles production. The approach included; an investigation of socio-economic parameters, biophysical characteristics and spatial analysis of hazards in the District.

Chapter four has findings that encompass multi hazard, risk and vulnerability status of the District. It has been noted that Sembabule District has continuously experienced multi-hazards for over 30 years. The multi-hazards that are experienced in the District can be classified as:

- i. Geomorphological and geological hazards including soil erosion
- ii. Climatological or hydro-meteorological including flash floods, hailstorms, Lightning, drought and strong winds
- iii. Ecological or biological hazards including pests, parasites and diseases, human and wildlife conflicts and invasive species
- iv. Technological hazards including road accidents
- v. Environmental hazards including wetland degradation, deforestation and land conflicts

In conclusion, reducing vulnerability at community, Local Government and National Levels should be a threefold effort hinged on:

- a) Reducing the impact of the hazard where possible through mitigation, prediction, early warning and preparedness;
- b) Building capacities to withstand and cope with the hazards and risks;
- c) Tackling the root causes of the vulnerability such as poverty, poor governance, discrimination, inequality and inadequate access to resources and livelihood opportunities.

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List of acronyms

DDP	:	District Development Plan
DLG	:	District Local Government
DWRM	:	District Water Resources Management
GIS	:	Geographical Information Systems
HRV	:	Multi hazard, Risk and Vulnerability
MWE	:	Ministry of Water and Environment
NARO	:	National Agricultural Research Organisation
NEMA	:	National Environmental Management Authority
NFA	:	National Forestry Authority
OPM	:	Office of the Prime Minister
SRTM	:	Shuttle Radar Topography Mission
ToR	:	Terms of Reference
UBOS	:	Uganda Bureau of Statistics
UNDP	:	United Nations Development Programme
UNRA	:	Uganda National Roads Authority

Definition of key terms

Hazard is a potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation

Risk is a probability of a hazard occurring or threatening to occur

Vulnerability refers to the propensity of exposed elements such as human beings, their livelihoods, and assets to suffer adverse effects when impacted by hazard events

Climate variability refers to the climatic parameter of a region varying from its long-term mean. Every year in a specific time period, the climate of a location is different. Some years have below average rainfall, some have average or above average rainfall

Disaster is a progressive or sudden widespread or localized, natural or human caused occurrence which causes or threatens to cause death or injury, damage to property, infrastructure or environment, disruption of life of a community and its magnitude exceeds the ability of those affected to cope using only their own resources

Disaster management is a continuous and integrated multi-sectoral and multidisciplinary process of planning and implementation of measures aimed at disaster prevention, mitigation, preparedness, response, recovery and rehabilitation

Mitigation means structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards

Preparedness means activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations

Response means measures taken during or immediately after an incident or a disaster in order to bring relief to affected communities or individuals

Adaptation means the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities

CHAPTER ONE

1.1 Background

Uganda has over the past years experienced frequent disasters that ranges from drought, to floods, landslides, human and animal diseases, pests, animal attacks, earthquakes, fires, conflicts and other hazards which in many instances resulted in death, property damage and loss of livelihood. With the increasing negative effects of hazards that accompany population growth, development and climate change, public awareness and proactive engagement of the whole spectrum of stakeholders in disaster risk reduction, are becoming critical. The Government of Uganda is shifting the disaster management paradigm from the traditional emergency response focus towards one of prevention and preparedness. Contributing to the evidence base for the Disaster and Climate risk Reduction action, the Government of Uganda is compiling a national risk atlas of hazard, risk and vulnerability conditions in the country to engage main streaming of disaster risk management in development planning and contingency planning at National and Local Levels.

Since 2013, UNDP has been supporting the Office of the Prime Minister to develop District hazard risk and vulnerability profiles in sub-regions of Rwenzori, Karamoja, Teso, Lango, Acholi, West Nile, Central and South western sub regions. During the exercise, local government officials and community members actively participated in the data collection and analysis through focus groups discussions and the key informant interviews. The data collected was used to generate hazard, risk and vulnerability maps and profiles for each District. Validation workshops were held in close collaboration with the District Local Government (DLG) technocrats, Development Partners, Agencies and academic/research institutions. The developed maps show the local geographical distribution of hazards and vulnerabilities up to Sub county level of the District.

1.2 Justification

The National Policy for Disaster Preparedness and Management (Section 4.1.1) requires the Office of the Prime Minister to “Carry out vulnerability assessment, hazard and risk mapping of the whole country and update the data annually”. UNDP’s DRM project 2016 Annual Work Plan; Activity 4.1 is “conduct national hazard, risk and vulnerability (HRV) assessment including sex and age disaggregated data preparation of District profiles.”

1.3 Objectives of the consultancy

The objectives of the assignment were to:

- 1) Collect and analyze field data using GIS in close collaboration and coordination with OPM in Sembabule District
- 2) Develop District specific multi hazard risk and vulnerability profiles using a standard methodology.
- 3) Preserve the spatial data to enable use of the maps for future information.
- 4) Produce age and sex disaggregated data in HRV maps

1.4 Scope of the assignment

This assignment was carried out by a team of consultants under the overall technical supervision by the Office of the Prime Minister and UNDP, Uganda. The assignment was conducted in the month of May, 2016.

CHAPTER TWO

2.1 Overview of Sembabule District

Sembabule District is located approximately 31°1'–31°36' East, and 0°22'S – 0°12'N in the central part of Uganda. Kyegegwa and Mubende Districts borders it in the North, Gomba and Bukomasimbi Districts in the East, while from the South the District of Lwengo borders with it. The West of the District is Kiruhura and in the West is Kiruhura and Lyantonde Districts (Figure 1). The District has two counties i.e. Mawogola and Lwemiyaga with a total area of 2,319.2 square kilometres.

Sembabule District has a favourable climate with the weather conditions characterized by bi-modal rain distribution Pattern. The District is watered with about 750mm-1200mm of rainfall over two growing seasons. The highest rains are normally received in March to May and September to December. The District has topographic features of rolling/ undulating hills with wide valleys that have greatly provided opportune water catchment for construction of dams and valley tanks.

About 86.2% of the people of Sembabule are engaged in peasantry agriculture growing crops like coffee, banana, millet, maize and rearing animals like goats and cattle. 97.4% of the agriculturalists are engaged in crop husbandry. Less than 1% is practicing fish farming. Generally speaking; land under cultivation covers 72,490 hectares (31.3% of the District total area).

The total area of land gazetted under forestry within the District is about 125.47 km². Therefore; land reserved for forestry within the District occupies about 5.4% of the District landmass. There are two central forest reserves and one local forest reserve, of which Kazooba Central Forest Reserve in Ntuusi and Lwemiyaga Sub-counties is the biggest (58.4% of the total area under forest reserve land). The second central forest reserve is Buyaga Dam, which is shared by Lwengo, Lyantonde and Sembabule Districts. The only local forest reserve is Ntuusi Local Forest Reserve located in Ntuusi Sub - county.

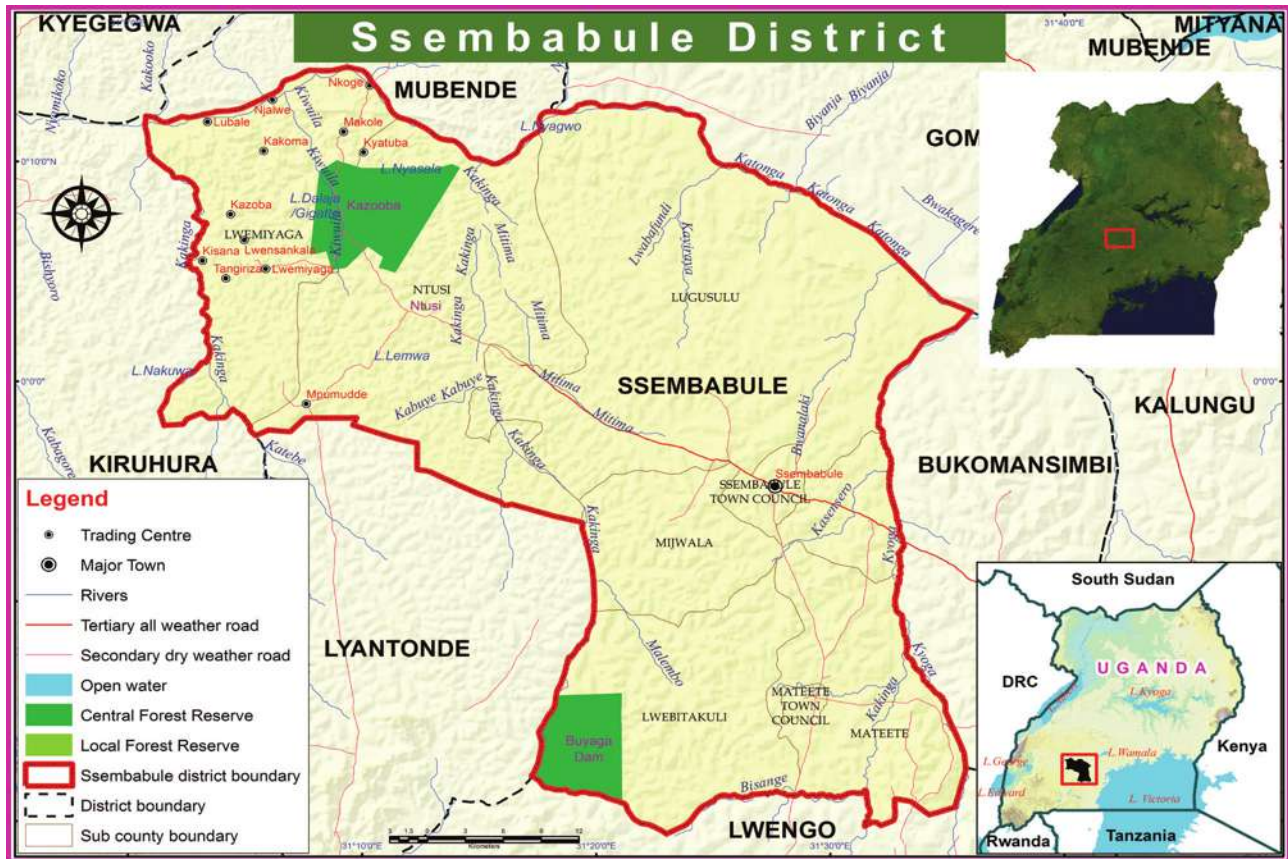


Figure 1: Map of Sembabule District

CHAPTER THREE

3.1 Materials and methods

3.1.1 Multi-hazard, risk and vulnerability profile assessment

3.1.1.1 Approach

A multidisciplinary approach was adopted for the assessment of multi-hazard, risk and vulnerability profiles production. The approach included; the investigation of socio-economic parameters, biophysical characteristics and spatial analysis of hazards in the District.

