THE REPUBLIC OF UGANDA

# Jinja District

## Hazard, Risk and Vulnerability Profile

2016

## Acknowledgement

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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My appreciation also goes to Jinja District Team:

| | | | |
|---|---|---|---|
| 1. | Mrs. Olive Hope Nakyanzi | – | Chief Administrative Officer |
| 2. | Mr. Maganda Moses | – | Environment Officer |
| 3. | Mrs. Hajira Lubanga | – | Information Officer |
| 4. | Mr. Baruzalire Fredrick | – | Natural Resources 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 counteract 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 and 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 moving the disaster management paradigm from the traditional emergency response focus toward 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 on the shores of L. Victoria in the Eastern Region of Uganda It borders the District of Iganga and Kamuli in the North, Buikwe in the south-west, Kayunga in the West, Mayuge in the East and Lake Victoria in the south. Most of the District stands at an approximate altitude of between 1143m and 1376m above sea level in an equatorial climate belt, which extends 30km -40km from Lake Victoria. It receives plenty of rain fall and has high temperatures throughout the year.

The vegetation in the District has minor variations, for areas bordering with Lake Victoria have Savannah vegetation while the central part has forest / savannah mosaic. Presently the main economic activities in Jinja Municipality comprise of commercial activities that take place in the Central Business District (CBD) where markets, supermarkets, wholesale and retail shops, commercial institutions, industries, service shops, workshops and garages are found. Commerce is the dominant component of the economy followed by the Service Sector, Manufacturing Sector, Construction and then Agriculture.

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 Jinja 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, drought and strong winds
iii. Ecological or biological hazards including; pests, parasites and diseases, and invasive species
iv. Technological hazards including; road accidents
v. Environmental including; wetland degradation 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

| | | |
|---|---|---|
| **DLG** | : | District Local Government |
| **DPP** | : | District Development Plan |
| **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 moving the disaster management paradigm from the traditional emergency response focus toward 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 atlas of hazard, risk and vulnerability conditions in the country to engage mainstreaming of disaster and 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 “Carryout 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 analyse field data using GIS in close collaboration and coordination with OPM in Jinja 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 Jinja District

Jinja district is located on the shores of L. Victoria in the Eastern Region of Uganda It borders the District of Iganga and Kamuli in the North, Buikwe in the south-west, Kayunga in the West, Mayuge in the East and Lake Victoria in the south. It is the western portion of the former Busoga District area: 722.7sqkm. The District Headquarters are located at Busoga Square within Jinja Municipality. Jinja (Administrative headquarters): Trading Centers-Bugembe, Buwenge and Kakira.

Most of the District stands at an approximate altitude of between 1143m and 1376m above sea level in an equatorial climate belt, which extends 30km -40km from Lake Victoria. It receives plenty of rain fall and has high temperatures throughout the year. Owing to the absence of marked dry season, the vegetation is predominantly tropical rain forest. Jinja District has a tropical climate with comparatively small seasonal variations of temperatures, humidity and wind throughout the year. The district receives rainfall of about 1200 - 1500 mm per annum, which is well distributed with peaks in March to May and October to November. There are two relatively dry seasons between December to March and another one from June to July. There is enough rainfall throughout the year to sustain man and animal except in very rare circumstances. Temperatures vary from a maximum daily temperature of 29 degrees Celsius in January to a minimum daily temperature of 27 degrees Celsius in July. The monthly average minimum Temperature range from 16 degrees Celsius to18 degrees Celsius.

The vegetation of Jinja District, like the rest of Uganda, has suffered from pressure created by the rapid population growth and the demand for fuel and space for man's activities. The vegetation in the District has minor variations, for areas bordering with Lake Victoria have Savannah vegetation while the central part has forest / savannah mosaic. Nearer the Kakira Sugar Estates and the area bordering Victoria Nile have medium altitude moist semi-deciduous forests. The District falls in a vegetation zone described as albizia, Chlorophora, Semi-deciduous forest. There are a few isolated patches of forest left in some of the valleys, mid and lower slopes. There are riverine forests along the Nile River and elsewhere; grasses such as Pennisetum Purpureus and Hparuhemia rufa dominate.

Presently the main economic activities in Jinja Municipality comprise of commercial activities that take place in the Central Business District (CBD) where markets, supermarkets, wholesale and retail shops, commercial institutions, industries, service shops, workshops and garages are found. Commerce is the dominant component of the economy followed by the Service Sector, Manufacturing Sector, Construction and then Agriculture. The greatest concentrations of commercial activities occur in the Town Centre especially along Main Street. However, it is important to note that 25% 0f the working population is involved in public services, 18% in agricultural services,, 13% in the manufacturing sector and 8% in the financial institutions