3.1.1.2 Data collection

3.1.1.2.1 Socio economic investigation

The socio economic assessment of hazards, risks and vulnerability was threefold: the consultations, key informant interviews and Focus Group Discussion. The consultations were conducted at the District level and this included Government Officials who were selected on the advice of the Chief Administrative Officer and assessment team. The issues and concerns discussed were the causes, effects, adaptive responses, risks and vulnerability of multi-hazards experienced in the District. The question and answer session was selected purely because the officials were knowledgeable and had vast experience in the occurrence, severity and frequency of hazards in the District.

In addition to consultations, the key informant interviews were also carried out on the Sub county officials for evidence based discovery. A total of two focus group discussions were also conducted in the Sub counties: Lwebitakuli and Sembabule Town Council. The groups on average comprised 10-15 members who were randomly selected by the Sub county focal persons from the different Parishes. The risk and vulnerability factors were determined through ranking and weighting procedures. The discussions helped to identify the most prone areas that were later visited for more site risk and vulnerability study. Four broad vulnerability areas were participatory identified in the District, these being social, economic, environmental and physical components. In each of these vulnerability components, participants characterised the exposure agents, including multi-hazards, elements at risk and their spatial dimension.

3.1.1.2.2 Spatial analysis

A series of spatial datasets were collected, pre-processed and processed to extract information on the magnitude and distribution of hazards, risks and vulnerability. The primary and secondary datasets were collected and collated prior to information extraction. The primary data include GPS coordinates while the secondary dataset included satellite images, land use/cover maps, digital elevation model, population and hydrological maps.

The utilised datasets used to create multi-hazards, risks and vulnerability maps are here indicated below:

Table 1: Sources of spatial datasets obtained and utilised in the study

No	Datasets	Sources	Period
1	Population	UBOS	2014
2	Roads	UNRA	2009
3	Land use/cover	NFA	2010
4	Hydrography	MWE	2010
5	Wetlands	MWE	2009
6	Protected areas	NFA	1990
7	Soil	NARO	2013
8	Trading centres	NFA	2014
9	Digital Elevation Model (30m)	SRTM	2014

The identified multi-hazards were mapped following standards procedures and methods for acceptability and reasonable output. Some of the analytical procedures are stated here below:

Table 2: Multi-hazard analytical detailed description of procedures

No	Multi hazards	Procedures
1	Flood inundation	Yang et al. (2006)
2	Soil erosion	Fistikoglu & Harmancioglu (2002)
3	Land conflicts	Homer-Dixon (1994)
4	Strong winds	Bunting & Smith (1993)
5	Invasive species	Venette et al. (2010)
6	Road accidents	Kamijo et al. (2000)
7	Lightning	Yokoyama (2002)
8	Pests, parasites and diseases	Based on major crop and livestock enterprise

The frequency and severity of multi-hazards, risks and vulnerability levels were categorized based on key informant interviews and expertise as follows:

Table 3: Multi-hazard severity classes/levels

Classes	Ranges (%)
Extremely/very high	90-100
High	60-89
Moderate	30-59
Low	10-29
Very low	0-9

3.1.1.2.3 Validation

The hazard, risk and vulnerability prone areas were identified and studied in the field. The Spectra Precision handheld Global Positioning System (model: Mobile Mapper 20) units were used to map the hotspot and vulnerable areas. The field compiled profile was validated by the representative District Government Officials in a validation workshop held in Jinja District from 27th June – 1st July, 2016.

3.2 Multi-hazard assessment

3.2.1 Introduction

The multi-hazards that are experienced in Sembabule District can be classified as:

- vi. Geomorphological and geological hazards including soil erosion
- vii. Climatological or hydro-meteorological including flash floods, hailstorms, Lightning, drought and strong winds
- viii. Ecological or biological hazards including pests, parasites and diseases, human and wildlife conflicts and invasive species
- ix. Technological hazards including road accidents
- x. Environmental hazards including wetland degradation, deforestation and land conflicts

The comprehensive information on the frequency, severity and distribution of multi-hazards is presented here below in a chronological episodes order.

3.2.2 Drought

Sembabule is one of the Districts found in the cattle corridor. The experienced drought events are manifested as prolonged dry spells that cause shifts in the onset of rainy seasons.

The frequency and severity of drought episodes are perceived to be caused by changes in the climate pattern, wetland degradation, location in the rain shadow, changes in land use, poor farming methods and deforestation. Drought occurrences are associated with deficit soil moisture, reduction of surface water sources, rotting of crops and reliance on imported foods. It is aggravated by low adaptive capacity of farmers and reduced soil fertility. Predictably, the most affected months are those from December – March and July – September of each seasonal calendar.

Notably, the most adverse effects of drought include reduced income levels for farmers and District revenue, reduced farm yields and reduced inputs and investment in the agricultural sector. In addition, drought increases prices of staple food, food insecurity, migration, theft of crops in gardens, wetland degradation, famine, pests, diseases and loss of livestock. The severity and distribution of drought affects all the six Sub counties and two Town Councils.

3.2.3 Pests, parasites and diseases

The occurrence, severity, frequency and distribution of pests, parasites and diseases are high as compared to the last 30 years in the District. In crop production, the farmers are engaged in the growing of coffee, beans, groundnuts, sweet potato, potato, millet, maize, horticultural crops and banana as food and cash crops, however, their production has drastically reduced over time due to increasing and emergence of new pests, parasites and diseases.



Plate 1: Banana weevils

The high pre-and post-harvest pest and disease incidences in crops are mainly attributed to changes in weather patterns, deforestation, inadequate extension services, inadequate regulation and surveillance, trans-boundary movement, soil exhaustion, recycling of planting materials, type of crop grown (cereals), poor farming methods, high costs of pesticides, substandard pesticides and poor storage facilities. The changes in weather patterns favour the life cycle of pests that continuously destroy crops resulting into famine and on the other hand poor farming methods are attributed to poverty, attitude, ignorance and poor mind-sets. The crop pests and diseases are associated with crop destruction, stunted growth, early rotting and farmer ignorance on better farming methods.

The factors that have contributed to the vulnerability of farmers include: poor planting materials, climate change, substandard pesticides and limited extension services. The adverse effects include low crop yields, low income levels, build-up of pests, disease outbreaks and soil degradation among others. Some of the notable pests and diseases are indicated here below (table 4). The effects of pests and diseases were evident in all the Sub counties.

Table 4: Major pests and diseases

No	Crops	Pests	Diseases
1	Cassava	Cassava mites and white flies	Cassava brown streak disease and cassava mosaic disease
2	Groundnuts	Leaf miner	Groundnut rosette
3	Maize	Maize stalk borer,	Maize smut and maize streak virus disease
4	Sorghum	Sorghum midge, stem borers and sorghum shoot fly	
5	Cowpeas	Aphids	Rust
6	Soybean	Web worm,	
7	Bananas	Banana weevils	Banana bacterial wilt and Black sigatoka
8	Tomatoes	Cut worms, Aphids	Tomato blight
9	Rice	Stem borers	Rice yellow mortal virus
10	Beans	Aphids	Bean rot
11	Citrus	Fruit-fly,	Hard scab and Rot
12	Coffee	Coffee twig borer	Coffee wilt disease

In livestock production, Sembabule District lies in an endemic Tsetse and trypanosomiasis zone. The occurrences of parasites and diseases was basically caused by communal grazing, limited agricultural extension services, poor on-farm management practices like deforestation and overgrazing, mixing of livestock due to limited pasture fields, wetland degradation, animal movement, grazing along road reserves and reduced surface water quality.

The parasites and diseases are associated with low milk yield, low meat output, slow growth rates and livestock death among others. Each year, the predictability of the parasites and diseases is on the increase. The livestock keepers are apparently vulnerable due to sub-standard pesticides, unreliable weather patterns, limited extension services, scarce water and pasture resources.

The adverse effects of livestock parasites and diseases include: loss of livestock, reduced household income levels, loss of revenue to the District, and human death. Some of the notable livestock parasites and diseases included ticks, tsetse flies, worms, mites, new castle, swine fever, nagana, east coast fever, foot and mouth disease among others. The most affected Sub-counties are Mateete, Lwebitakuli, Lugusulu, Ntuusi and Lwemiyaga.

3.2.4 Wetland degradation

The wetland types found in Sembabule District are classified as seasonal and permanent wetland characterised with bush, grassland, papyrus, woodlands of acacia species among others. The wetland systems are under continual threats from the increasing rate of encroachment for wetland products, services and agriculture. The wetlands are utilised as livestock grazing fields, extraction of building materials, crop growing, fishing, charcoal and firewood among others. The major causes of wetland degradation include; land shortage, drought, reduced soil fertility, political interference, soil erosion, poor farming methods, assumed ownership, change in land use, ignorance, resource conflicts, brick making, sand mining, seasonal fires, over harvesting of wetland resources and invasion by invasive species (Plate 2).

The degradation is associated with silting of water bodies, reducing soil nutrients, lowering the water table, resource conflicts and over cultivation. The rates of wetland encroachments are high during the prolonged dry months characterised with low water availability and limited pastures. The factors that have increased the vulnerability of wetlands include limited enforcement mechanism and funds to demarcate the wetland boundaries.



Plate 2: Crop growing in wetland (Katonga-Kakinga)

The adverse effects of wetland degradation include subsequent occurrences of flash floods, erratic rains and drought, reduced water quality and quantity in water sources, loss of wetland biodiversity, drought, increased incidences of pests, parasites and diseases, loss of property, livestock and human life. The effects have been reported in all the Sub counties found in the District.

3.2.5 Soil erosion

Soil erosion has affected the integrity of farmlands, wetlands and water sources in the District. The main soil erosion types common in the District include rill, gully and sheet erosion. Soil erosion is principally triggered by over grazing, vegetation clearing, bush burning, inadequate advisory services, lack of appropriate ordinances and bye laws, deforestation, poor land use planning, poor maintenance of roads and intensive rainfall events.

The occurrence of soil erosion is associated with the washing away of top soil, siltation of water sources and destruction of infrastructure including roads and bridges. The events are common and widespread during the rainy season. The famers are vulnerable to the severity of soil erosion due to poor farming methods, and land shortage which lead to cultivation of steep slopes and low lying flood prone areas.



Plate 3: Soil erosion ridges around Kyambidde dam, Sembabule District

The adverse effects of soil erosion experienced in the District include: low crop yields, low income levels, land abandonment, reduction in the quality and quantity of surface water sources, high costs of transport, increased incidences of pests, parasites and diseases, loss of landscape beauty, land conflicts, invasive species and famine (Plate 3) This is rampant in the Sub counties of Mateete, Lwebitakuli and Mijwala. The severe effect of soil erosion in the District started in 2000 and has been increasing (Figure 2).

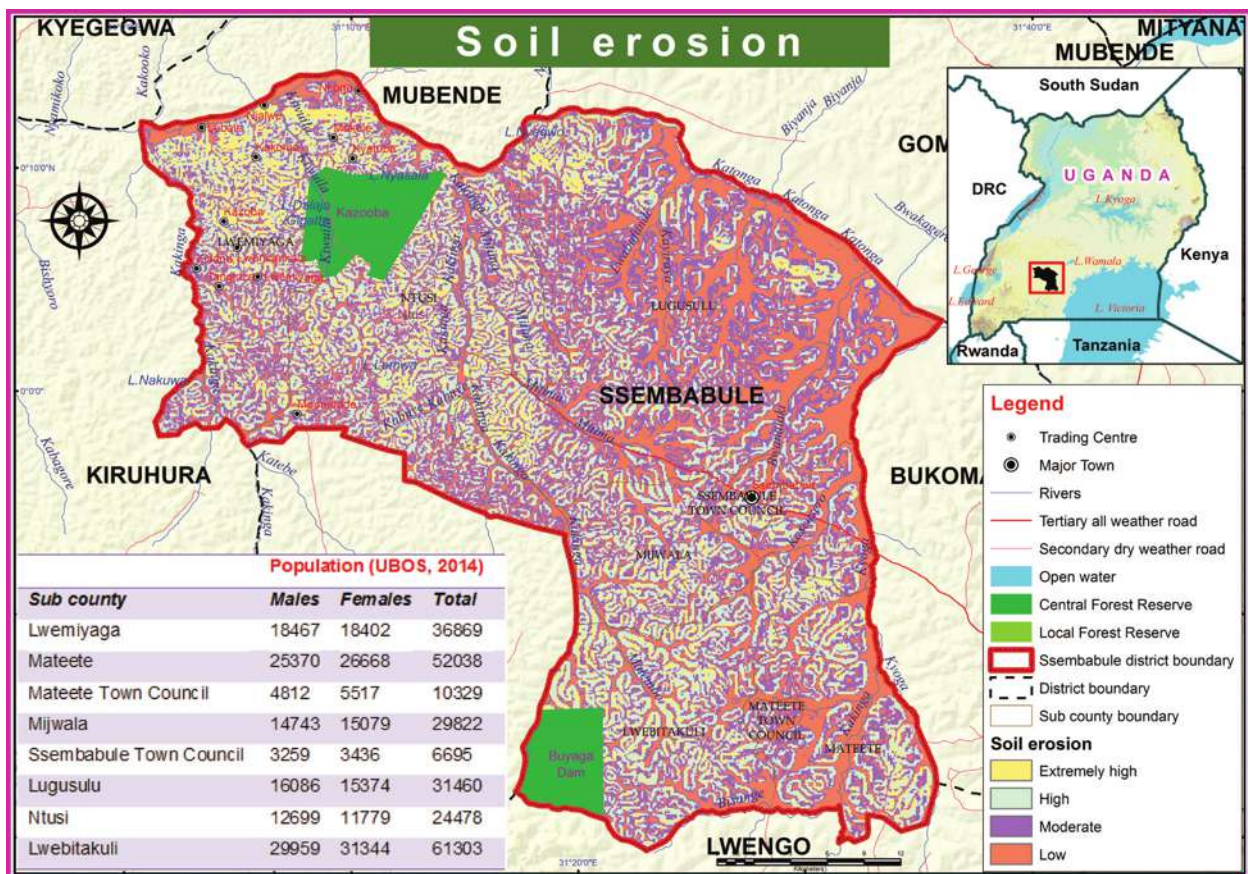


Figure 2: Soil erosion prone areas

3.2.6 Land conflicts

Land conflicts have now become rampant in the District for the last 15 years. Most of the land in the District is under unregistered customary ownership with an increasing number of leaseholds and freeholds. The conflicts are between the people and government, communities and cultural institutions and vice versa.

The land conflicts in the District are fuelled by unclear ownership of wetlands, population pressure, customary land ownership, overlapping land policies, ignorance, unclear administrative and protected area boundaries, absent land lords, land grabbing, unequal distribution of land in families and untitled land. The conflicts are associated with prolonged court cases, displacement of people and low crop and livestock production among others. The land conflicts are more frequent in the populated Sub counties in the District. The households are vulnerable to the frequent occurrence of land conflicts due to land ownership rights, land grabbers, unplanned settlements and lack of clear boundaries with the neighbours.

The conflicts have resulted into the migration of people to the neighbouring Sub counties and other Districts, under development, loss of human life and livestock; and loss of property and income due to court cases. Furthermore, the tenure arrangements are associated with over exploitation by several implemented land use options such as overgrazing, bush burning and land fragmentation on the allocated piece of land. The eventualities are more severe in all the Sub counties (figure 3).

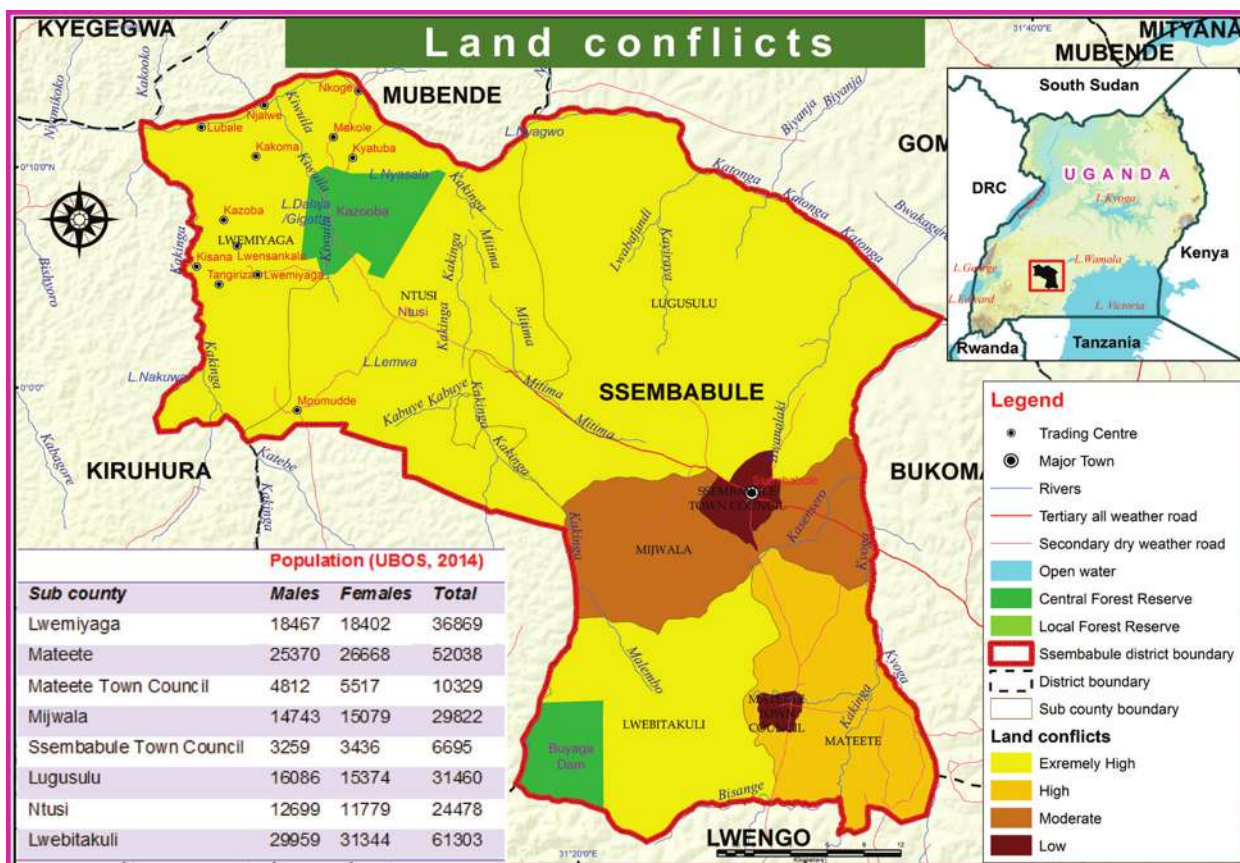


Figure 3: Severity of land conflicts

3.2.7 Bush burning

The occurrence and frequency of fires is seasonal in the District. The fires are started by majorly the cattle keepers to break the cycle of parasites and facilitate pasture regeneration as perceived and farmers during opening of gardens. Some of the fires are attributed to poverty, ignorance, charcoal burning, poor farming methods, hunting, cigarette smoking and land conflicts.

Bush burning is associated with the clearance of vegetation, conversion of wood into charcoal, destruction of crops and property. The bush fire incidences are rampant during the dry season (December-March and July-September). Vulnerability to the fires is due to the rampant land conflicts, drought, livestock production and inadequate enforcement of conservation policies and laws.

The secondary effects of unmonitored fires include loss of property, loss of human life and livestock, low crop yields, migration of animals, displacement of people, soil degradation and loss of biodiversity. Severe fire incidents have been recorded in Lugulusu, Mateete, Sembabule Town Council and Ntuusi Sub counties.

3.2.8 Hailstorms

The occurrence and severity of hailstorms are a frequent phenomenon in Sembabule District. The hailstones fall during heavy downpour and these take a period of about 10-30minutes. The frequency and distribution of hailstorms is primarily caused by changes in the onset of rainy seasons especially after prolonged dry spells, erratic rains and deforestation. Hailstorms are associated with vegetation, crop and property destructions. The hailstorms are severely predicted to occur during the second rainy season. The deforestation activities have increased the magnitude of severity especially in farmlands and homesteads. The trees are cut down to acquire charcoal fuel wood for brick making and construction materials. The farmers are vulnerable to the effects of hailstorms due to the massive clearance of trees, limited availability of tree seedlings and unreliable seasonal weather forecasts among others.

The adverse effects of hailstorms include destruction of property, low household income levels, loss of District revenue, food shortages, loss of human life and livestock (Plate 4). The episodes have been reported in Lwebitakuli, Mateete and Lwemiyaga Sub counties in the District (figure 4).