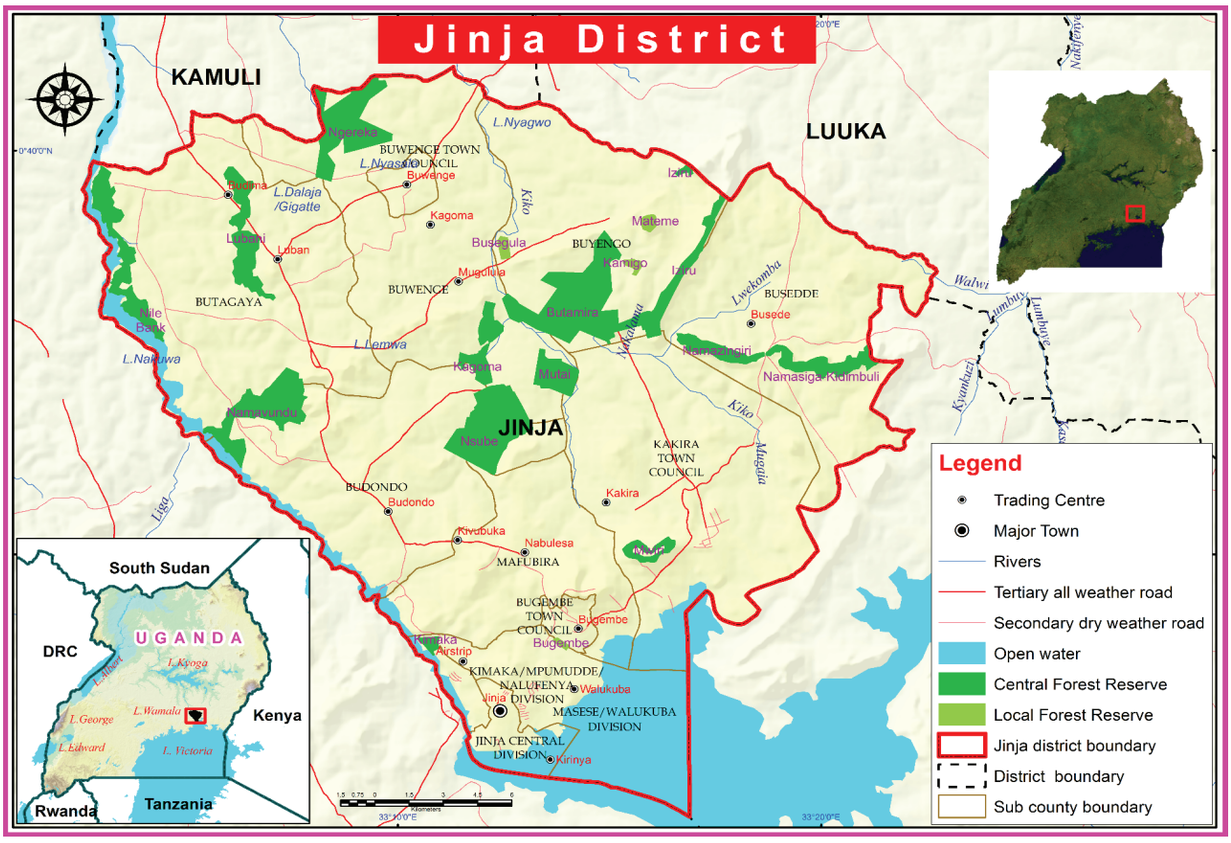


**Figure 1: Jinja District Map**

# 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: Budondo and Mafubira. 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 characterized 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 dataset included GPS coordinates while the secondary datasets were satellite images, land use/cover maps, digital elevation model, population and hydrological maps.
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. This profile was certified by the district representative 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 Jinja District can be classified as:

i. Geomorphological and geological hazards including soil erosion
ii. Climatological or hydro-meteorological including flash floods, hailstorms, lightning and drought
iii. Ecological or biological hazards including pests, parasites and diseases, and invasive species
iv. Technological hazards including road accidents, pollution
v. Environmental hazards including wetland degradation, fires 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 Hailstorms

The occurrence and severity of hailstorms are a frequent phenomenon in Jinja 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. In addition to increasing surface rainfall runoff, they also clog water channels. 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 firewood for brick making, domestic use, provision of energy in factories and institutions and timber for construction.

The famers are vulnerable to the effects of hailstorms due to the massive clearance of trees, limited availability of tree seedlings, unreliable seasonal weather forecasts and limited agro input 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. The episodes affect Busedde, Buwenge, Bugembe, Butagaya and Buwenge town council in the district (figure 2).

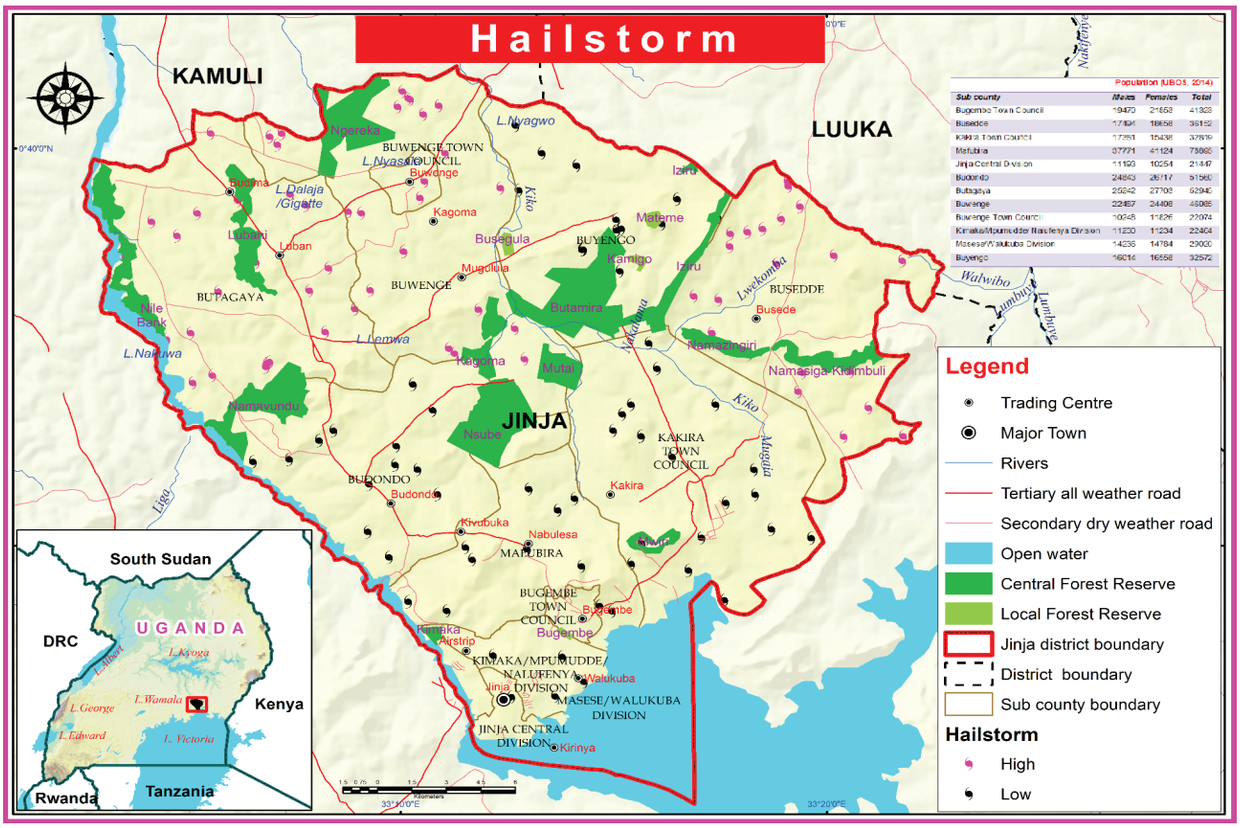


**Figure 2: Distribution of hailstorms**

### 3.2.3 Wetland degradation

The wetland types found in Jinja District are characteristized as papyrus, palms and thickets, bushlands, grasslands (MWE, 2009). The wetland systems are under continual threats from the increasing rate of encroachment for wetland products and services. The wetlands are utilised as livestock grazing fields, extraction of building materials, crop growing, fishing and firewood among others.