Plate 4:Hailstorm in Lubaale Parish -Lwemiyaga Sub county

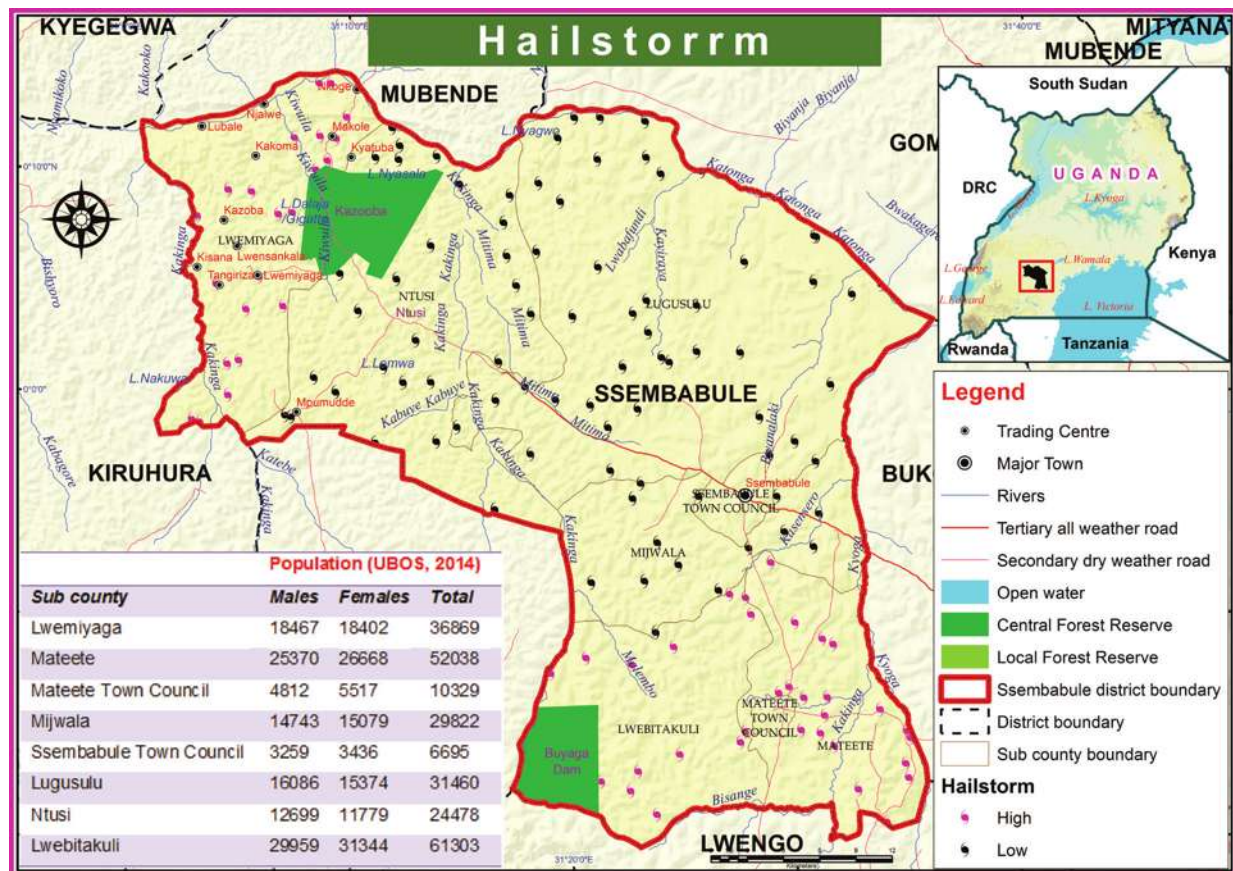


Figure 4: Distribution of hailstorms

3.2.9 Invasive species

The occurrence of invasive species in the District is twofold: those that are land and water based. The invasions on land are mainly in farmlands while the water based can be seen on the dams, valley tanks, ponds and wetlands. The frequency and severity of invasive species are sometimes determined by both natural and anthropogenic factors. In particular, the invasive species on land have evaded the District purely because of changes in weather patterns, reduced soil fertility, poor farming methods, soil erosion, animal movements, wetland degradation, high seed multiplication and dispersion by wind. Some of the notable species include *Striga spp* “Kayongo”, *Lantana camara*, *Cymbopogon nardus* “Eteete”, and *Parthenium hysterophorus* (Congress weed) (among others. On water, the species are spread by strong winds, fishing activities, and siltation among others.



Plate 5: Grass

The occurrence of land based species is associated with stunted crop growth, crop failure, frequent weeding, poor yields and land abandonment. The water species are characterised with depletion of fish stocks and water pollution among others. The invasions are high during the rainy season due to the increase in the plant water content that facilitates their high growth.

The adverse effects of land based species include loss of biodiversity, loss of livestock, low income levels, poor crop yields and encroachment on public land among others. On the other hand in water based species cause illness, and loss of biodiversity among others. The invasion of both alien species has been reported in all the Sub counties.

3.2.10 Deforestation

Deforestation is perceived as the cutting of trees for charcoal, and wood. This has mainly affected Sembabule District because most of the trees have been wiped away in search for land for settlement, charcoal, other wood products and agriculture (Plate 6). The factors that contribute to the vulnerability include weak enforcement of forestry laws, high population growth rates, migrants into the District, drought and reduced soil fertility among others in the District.

The resultant effects have led to increases in pests, parasites and diseases, destruction of habitats, siltation of wetlands and drought. In addition to the loss of biodiversity, water resource conflicts and loss of water quality have been recorded in the District. The activities are prevalent in all the Sub counties. Though more prone severe in and around wetlands in Lwemiyaga, Ntuusi, and Lugusulu.



Plate 6: Deforestation in Nabitanga parish-Ntuusi Sub county

3.2.11 Road accidents

Road accidents claim a number of lives in the District of recent than before. The prevalence of road accidents are attributed to the driving of cars in dangerous mechanical conditions, reckless driving, lack of road sign posts, bad weather, indiscipline, negligence, overloading, lack of driving documents, livestock grazing in the road reserves, narrow roads, incompetent drivers and over speeding. The road accidents mainly involve pedestrians, cars, bicycles and motorcycles.

The road accidents are associated with injuries, disabilities, transport hindrances and arrests among others. The incidences are more frequent during the festive seasons such as Christmas and Easter, election days and at the start and closure of schools. The factors that contributed to the vulnerability of households to road accidents are; weak enforcement of traffic laws, poor roads, establishment of road markets and a number of highways (Masaka-Sembabule, Sembabule-Ntuusi-Lwemiyaga, Sembabule-Gomba, and Sembabule-Masaka-Mateete) among others.

The notable effects of road accidents include: loss of human life and livestock, illness, disabilities, loss of property and documentation, reduction in crop and livestock production and loss of income in compensations. The accident incidents are reported in all the Sub counties throughout the year (figure 5).

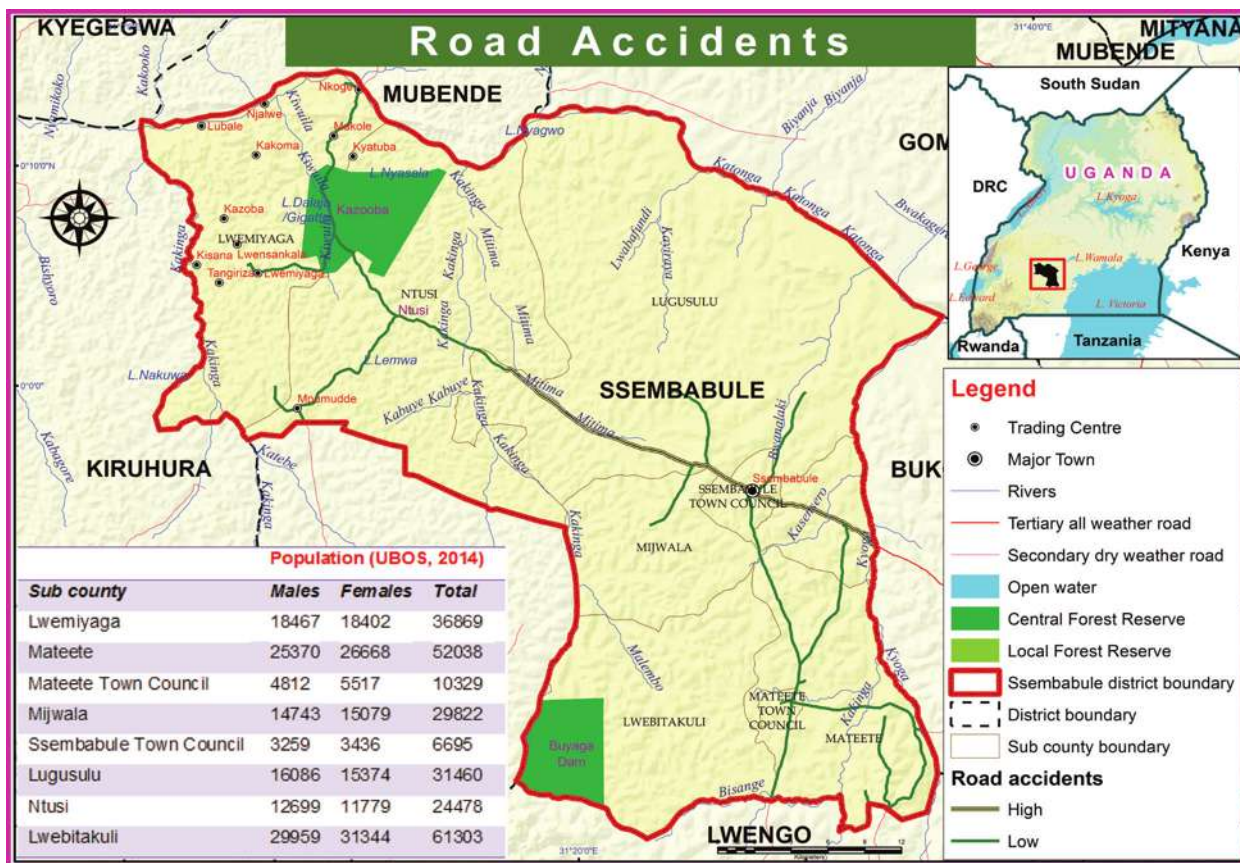


Figure 5: Road accidents distribution

3.2.12 Strong winds

The strong winds are normally experienced during the rainy season as compared to the dry season. The devastating winds occur during torrential rains and cause significant havoc in the social and economic wellbeing of the communities. The winds have become more rampant and severe simply because of high deforestation rates, wetland degradation, changes in the onset of rainy seasons and poor farming methods among others.

The occurrences and severity of strong winds are characterised with heavy showers, falling of crops, high rates of surface runoff, breakage of trees and destruction of houses. The winds are more common during the rainy season especially in the months of July, September, October, November and December of each seasonal year. The communities have become vulnerable due to lack of tree seedlings, unreliable seasonal weather forecasts and clearance of vegetation among others.

The strong winds have led to low crop yields, loss of life and property, increase in the occurrences of diseases, multiplication of invasive water weeds and low income levels etc. The most severe impacts have been reported in Lwebitakuli, Lwemiyaga, Lugusulu, Mijwala, Sembabule Town Council, Ntuusi and Mateete Sub counties (Figure 6).



Plate 7: Strong winds impact, Njalwe Primary School in Lwemiyaga Sub county, Lubaale parish

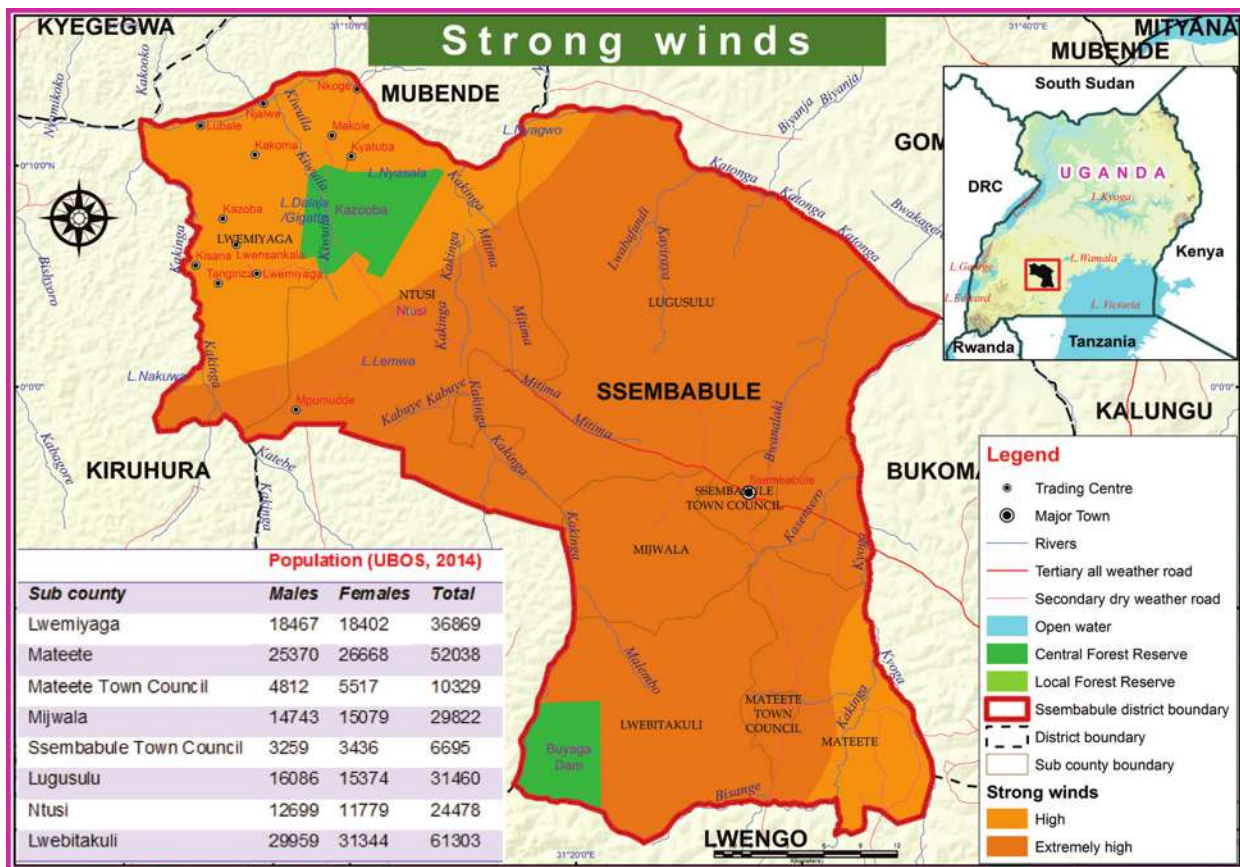


Figure 6: Strong winds levels

3.2.13 Flash floods

Sembabule District experiences flash floods that destroy several acres of crops and properties. In addition to erratic/heavy rainfall, wetland degradation, poor drainage and farming methods, siltation, unplanned settlement, deforestation and political pronouncements are the major causes of flash floods in the District. The District experiences a bi-model type of rainfall pattern. The floods occur in the months of April-May and September-November of each year. The rainfall patterns are largely influenced by neutral conditions of sea surface temperatures in the eastern and central equatorial Pacific Ocean, and the warming of sea surface temperatures in the western sector of equatorial Indian Ocean.

The wetlands are degraded in search to create cultivable fields for crop growing and establish settlements. In their happening, the wetland vegetation is cut down resulting into less absorption of excess water. The cultivation is responsible for the blockage of stream channels that cause excess water to inundate. In addition, the nature of clay soil type which exhibits hard soil structure does not easily allow runoff water to percolate resulting into stagnation of water.

The characteristics of flash floods is associated with water logging of crop fields, increment in water borne diseases (malaria, typhoid, cholera etc), submergence of roads and houses etc. However, seasonal predictions show that the District has a high chance of receiving near below normal rains. The factors that contribute to the vulnerability of households

include: ignorance, sub-standard agro inputs, and weak enforcement of wetland policies among others.

The adverse effects of flash floods include a reduction in household income levels, low crop yields, increased prices of staple foods, illness, destruction of water sources, displacement of families, destruction of roads, loss of human life, property and livestock. The phenomenon severely affects all the Sub counties in Sembabule District (figure 7).

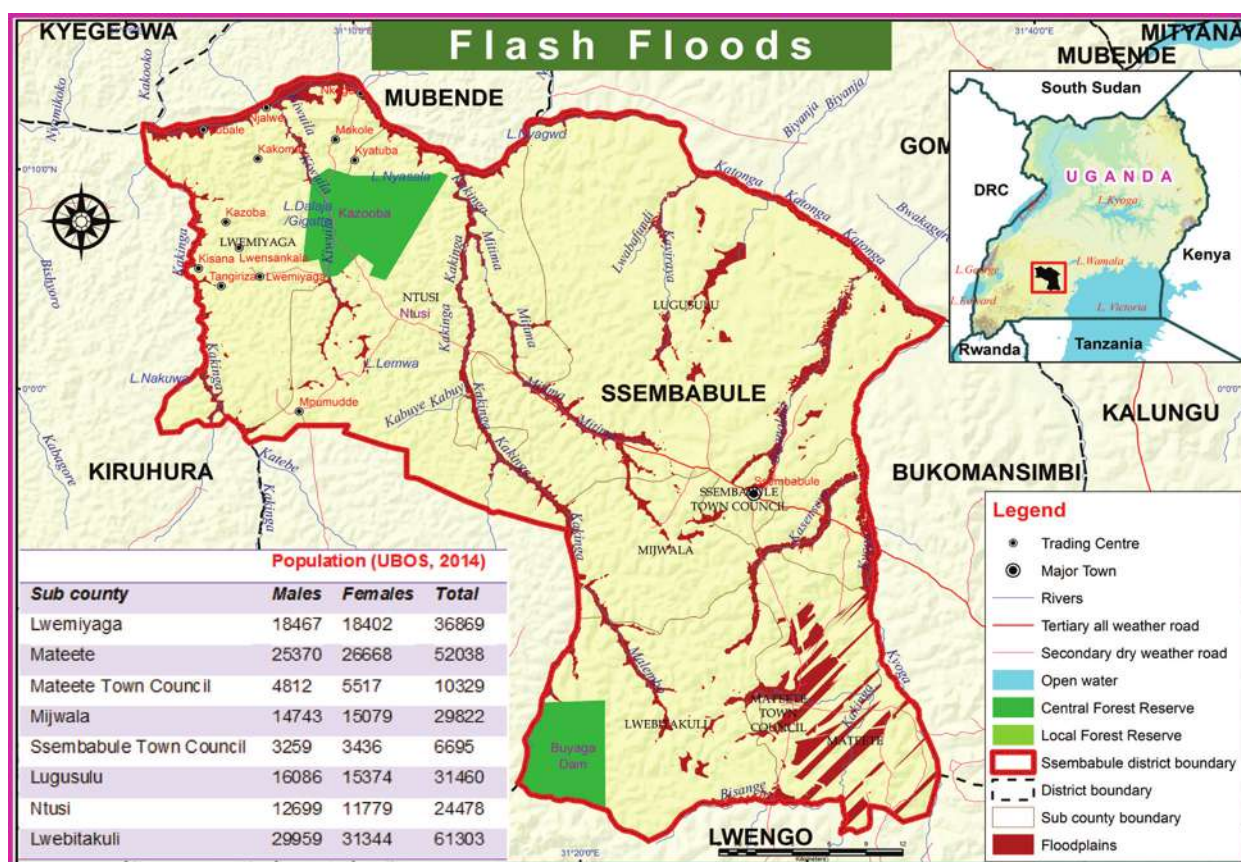


Figure 7: Flood prone/inundation areas

3.2.14 Lightning

Uganda has one of the highest rates of lightning strike deaths in the world. The incidences are attributed to changes in climate and weather patterns, construction of houses on high grounds, and loss of natural tree cover due to deforestation activities. In particular, the Lightning incidences are influenced by the unusual surge of the moist air from the Atlantic Ocean and Congo air-mass that occur during the rainy seasons.

The thunderbolt incidences are associated with the destruction of crops and vegetation, loss of life in human and livestock, heavy downpour and hailstorms. The incidences normally occur at the onset of the rainy season. These are frequent in the months of April-May and September-December of every year. The increase in vulnerability to Lightning cases is attributed to deforestation, degradation of hills and shift in seasons.

The strikes have resulted into the loss of household income, and loss of property. The deficiencies in soil moisture and water stress are highly reported in Lwebitakuli, Mateete, Mijwala and Lugusulu Sub counties in the District.



Plate 8: Lightning incidences

3.2.15 Human and wildlife conflicts

The human and wildlife conflicts are apparently on the increase primarily because of changes in weather patterns and increase in demand for land and vegetation related products. For example the high demand for charcoal has deprived wild animals of their habitats therefore making them to invade farmlands and people's homes in search for food and shelter.

The attacks area characterized by crop destruction, increase in disease incidences, death of wild animals (monkeys etc) and loss of human life. The conflicts are more common during the crop harvesting period of each year. The factors that contribute to the vulnerability of these conflicts include the types of crops grown, wetland degradation, deforestation, unclear boundaries of protected areas and population pressure.

The encounters have resulted into the loss of household income, reduction in tourism revenue, migration, illness, low crop yields and modification of local climate. The fatalities have been highly reported in Lugusulu, Lwemiyaga and Ntuusi Sub counties (figure 8).



Plate 9: Habitat for vermins in Kabehe Village-Katonga river in Ntuusi Sub county