The major causes of wetland degradation include land shortage, drought, reduced soil fertility, political interference, soil erosion, drought, poor farming methods, assumed ownership, change in land use, ignorance, resource conflicts, brick making, sand mining, seasonal fires, over harvesting and invasion by invasive species (Plate1).

**Plate 1 : Rice growing in Bugembe Town Council**

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.

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 (figure 3).

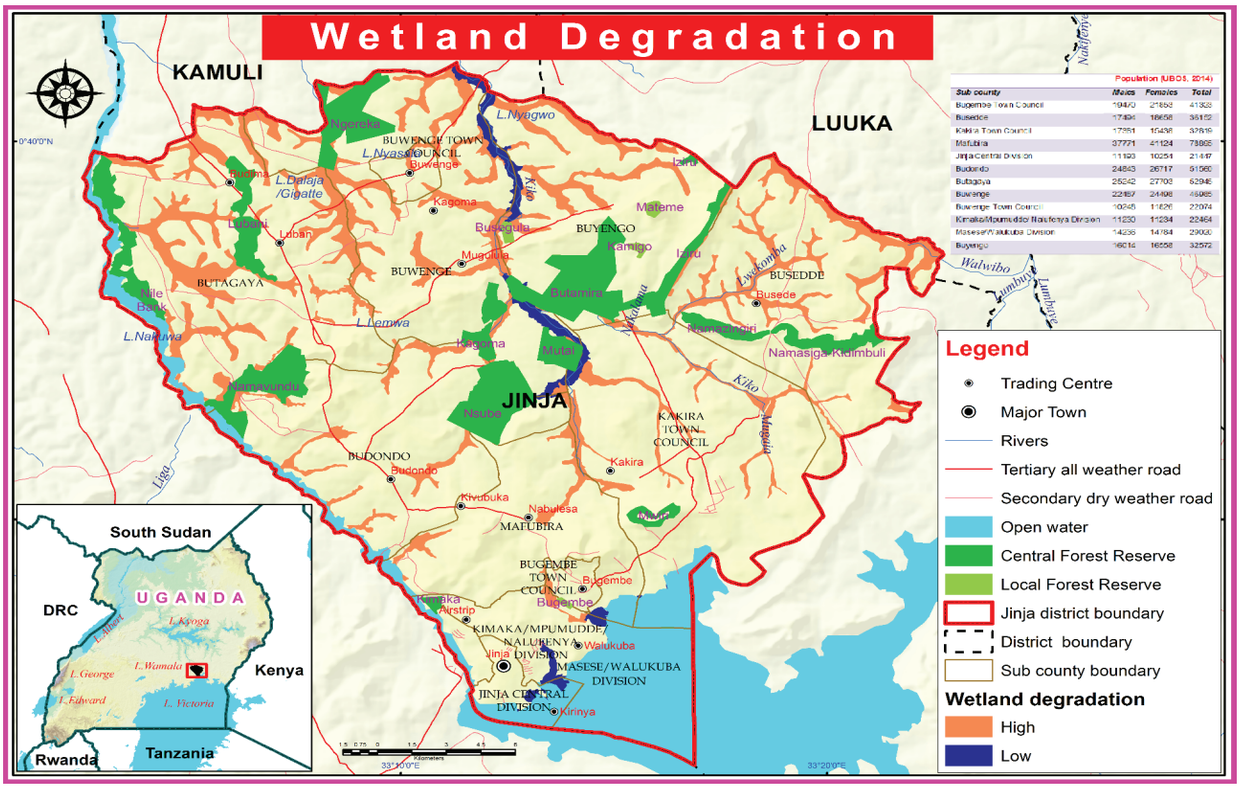


**Figure 3: Levels of wetland degradation**

### 3.2.4 Pests, parasites and diseases

The occurrence, severity, frequency and distribution of Pests, parasites and diseases are high as compared to the last 10 years in the district. In crop production, the farmers are engaged in the growing of cassava, beans, groundnuts, rice, potatoes, millet maize and Bananas, coffee as food and cash crops, however, their production has drastically reduced over time due to increasing and emergence of new crop pests and diseases.

**Plate 2: Eggplant bacterial wilt in Mafubira**

The high pest and disease incidences in crops is mainly attributed to changes in weather patterns, deforestation, inadequate extension services, inadequate regulation and surveillance, trans-boundary movement, soil exhaustion, type of crop grown (cereals), poor farming methods, high costs of pesticides, substandard pesticides and poor storage facilities. The changes in weather patterns favours 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 seeds and seedlings, substandard pesticides and limited extension services. The adverse effects include low crop yields, low income levels, build-up of pests and soil degradation among others. Some of the notable Pests, parasites and diseases are indicated here below (table 4). The effects of Pests, parasites and diseases were evident in all the sub counties (figure 4).

**Table 4: Major pests and diseases**

| No | Crops | Pests and diseases |
|---|---|---|
| 1 | Cassava | Cassava brown streak disease, cassava mosaic |
| 2 | Groundnuts | Groundnut rosette, Leaf miner |
| 3 | Maize | Stem borers, maize smurt, maize streak |
| 4 | Sorghum | Striga, sorghum midge, stem borers, sorghum shoot fly |
| 5 | Cowpeas | Aphids |
| 6 | Soybean | Web worm, rust |
| 9 | Bananas | Banana Bacterial Wilt, banana weevils, sigatoka |
| 10 | Tomatoes | Tomato Blight |
| 11 | Rice | Stem borers, rice yellow mortal virus, birds |
| 12 | Beans | Aphids |
| 13 | Citrus | Rot, fruit-fly, hard scab |
| 14 | Coffee | Coffee wilt disease, coffee twig borer |

In livestock production, the occurrences of parasites and diseases was basically caused by ignorance, poor on-farm management, deforestation, 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 products, slow growth in livestock and encroachment of marginal lands such as wetlands among others.

The predictability of the parasites and diseases is on the increase of each year. The livestock keepers are apparently vulnerable due to sub-standard pesticides, unreliable weather patterns, limited extension services, water and pasture.

The adverse effects of livestock parasites and diseases include: loss of livestock, reduced household income levels, loss of revenue to the district, illness and human death. Some of the notable parasites and diseases included ticks, worms, and mites in poultry, New castle, Swine fever, East Coast fever, and foot and mouth disease among others. The livestock parasite and disease incidences are reported in all the sub counties (figure 4).