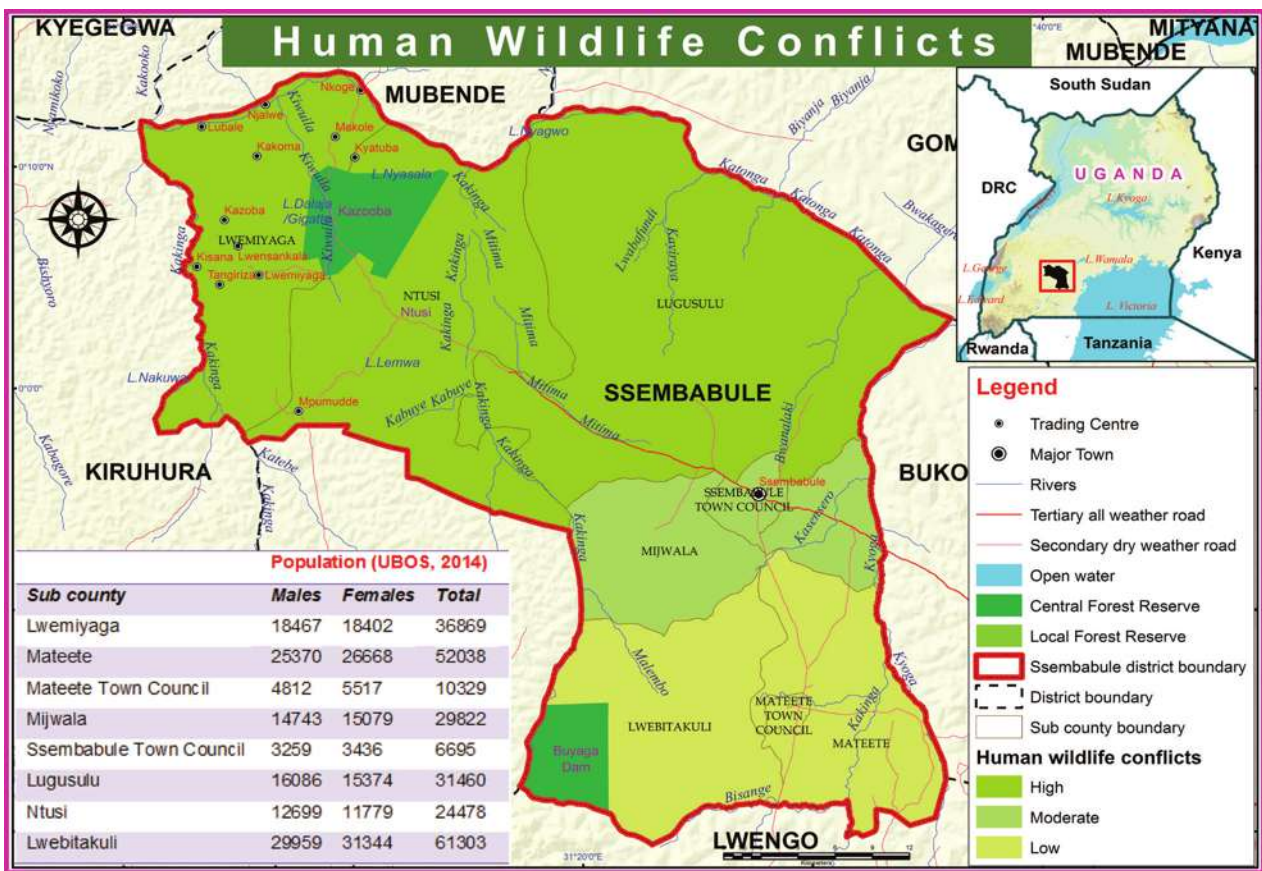


Figure 8: Human and wildlife conflicts

3.3 Multi-hazard adaptation responses

According to the key informant interviews and FGDs, indicated here below are responses undertaken by the communities to adapt to the multi-hazards.

Table 5: Multi-Hazard adaptation responses

No	Multi-Hazards	Adaptation Reponses	Recommendations
1	Floods	<ul style="list-style-type: none"> • Channeling water(trenches) • Installation of road culverts • Sensitization 	<ul style="list-style-type: none"> • Tree planting • Sensitization on wetland degradation • Wetland demarcation • Enforce buffer zone
2	Drought	<ul style="list-style-type: none"> • Tree planting • Planting drought resistant crops • Establishment of alternative income generating activities like business • Agro forestry • Food preservation and storage • Planting quick maturing seeds • Practicing conservation agriculture • Rain water harvesting 	<ul style="list-style-type: none"> • Provision of tree seedlings • Food relief • Construction of valley dams • Fund irrigation technologies • Diversify sources of livelihood • Construction of food storage facilities • Construction of more boreholes • Law enforcement on wetland degradation • Fund tree planting through NFA
3	Pests, parasites and Diseases	<ul style="list-style-type: none"> • Crop rotation • Spraying of vegetables • Vaccination of livestock • Treatment of animals • Using disease resistant varieties • Distribution of nets (mosquito and tsetse flies) 	<ul style="list-style-type: none"> • Recruitment of veterinary doctors at Sub county level • Subsidizing pesticides and vaccines • Sensitization on control measures • Provide improved breeds • Recruitment of more extension workers • Restrict trans Districts boundary animals and birds movement • Construction of valley dams
4	Invasive Species	<ul style="list-style-type: none"> • Mixed planting • Crop rotation • Uprooting • Planting resistant crops • Sensitization 	<ul style="list-style-type: none"> • More research on invasive species • Planting resistant improved seeds e.g in Maize Longe 7-H to control striga • Legislation on the movement of seeds • Provision of improved seedlings
5	Hailstorms	<ul style="list-style-type: none"> • Tree planting 	<ul style="list-style-type: none"> • Food and seedlings provision on occurrence • Provision of tree seedlings • Provision of weekly weather forecasts
6	Soil erosion	<ul style="list-style-type: none"> • Mixed cropping • Tree planting • Crop spacing • Growing of cover crops • Sensitization (farmer visits) • Minimum tillage 	<ul style="list-style-type: none"> • Sensitization of the farmers on proper farming methods • Agro-forestry • Provision of tree seedlings • Subsidize the costs of pesticides and fertilizers • Funding the community outreach department

7	Land Conflicts	<ul style="list-style-type: none"> • Law courts like Clan, LC's, magistrate courts • Demarcation of land • Acquisition of land titles • Sensitization 	<ul style="list-style-type: none"> • Reducing the costs involved in acquiring land titles • Sensitization of the community on land ownership • Consistency in buffering of wetlands, roads as per the act • Popularize the land policy • Quick judgments of land cases
8	Wetland degradation	<ul style="list-style-type: none"> • Sensitization on the dangers of encroaching wetlands • Wetland demarcation • Tree planting • Upland rice growing • Practicing conservation agriculture 	<ul style="list-style-type: none"> • Provision of highly yielding upland rice • Funding the community outreach department • Strict enforcement of wetland laws • Diversify sources of livelihood e.g. Apiary • Improved irrigation technologies • Demarcation of wetlands • Water harvesting for agriculture
9	Road accidents	<ul style="list-style-type: none"> • Law enforcement • Installation of road signs • Recommendations from the driving school for license acquisition • Road maintenance • Wearing reflectors and helmets 	<ul style="list-style-type: none"> • Enforcement of traffic laws • Frequent maintenance of roads • Prioritizing the permit licensing sector • Using reputable constructors • Screening boda-boda riders
10	Strong winds	<ul style="list-style-type: none"> • Tree planting • Planned constructions 	<ul style="list-style-type: none"> • Provision of tree seedlings • Sensitization of the community on a village level about tree planting • Construction of planned houses
11	Bush fires	<ul style="list-style-type: none"> • Sensitization • Fire lanes 	<ul style="list-style-type: none"> • Law enforcement • Increased sensitization
12	Human wildlife conflicts	<ul style="list-style-type: none"> • Community conservation areas • Use of scare crows • Demarcation of boundary • Conservation law enforcement • Involving Wildlife authority • Trapping and hunting 	<ul style="list-style-type: none"> • Equip vermin control staff • Conduct massive awareness campaigns • Sensitization of the community on the peak hours • Re-gazetting encroached wild life habitats • More resource allocation for sensitization • Increasing the surveillance and early warning systems
13	Deforestation	<ul style="list-style-type: none"> • Use of energy saving stores • Sensitization • Tree planting • Law enforcement and evictions • Gazetting and rehabilitation of forests 	<ul style="list-style-type: none"> • More sensitization • Law enforcement • More funds to the natural resource department • Provision of tree seedlings by NFA
14	Lightning	<ul style="list-style-type: none"> • Planting of trees • Installation of Lightning arrestors • Proper electrical installation 	<ul style="list-style-type: none"> • Subsidization of Lightning arrestors • Encourage tree planting • Law enforcement on the installations of arrestors • Early warning systems • Wetland demarcations

CHAPTER FOUR

4.1 Risk assessment

This table presents relative risk for multi-hazards to which the communities attached probability and severity scores.

Table 6: Risk assessment of multi-hazards for Sembabule District

	PROBABILITY	SEVERITY OF IMPACTS	RELATIVE RISK	VULNERABLE Sub counties
	<i>Relative likelihood this will occur</i>	<i>Overall Impact (Average)</i>	<i>Probability x Impact Severity</i>	
Hazard	1 = Not occur 2 = Doubtful 3 = Possible 4 = Probable 5 = Inevitable	1 = Very Low 2 = Low 3 = Moderate 4 = High 5 = Very High	1-10 = Low 11-20 = Moderate 21-25 = High	
Floods/ Runoffs	2	5	10	Mateete, Mijwala, Lugusulu, Lwemiyaga and Mateete T/C
Droughts	5	5	25	Lugusulu, Lwemiyaga, Mijwala, Ntuusi and Lwebitakuli
Hail storms	2	4	8	Lugusulu, Lwemiyaga, Mijwala, Mateete and Lwebitakuli
Pests, parasites and diseases	5	5	25	Lugusulu, Lwemiyaga, Mijwala, Mateete, Ntuusi and Lwebitakuli
Land conflicts	4	5	20	Lugusulu, Ntuusi, Lwemiyaga, Mijwala, Mateete and Lwebitakuli
Strong winds	2	3	6	Lugusulu, Lwemiyaga, Mijwala, Mateete and Lwebitakuli
Invasive species	3	4	12	Lugusulu, Ntuusi, Mijwala, Sembabule T/C, Mateete, Lwebitakuli and Lwemiyaga
Road, water accidents	3	4	12	Sembabule T/C, Mateete T/C and Mijwala
Soil erosion	5	5	25	Lugusulu, Ntuusi, Mijwala, Sembabule T/C, Mateete, Lwebitakuli and Lwemiyaga
Human wild life conflicts	3	4	12	Lugusulu, Ntuusi, Mijwala, Mateete, Lwebitakuli and Lwemiyaga
Bush fire	3	5	15	Lugusulu, Ntuusi, Mijwala, Sembabule T/C, Mateete, Lwebitakuli and Lwemiyaga
Wetland degradation	4	5	20	Lugusulu, Ntuusi, Mijwala, Sembabule T/C, Mateete, Lwebitakuli and Lwemiyaga
Deforestation	4	4	16	Lugusulu, Ntuusi, Mijwala, Sembabule T/C, Mateete, Lwebitakuli and Lwemiyaga
Lightning	4	4	16	Lugusulu, Ntuusi, Mijwala, Sembabule T/C, Mateete, Lwebitakuli, Lwemiyaga, Mateete T/C and Sembaule T/C

Key for Relative Risk

	High		Moderate		Low
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4.2 Occurrence and frequency of multi-hazards

The table below shows the years in record and recurrence intervals of multi-hazards reported by the respondents in the District (table 7).

Table 7: Frequency of multi-hazards

No	Multi-hazard	Number of Events (last 30 years)	No. years in record	Recurrence Interval per year (months/ seasons)	Hazard Frequency (%) Chance/year
1	Pests, parasites and diseases	30	1986-2016	12	40
2	Drought	20	1995-2016	2	20
3	Hailstorms	10	2006-2016	2	20
4	Bush fires	30	1986-2016	2	6
5	Invasive species	26	1990-2016	12	46
6	Human wildlife conflicts	30	1986-2016	12	40
7	Wetland degradation	30	1986-2016	12	40
8	Soil erosion	15	2001-2016	2	6
9	Strong winds	30	1986-2016	2	6
10	Land conflicts	30	1986-2016	12	40
11	Floods	19	1997-2016	2	10
12	Water, Road accidents	15	2001-2016	12	80
13	Deforestation	15	2001-2016	12	80

4.3 Elements at Risk and Vulnerability assessment

Vulnerability depends on low capacity to anticipate, cope with and/or recover from a disaster and is unequally distributed in a society. The vulnerability profile for Sembabule District was assessed based on exposure, susceptibility and adaptive capacity at Sub county and District levels highlighting their sensitivity to multi-hazards. Indeed, vulnerability was divided into biophysical (or natural including environmental and physical components) and social (including social and economic components) vulnerability. Whereas the biophysical vulnerability is dependent upon the characteristics of the natural system itself, the socio-economic vulnerability is affected by economic resources, power relationships, institutions or cultural aspects of a social system.