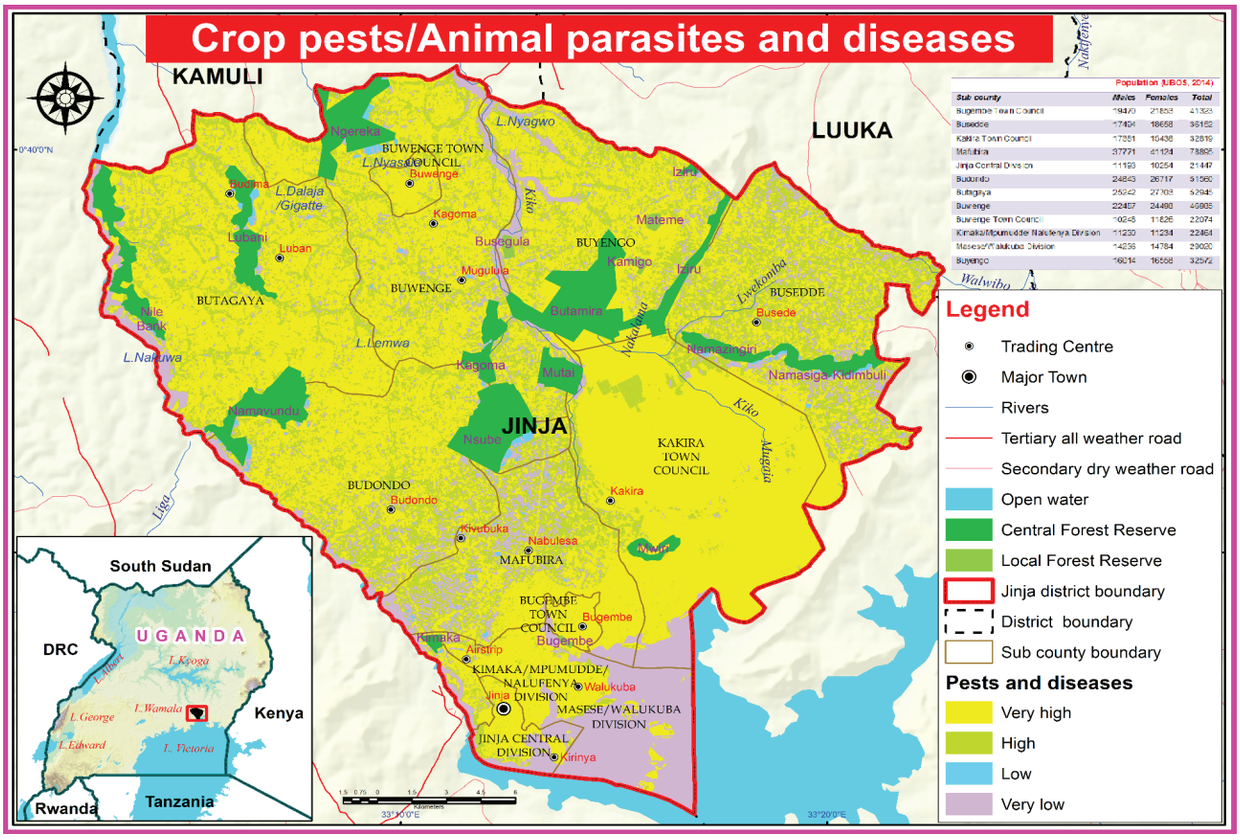


**Figure 4: Distribution of pests, parasites and diseases**

### 3.2.5 Drought

Drought has been more severe in the last five years. 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, 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 Jan – 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, 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, transactional sex for food, illness and loss of livestock. The severity and distribution of drought affects all the sub counties.

### 3.2.6 Soil erosion

The 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, gulley and sheet erosion. Soil erosion is principally triggered by poor farming methods, over grazing, 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 low lying flood prone areas.

**Plate 3: Soil Erosion in Masese Division**

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, introduction of new invasive species and famine. The occurrences and severity of soil erosion equally affects all the sub counties in the district (figure 5).

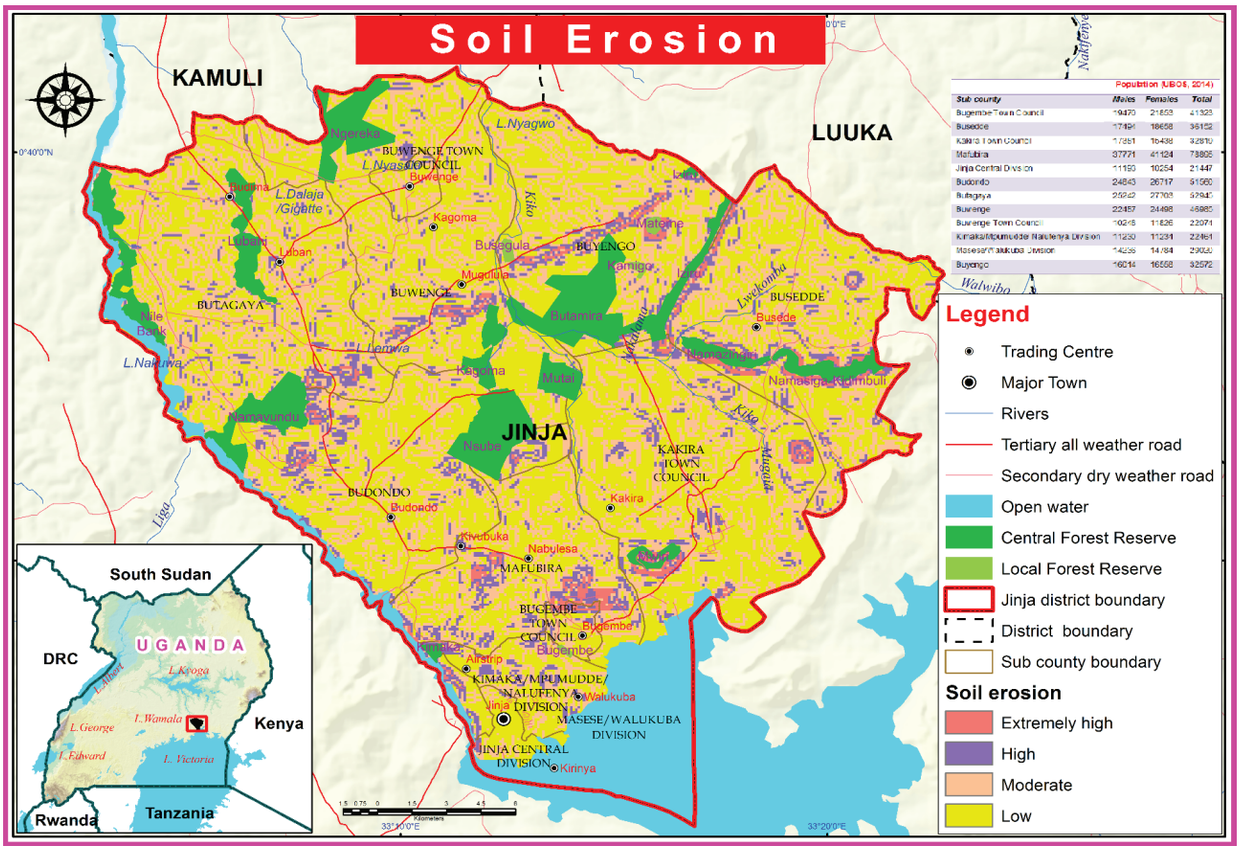


**Figure 5 : Soil erosion prone areas**

### 3.2.7 Land conflicts

Land conflicts have now become rampant in the district for the last 10 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 severe in all sub counties (figure 6).

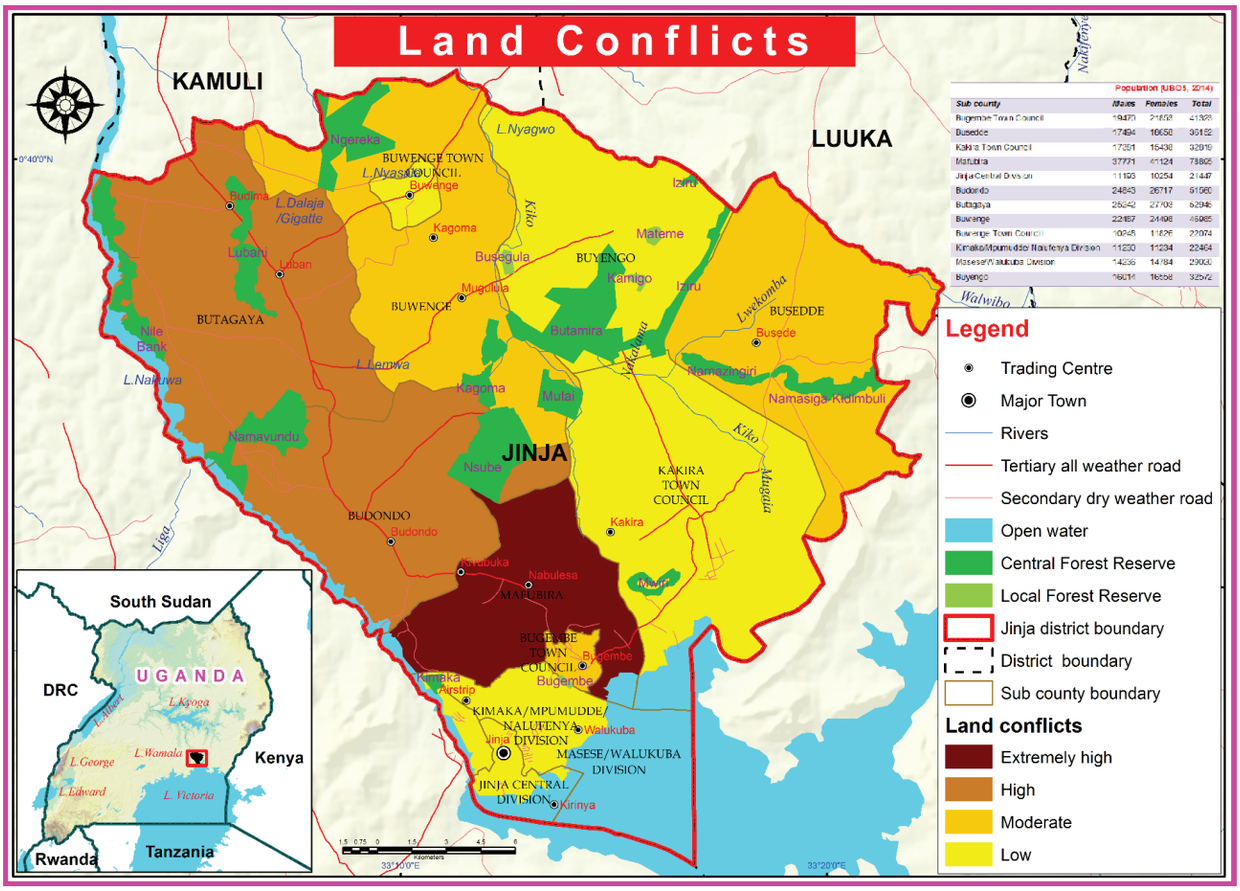


**Figure 6: Severity of land conflicts**

### 3.2.8 Road and water accidents

Road and water accidents have claimed 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, 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, motorcycles and boats. The water accidents are largely caused by strong winds and Hippos in the water bodies.

The road and water accidents are associated with injuries, disabilities 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 and establishment of road markets among others.

The notable effects of road and water 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 7).