The assessment reveals that geomorphological and geological hazards inform of soil erosion; climatological or hydro-meteorological in the form of flash floods, hailstorms, drought, Lightning and strong winds; ecological or biological hazards in the form of pests, parasites and diseases, and invasive species; technological hazards in the form of road accidents and environmental hazards in the form of wetland degradation and land conflicts predispose the community to high vulnerability state in the Sembabule District (table 8).

Table 8: Components of vulnerability in Sembabule District

Vulnerability Components	Exposure	Elements at risk	Geographical Scale	Susceptibility	Geographical Scale	Resilience	Geographical Scale	
Social components	Hazards							
	Land conflicts	<ul style="list-style-type: none"> • Human population • Crops 	Sub county	<ul style="list-style-type: none"> • Loss of property • Displacement of people • Retards developments 	District	<ul style="list-style-type: none"> • Sensitise people on land developments and land use • Clearly demarcating and defining land owner ship • Court • Acquiring land titles 	District	
	Invasive species	<ul style="list-style-type: none"> • Crops • Livestock 	Sub county	<ul style="list-style-type: none"> • -Interfere with water transport. • -Loss crop yields 	Sub county	<ul style="list-style-type: none"> • Destruction of weeds through uprooting, burning and slashing • Bio control approach • Integrated pest management 	District	
	Soil erosion	<ul style="list-style-type: none"> • Human population • Crops • Infrastructures like roads 	District	<ul style="list-style-type: none"> • Stunted crop growth • Poor crop production • Siltation of water bodies • Decreased biodiversity • Decrease in soil fertility • Reduced water quality • Destruction of property 	District	<ul style="list-style-type: none"> • Tree planting • Sensitization • Soil and water conservation i.e. bridges, trenches, mulching • Restricting people to use lake shore lines 	District	
	pests, parasites and diseases	<ul style="list-style-type: none"> • Human and livestock populations • Crops 	District	<ul style="list-style-type: none"> • Loss of livestock and humans • Reduced livestock productivity • Complete crop failure • Stunted growth of crops 	District	<ul style="list-style-type: none"> • Vaccination • Spraying • Sensitization • Crop rotation • Planting disease resistant crops • Mosquito nets • Destruction of effected crops& animals • Alternative income sources • Crop rotation 	District	
	Hail storms	<ul style="list-style-type: none"> • Human and livestock populations • Crops 	District	<ul style="list-style-type: none"> • Complete crop failure • Stunted growth of crops 	District			District
	Wetland degradation	<ul style="list-style-type: none"> • Lakes • Crops • Human population 	District	<ul style="list-style-type: none"> • Flooding • Drying of water sources • Migration of wildlife • Diseases • Loss of water quality and quantity • Conflicts on water waters 	District	<ul style="list-style-type: none"> • Sensitisation through radios • Enforcement of wetland laws • Demarcation of wetlands • Prosecuting culprits to Court • Eviction 	District	



Social components	Water, Road accidents	Human and livestock populations	District	<ul style="list-style-type: none"> Disabilities after injuries 	District	<ul style="list-style-type: none"> Regular guidance by traffic officers Construction of humps and road signs Use of reflector jackets, Life jackets, seat belts and helmets Spot checks for alcoholism Sensitisation 	District
	Floods/Water logging	Human and livestock populations Crops Infrastructure including roads	Sub county	<ul style="list-style-type: none"> Diseases Loss of soil fertility Displacement of people Accidents Food insecurity 	Sub county	<ul style="list-style-type: none"> Raising of roads by use of culverts Eviction Awareness and trainings Wetland restoration 	District
	Drought	Human and livestock populations Crops	Sub county	<ul style="list-style-type: none"> Reduced crop and animal production Theft of food 	Sub county	<ul style="list-style-type: none"> Planting drought resistant crops Sensitization Water harvesting Mulching especially in banana plantations Tree planting Micro Irrigation 	District
	Human wild life conflicts	Crops -Human and livestock population	Sub county	<ul style="list-style-type: none"> Spread of diseases 	Sub county	<ul style="list-style-type: none"> Trapping Hunting Gazetting natural resources Involving UWA 	District
	Man-made fires	-Human and livestock populations	Sub county	<ul style="list-style-type: none"> Conflicts and mistrust 	Sub county	<ul style="list-style-type: none"> Install fire extinguishers Awareness Courts of law Witch craft 	District
	Deforestation	Human and livestock populations	Sub county	<ul style="list-style-type: none"> Loss of water quality Loss of fire wood 	Sub county	<ul style="list-style-type: none"> Tree planting Use alternative sources of fuel like bio gas Use of energy saving stoves Awareness Sensitisation 	Sub county
	Bush fires	Crops	Sub county	<ul style="list-style-type: none"> Soil erosion and its effect 	Sub county	<ul style="list-style-type: none"> Fire lanes Awareness 	Sub county
	Strong winds	Human and livestock populations Crops Infrastructure including homes, schools and hospitals Natural vegetation including trees	District	<ul style="list-style-type: none"> Increased plants, human and animal diseases Reduced production 	District	<ul style="list-style-type: none"> Afforestation Constructing planned houses 	District

Economic component	Invasive species	<ul style="list-style-type: none"> • Crops • Livestock 	Sub county	<ul style="list-style-type: none"> • Low income in the long run as a result of poor yield and low productivity • High costs of removal • Increased costs of production 	Sub county	<ul style="list-style-type: none"> • Destruction of weeds through uprooting, burning and slashing • Bio control approach • Integrated pest management 	District
	Land conflicts	<ul style="list-style-type: none"> • Human population 	Sub county	<ul style="list-style-type: none"> • Retards personal and community development • High court expenses 	District	<ul style="list-style-type: none"> • Sensitise people on land developments and land use • Clearly demarcating and defining land owner ship • Court • Acquiring land titles 	District
	Wetland degradation	<ul style="list-style-type: none"> • Lakes • Crops • Human population 	District	<ul style="list-style-type: none"> • Loss of income • Loss of government revenue 	District	<ul style="list-style-type: none"> • Sensitisation through radios • Enforcement of wetland laws • Demarcation of wetlands • Prosecuting culprits to Court • Eviction 	District
	pests, parasites and diseases	<ul style="list-style-type: none"> • Human and livestock populations • Crops 	District	<ul style="list-style-type: none"> • Loss of income • Loss of government revenue • Increased expenditure on pesticides and drugs 	District	<ul style="list-style-type: none"> • Vaccination • Spraying • Sensitization • Crop rotation • Planting disease resistant crops • Mosquito nets • Destruction of effected crops& animals • Alternative income sources • Crop rotation 	District
	Soil erosion	<ul style="list-style-type: none"> • Human population • Crops • Infrastructures like roads 	Sub county	<ul style="list-style-type: none"> • Loss of income • Loss of government revenue 	District	<ul style="list-style-type: none"> • Tree planting • Sensitization • Soil and water conservation i.e. bridges, trenches, mulching • Restricting people to use lake shore lines 	District
	Hailstorms	<ul style="list-style-type: none"> • Human and livestock populations • -Crops 	District	<ul style="list-style-type: none"> • Loss of income • Loss of government revenue 	District	<ul style="list-style-type: none"> • Planting drought resistant crops • Sensitization • Water harvesting • Mulching especially in banana plantations • Tree planting • Micro Irrigation 	District
	Drought	<ul style="list-style-type: none"> • Human and livestock populations • Crops 	Sub county	<ul style="list-style-type: none"> • Loss of income due to low productivity • Loss of government revenue 	Sub county	<ul style="list-style-type: none"> • Planting drought resistant crops • Sensitization • Water harvesting • Mulching especially in banana plantations • Tree planting • Micro Irrigation 	District



Economic component	Water, Road accidents	<ul style="list-style-type: none"> Human populations 	District	<ul style="list-style-type: none"> Loss of lives hence low incomes 	District	<ul style="list-style-type: none"> Regular guidance by traffic officers Construction of humps and road signs Use of reflector jackets, Life jackets, seat belts and helmets Spot checks for alcoholism Sensitisation 	District
	Water logging	<ul style="list-style-type: none"> Human and livestock populations Crops Natural vegetation Infrastructure including roads 	Sub county	<ul style="list-style-type: none"> Loss of income Loss of government revenue 	Sub county	<ul style="list-style-type: none"> Raising of roads by use of culverts Eviction Awareness and trainings Wetland restoration 	District
	Wetland degradation	<ul style="list-style-type: none"> Crops Human and livestock population 	District	<ul style="list-style-type: none"> Loss of biodiversity Reduced water quality Increased incidences of water borne diseases 	District	<ul style="list-style-type: none"> Tree planting along the wetland area Awareness 	District
	Human wild life conflicts	<ul style="list-style-type: none"> Crops Human and livestock population 	Sub county	<ul style="list-style-type: none"> Loss of income 	Sub county	<ul style="list-style-type: none"> Trapping Hunting Gazetting natural resources Involving UWA 	District
	Man-made fires	<ul style="list-style-type: none"> Human and livestock populations 	Sub county	<ul style="list-style-type: none"> Low income Loss of government revenue Increased costs for maintenance 	Sub county	<ul style="list-style-type: none"> Install fire extinguishers Awareness Witch craft 	District
	Deforestation	<ul style="list-style-type: none"> Human and livestock populations 	Sub county	<ul style="list-style-type: none"> Loss of government revenue 	Sub county	<ul style="list-style-type: none"> Tree planting Use alternative sources of fuel like bio gas Use of energy saving stoves Awareness Sensitisation 	Sub county
	Bush fires	<ul style="list-style-type: none"> Crops 	Sub county	<ul style="list-style-type: none"> Low income 	Sub county	<ul style="list-style-type: none"> Fire lanes Awareness 	Sub county
	Strong winds	<ul style="list-style-type: none"> Human and livestock populations Crops Infrastructure including homes, schools and hospitals Natural vegetation including trees 	District	<ul style="list-style-type: none"> Low income Loss of government revenue 	District	<ul style="list-style-type: none"> Afforestation Constructing planned houses 	District