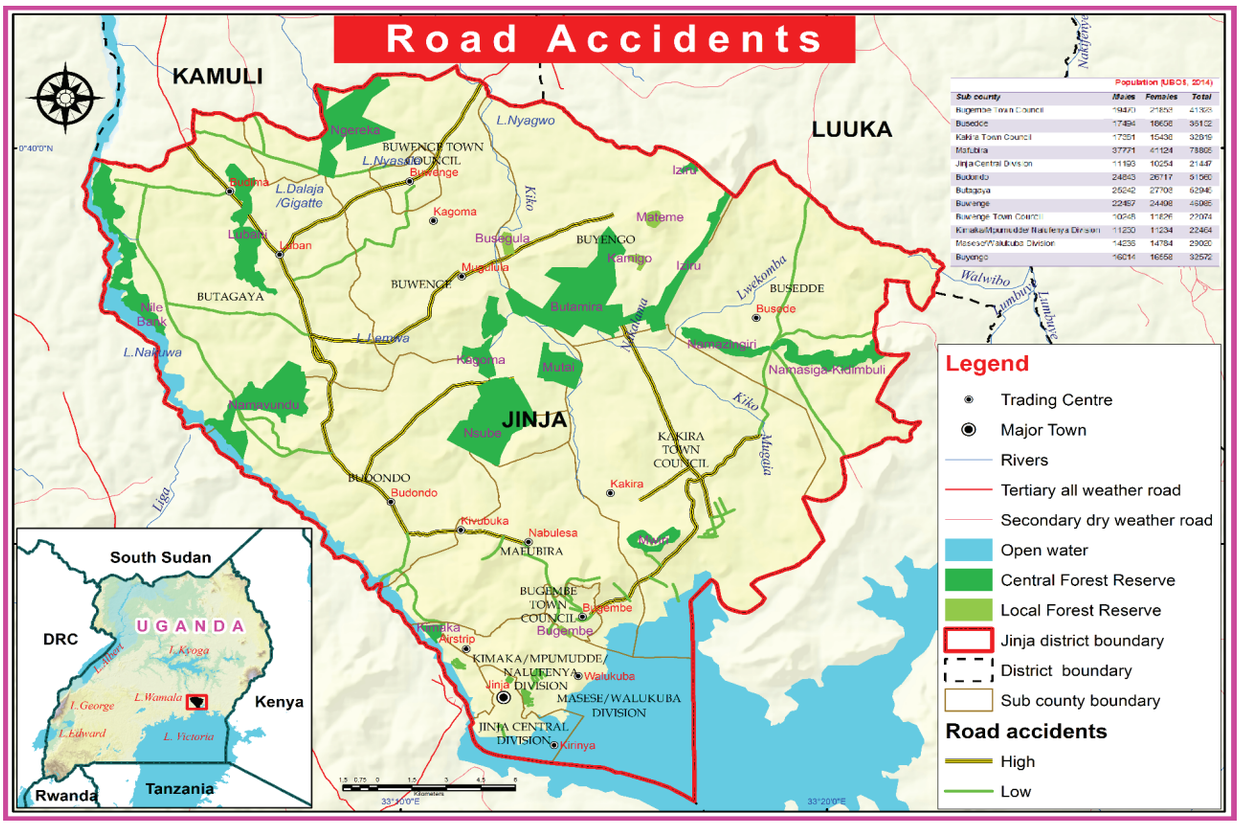


**Figure 7: Road and water accidents distribution**

### 3.2.9 Man Made fires

The district experiences a series of man-made fires that ravage people's lives and property. The disastrous fires are caused with the aim to cause damage and losses to the offended. The fires are largely caused due to hatred, negligence, electric short circuits and indiscipline. The fires in some cases are triggered by storing inflammable liquids in the houses and unplanned settlements.

The scenes are characterized by loss of property, lives and air pollution. The eventualities are more common in the municipality (e.g. schools, markets, houses, factories etc) than the outskirt areas especially during the dry season.

The communities are vulnerable to the fires primarily because of lack of early warning systems, delayed responses by fire brigades, woody building materials, congestion and creation of slums. As a result, the fires have caused loss of income, reduction in municipality revenue and displacement of people among others. The severe sub counties include: Butagaya , Kakira town council, Buwenge town council, and Bugembe town council.

### 3.2.10 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 serge 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, loss of property and drought. The deficiencies in soil moisture and water stress are highly reported in Busedde and Budondo a sub counties.

**Plate 4: Lightning**

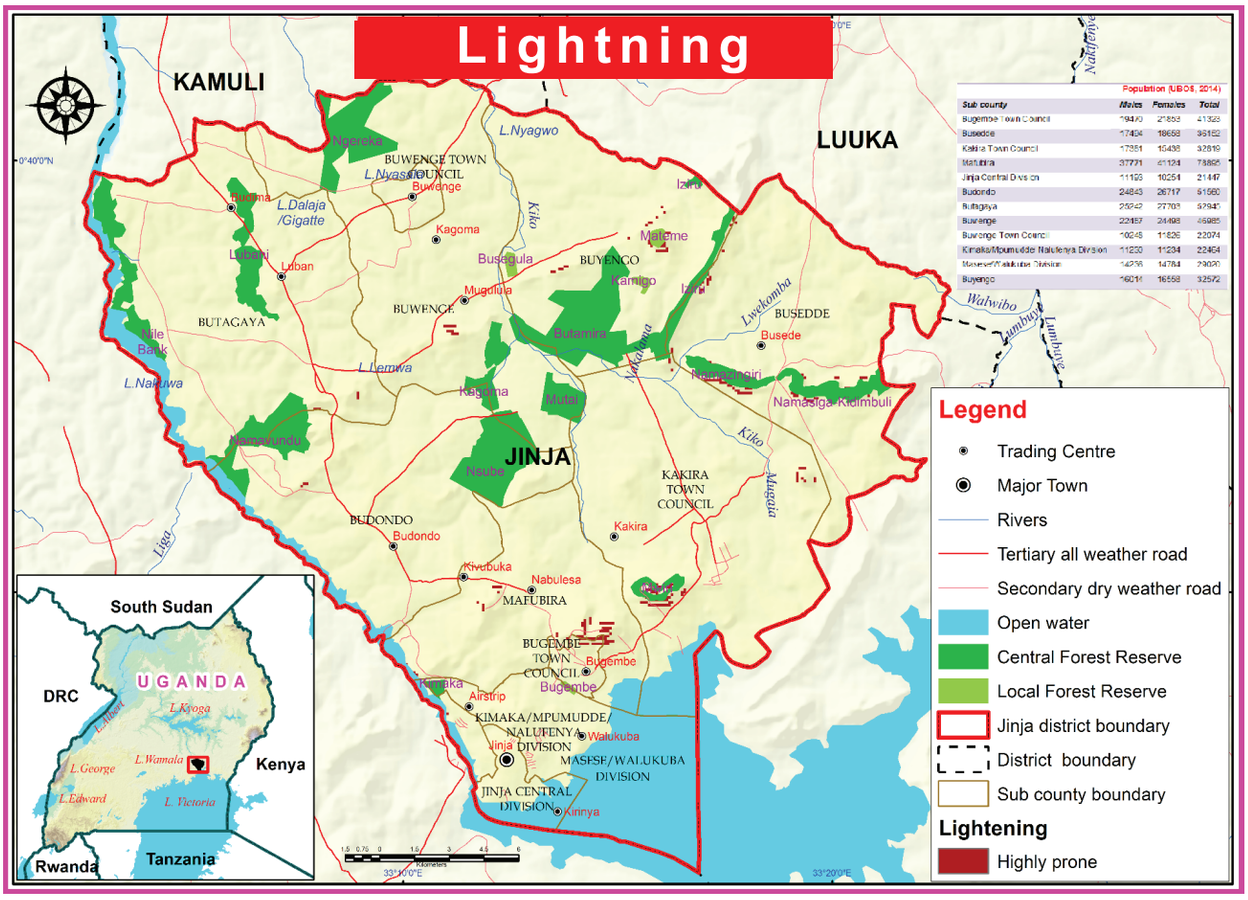


**Figure 8: Lightning prone areas**

### 3.2.11 Flash floods

Jinja district experiences flash floods that destroy several acres of crops and properties. The district lies in the Lake Victoria floodplain. 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 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 Jinja District (figure 9).

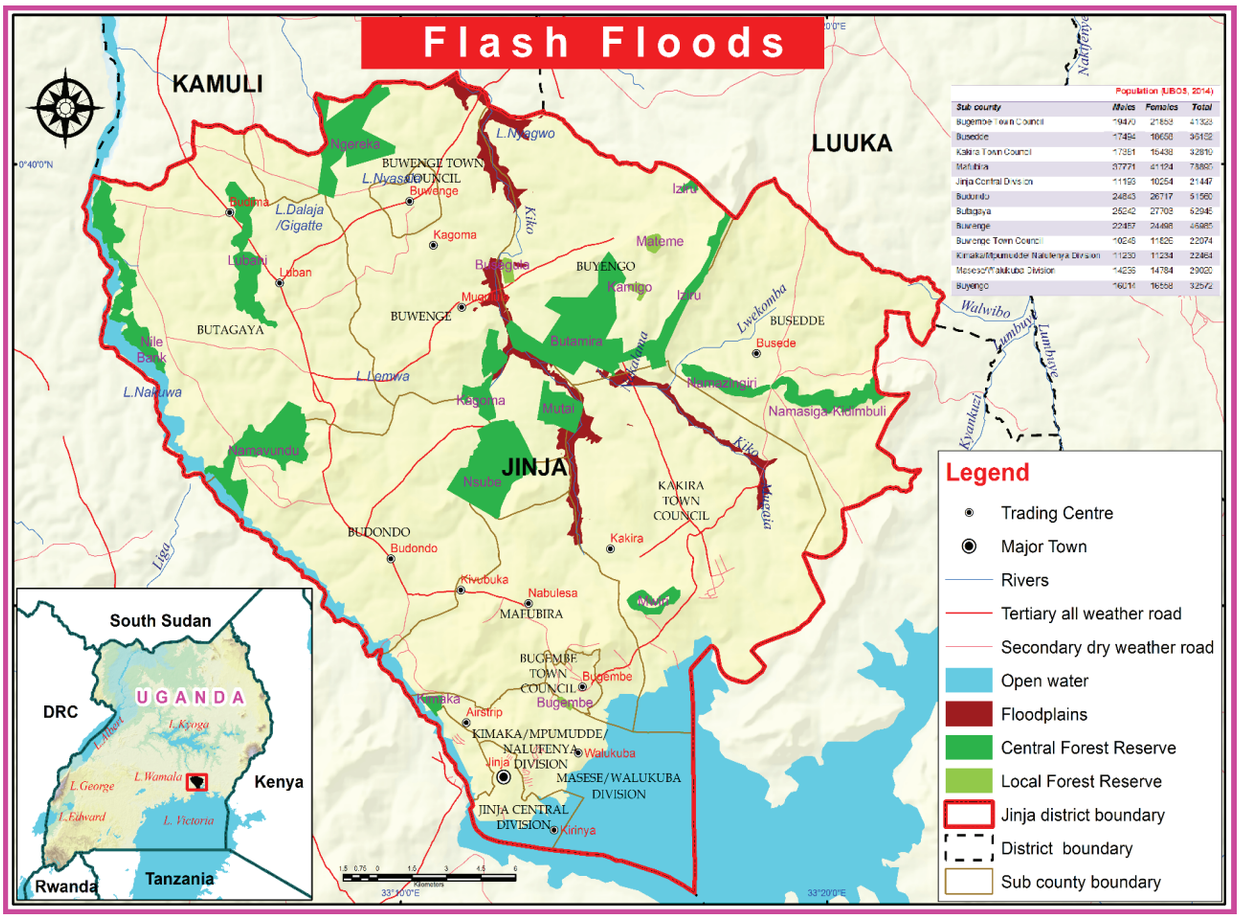


**Figure 9: Flood prone/inundation areas**

### 3.2.12 Pollution

Jinja is the second industrialised town after Kampala city with small and large scale industries. The establishment of industries over time has attracted a number of people from the rural areas to work in the factories and also access social amenities such as schools and hospitals. Consequently, water, air and land pollution are a recurrent phenomenon in Jinja purely because of industrialization, poor waste management, poor treatment of effluent from industries, wetland degradation and improper extensive application of pesticides and herbicides that have degraded the integrity of nature.

For instance, the mean particulate matter in Jinja is 5.3 times in respect to safe levels recommended by the World Health Organisation. The matter comprises of dust and acids. The resultant effects of pollution include loss of biodiversity, outbreak of diseases such as cancer, increase in the cost of domestic water treatment, loss of fingerlings in cage fishing on Lake Victoria and depletion of fish stocks. A high number of pollution cases have been recorded in the municipality.

### 3.2.13 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 lakes, 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 "Kayongo", Lantana Camara, Congress weed (*Parthenium hysterophorus)* among others. On water, the species are spread by strong winds, boat movements, wetland degradation, fishing activities, high seed multiplication and siltation among others.

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 slow boat movement, migration of fish stocks, high transport costs 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.

**Plate 5 : Latana camara in Busedde**

The adverse effects of land based species include loss of biodiversity, loss of livestock, low income levels, poor crop yields and encroachment of public land among others. On the other hand in water, the species cause illness, loss of biodiversity, depletion of fish stocks, high transport costs and malnutrition among others. The invasion of both alien species is common in all the sub counties (figure 10).