Environmental component							
Invasive species	<ul style="list-style-type: none"> • Crops 	Sub county	<ul style="list-style-type: none"> • Loss and stunted growth of crops 	Sub county	<ul style="list-style-type: none"> • Destruction of weeds through uprooting, burning and slashing • Bio control approach • Integrated pest management 	District	
Land conflicts	<ul style="list-style-type: none"> • Crops • Human population 	District	<ul style="list-style-type: none"> • Destruction of crops 	District	<ul style="list-style-type: none"> • Sensitise people on land developments and land use • Clearly demarcating and defining land owner ship • Court • Acquiring land titles 	District	
Wetland degradation	<ul style="list-style-type: none"> • Lakes • Crops • Human population 	District	<ul style="list-style-type: none"> • Loss of bio diversity • Drying of water resources • climatic change 	District	<ul style="list-style-type: none"> • Sensitisation through radios • Enforcement of wetland laws • Demarcation of wetlands • Prosecuting culprits to Court • Eviction 	District	
Soil erosion	<ul style="list-style-type: none"> • Human population • Crops • Infrastructures like roads 	Sub county	<ul style="list-style-type: none"> • Loss of vegetation cover including trees and crops • Land degradation 	District	<ul style="list-style-type: none"> • Tree planting • Sensitization • Soil and water conservation i.e. bridges, trenches, mulching • Restricting people to use lake shore lines 	District	
pests, parasites and diseases	<ul style="list-style-type: none"> • Human and livestock populations • Crops 	District	<ul style="list-style-type: none"> • Loss of crops and animals 	District	<ul style="list-style-type: none"> • Vaccination • Spraying • Sensitization • Crop rotation • Planting disease resistant crops • Quarantine 	District	
Hailstorms	<ul style="list-style-type: none"> • Human and livestock populations • Crops 	District	<ul style="list-style-type: none"> • Loss of vegetation cover including trees and crops 	District		District	
Drought	<ul style="list-style-type: none"> • Human and livestock populations • Crops 	Sub county	<ul style="list-style-type: none"> • Stunted growth of crops • Loss of pasture 	Sub county	<ul style="list-style-type: none"> • Planting drought resistant crops • Sensitization • Water harvesting • Mulching especially in banana plantations • Tree planting • Micro Irrigation 	District	
Human wild life conflicts	<ul style="list-style-type: none"> • Crops • Human and livestock population 	Sub county	<ul style="list-style-type: none"> • Destruction of crops 	Sub county	<ul style="list-style-type: none"> • Trapping • Hunting • Gazetting natural resources • Involving UWA 	District	



Environmental component	Man-made fires	<ul style="list-style-type: none"> Human and livestock populations 	Sub county	<ul style="list-style-type: none"> Pollution 	Sub county	<ul style="list-style-type: none"> Install fire extinguishers Awareness Witch craft 	District
	Strong winds	<ul style="list-style-type: none"> Human and livestock populations Crops Infrastructure including homes, schools and hospitals Natural vegetation including trees 	District	<ul style="list-style-type: none"> Destruction of crops 	District	<ul style="list-style-type: none"> Afforestation Constructing planned houses 	District
	Deforestation	<ul style="list-style-type: none"> Human and livestock populations 	Sub county	<ul style="list-style-type: none"> Loss of biodiversity Soil degradation 	Sub county	<ul style="list-style-type: none"> Tree planting Use alternative sources of fuel like bio gas Use of energy saving stoves Awareness Sensitisation 	Sub county
	Bush fires	<ul style="list-style-type: none"> Crops 	Sub county	<ul style="list-style-type: none"> Loss of bio diversity Destruction of crops Migration of wildlife 	Sub county	<ul style="list-style-type: none"> Fire lanes Awareness 	Sub county
	Water logging	<ul style="list-style-type: none"> Human and livestock populations Crops Natural vegetation Infrastructure including roads 	District	<ul style="list-style-type: none"> Loss of bio diversity Destruction of crops 	Sub county	<ul style="list-style-type: none"> Raising of roads by use of culverts Eviction Awareness and trainings Wetland restoration 	District
	Invasive species	<ul style="list-style-type: none"> Crops Livestock 	Sub county	<ul style="list-style-type: none"> Low fish production Harbours snakes and crocodiles Blocks transport 	Sub county	<ul style="list-style-type: none"> Destruction of weeds through uprooting, burning and slashing Bio control approach Integrated pest management 	District
	pests, parasites and diseases	<ul style="list-style-type: none"> Human and livestock populations Crops 	District	<ul style="list-style-type: none"> Loss of livestock and humans Complete crop failure Stunted growth of crops 	District	<ul style="list-style-type: none"> Vaccination Spraying Sensitization Crop rotation Planting disease resistant crops Mosquito nets Destruction of effected crops& animals Alternative income sources Crop rotation 	District

Physical components	Wetland degradation	<ul style="list-style-type: none"> Lakes Crops Human population 	District	<ul style="list-style-type: none"> Drying of water sources Bio diversity destruction 	District	<ul style="list-style-type: none"> Sensitisation through radios Enforcement of wetland laws Demarcation of wetlands Prosecuting culprits to Court Eviction 	District
	Soil erosion	<ul style="list-style-type: none"> Human population Crops Infrastructures like roads 	District	<ul style="list-style-type: none"> Stunted crop growth Siltation of water bodies Decreased biodiversity Destruction of property 	District	<ul style="list-style-type: none"> Tree planting Sensitization Soil and water conservation i.e. bridges, trenches, mulching Restricting people to use lake shore lines 	District
	Water, Road accidents	<ul style="list-style-type: none"> Human and livestock populations 	District	<ul style="list-style-type: none"> Human deaths 	District	<ul style="list-style-type: none"> Regular guidance by traffic officers Construction of humps and road signs Use of reflector jackets, Life jackets, seat belts and helmets Spot checks for alcoholism Sensitisation 	District
	Hailstorms	<ul style="list-style-type: none"> Human and livestock populations Crops 	District	<ul style="list-style-type: none"> Loss of livestock Complete crop failure Stunted growth of crops 	District		District
	Land conflicts	<ul style="list-style-type: none"> Human population Crops 	Sub county	<ul style="list-style-type: none"> Loss of property Displacement of people 	District	<ul style="list-style-type: none"> Sensitise people on land developments and land use Clearly demarcating and defining land owner ship Court Acquiring land titles 	District
	Drought	<ul style="list-style-type: none"> Human and livestock populations Crops 	Sub county	<ul style="list-style-type: none"> Loss of vegetation cover Lowering of water levels Death of livestock Scarcity of water Proliferation of livestock diseases Limited pasture 	Sub county	<ul style="list-style-type: none"> Planting drought resistant crops Sensitization Water harvesting Mulching especially in banana plantations Tree planting Micro Irrigation 	District
	Floods/Water logging	<ul style="list-style-type: none"> Human and livestock populations Crops Infrastructure including roads 	Sub county	<ul style="list-style-type: none"> Loss of lives Destruction of roads Displacement of people Destruction of property 	Sub county	<ul style="list-style-type: none"> Raising of roads by use of culverts Eviction Awareness and trainings Wetland restoration 	District



Physical components	Human wild life conflicts	<ul style="list-style-type: none"> • Crops • -Human and livestock population 	Sub county	<ul style="list-style-type: none"> • Death of people • Destruction of property 	Sub county	<ul style="list-style-type: none"> • Trapping • Hunting • Gazetting natural resources • Involving UWA 	District
	Man-made fires	<ul style="list-style-type: none"> • -Human and livestock populations 	Sub county	<ul style="list-style-type: none"> • Destruction of crops • Loss of property 	Sub county	<ul style="list-style-type: none"> • Install fire extinguishers • Awareness • Witch crafts 	District
	Strong winds	<ul style="list-style-type: none"> • Human and livestock populations • Crops • Infrastructure including homes, schools and hospitals • Natural vegetation including trees 	District	<ul style="list-style-type: none"> • Destruction of crops and properties 	District	<ul style="list-style-type: none"> • -Afforestation • -Constructing planned houses 	District
	Deforestation	<ul style="list-style-type: none"> • Human and livestock populations 	Sub county	<ul style="list-style-type: none"> • Wildlife conflicts • Soil erosion 	Sub county	<ul style="list-style-type: none"> • Tree planting • Use alternative sources of fuel like bio gas • Use of energy saving stoves • Awareness • Sensitisation 	Sub county
	Bush fires	<ul style="list-style-type: none"> • Crops 	Sub county	<ul style="list-style-type: none"> • Loss of bio diversity • Destruction of crops • Migration of wildlife 	Sub county	<ul style="list-style-type: none"> • Fire lanes • Awareness 	Sub county
	Wetland degradation	<ul style="list-style-type: none"> • Lakes • Crops • Human population 	District	<ul style="list-style-type: none"> • Bio diversity destruction • Low arts and crafts production • Conflicts on water waters 	District	<ul style="list-style-type: none"> • Sensitisation through radios • Enforcement of wetland laws • Demarcation of wetlands • Prosecuting culprits to Court • Eviction 	District

CONCLUSION AND RECOMMENDATION

It was established that Sembabule District has over the last 32 years increasingly experienced multi-hazards including floods, drought, invasive species, Lightning, strong winds, human and wildlife conflicts, pests, parasites and diseases for crops and livestock, soil erosion, land conflicts, wetland degradation, road accidents and hailstorms putting livelihoods at increased risk. The limited adaptive capacity (and or/resilience) and high sensitivity of households and communities in Sembabule District increase their vulnerability to multi-hazard exposure necessitating urgent external support.

The multi-hazards that are experienced in Sembabule District can be classified as:

- i. Geomorphological and geological hazards including soil erosion
- ii. Climatological or hydro-meteorological including flash floods, hailstorms, Lightning, drought and strong winds
- iii. Ecological or biological hazards including pests, parasites and diseases, human and wildlife conflicts and invasive species
- iv. Technological hazards including road accidents
- v. Environmental hazards including wetland degradation, deforestation and land conflicts

However, reducing vulnerability at community, Local Government and National Levels should be a threefold effort hinged on:

- i. Reducing the impact of the hazard where possible through mitigation, prediction, early warning and preparedness
- ii. Building capacities to withstand and cope with the hazards and risks
- iii. Tackling the root causes of the vulnerability such as poverty, poor governance, discrimination, inequality and inadequate access to resources and livelihood opportunities

Recommended policy actions that should target vulnerability reduction include:

- i. Improved enforcement of policies aimed at enhancing sustainable environmental health;
- ii. Increased awareness campaigns aimed at sensitizing farmers/communities on disaster risk reduction initiatives and practices.
- iii. Revival of disaster risk management committees at the District levels
- iv. Support extensive research on the occurrence and frequency of disasters prior to disaster management
- v. Improve the communication channel between the Disaster Department and Local Communities
- vi. Office of the Prime Minister should decentralise their activities at the District level
- vii. OPM should strengthen the District Disaster Management Committees by developing guidelines and trainings
- viii. Establishment of disaster fund at the District levels

- ix. Fund and equip recruited extension works
- x. Establish a fund aimed at Disaster Preparedness and Management at District levels
- xi. Increase funding and staff to monitor wetland degradation and non-genuine agro-inputs
- xii. Support establishment of a disaster risk early warning systems
- xiii. Provide support in form of free seedlings to promote afforestation and reforestation programmes
- xiv. Cancellation of land titles in protected areas such as wetlands
- xv. Formulation of relevant ordinances/ Bye – laws by the Sembabule District Local Government.

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Department of Relief, Disaster
Preparedness and Management
Office of the Prime Minister
P.O.Box 371, Kampala, Uganda

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Plot 11 Yusuf Lule, Road, Nakasero
P. O. Box 7184, Kampala, Uganda
Tel: (+256) 417 112 100
Fax: (+256) 414 344 801
www.undp.org