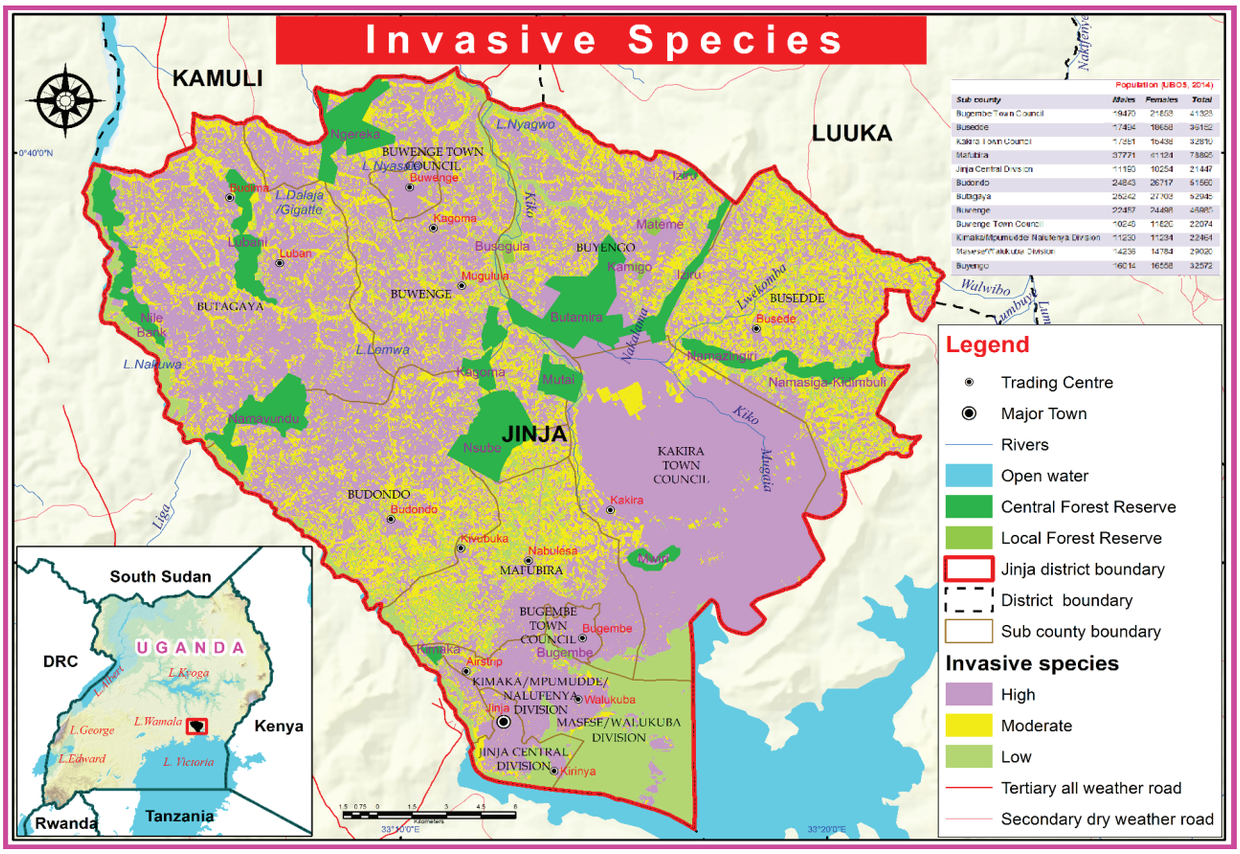


**Figure 10: Distribution of invasive species**

### 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 | Hailstorms | • Tree planting (Eucalyptus, citrus, Musizi etc)<br>• Sensitization on the dangers of encroaching wetlands | • Food and seedlings provision on occurrence<br>• Provision of tree seedlings<br>• Provision of weekly weather forecasts |
| 2 | Wetland degradation | • Sensitization on the dangers of encroaching wetlands<br>• Wetland demarcation<br>• Reduction of herd size<br>• Legislation through the National Environment Wetland Act<br>• Establishment of local government committees | • Provision of highly yielding upland rice<br>• Funding the community outreach department<br>• Strict enforcement of wetland laws<br>• Diversify sources of livelihood e.g Apiary<br>• Enact some laws in urban centres but active in rural areas<br>• Relocate industries from water bodies<br>• Carryout inventory of wetlands |
| 3 | Pests, parasites and Diseases | • Crop rotation<br>• Spraying of vegetables<br>• Vaccination of livestock<br>• Use of disease resistant varieties | • Recruitment of veterinary doctors at sub-county level<br>• Subsidizing pesticides and vaccines |

| | | | |
|---|---|---|---|
| 4 | Drought | • Water harvesting in the rainy season<br>• Tree planting.<br>• Planting drought resistant crops.<br>• Establishment of alternative income generating activities like business.<br>• Agro forestry.<br>• Planting quick maturing seeds.<br>• Farming in wetlands.<br>• Silage processing<br>• Using early warning systems | • Provision of tree seedlings<br>• Food relief<br>• Water harvesting techniques<br>• Improved irrigation technologies<br>• Diversify sources of livelihood<br>• Construction of food storage facilities<br>• Construction of more boreholes<br>• Law enforcement on wetland degradation<br>• Fund tree planting through NFA |
| 5 | Soil erosion | • Digging trenches and ridges<br>• Growing cover crops<br>• Mixed cropping<br>• Afforestation<br>• Crop spacing<br>• Sensitization (farmer visits)<br>• Minimum tillage<br>• Trash lines and bands | • Sensitization of the farmers on proper farming methods<br>• Agro-forestry<br>• Provision of tree seedlings<br>• Subsidize the costs of pesticides and fertilizers |
| 6 | Land Conflicts | • Law courts like Clan, LC's, magistrate courts<br>• Demarcation of land<br>• Land titling<br>• Sensitization | • Reducing the costs involved in acquiring land titles<br>• Sensitization of the community on land ownership<br>• Consistency in buffering of wetlands, roads as per the act<br>• Amendment of the land policy<br>• Quick judgments of land cases |
| 7 | Road and water accidents | • Law enforcement<br>• Installation of road signs<br>• Use of life jackets<br>• Recommendations from the driving school for license acquisition<br>• Road maintenance | • Enforcement of traffic laws<br>• Frequent maintenance of roads<br>• Prioritizing the permit licensing sector<br>• Provision of life jackets |

| | | | |
|---|---|---|---|
| 8 | Fires | • Establishment of fire lines<br>• Sensitization on fire safety measures | • Enforcement of safety measures |
| 9 | Lightning | • Tree planting<br>• Installation of lightning arrestors | • Subsidization of lightning arrestors<br>• Encourage tree planting |
| 10 | Floods | • Digging of trenches<br>• Shifting to safe places<br>• Sale of livestock to buy food<br>• Installation of road culverts<br>• Proper wastage disposal | • Tree planting (Eucalyptus, Pine, Gravelia, Musizi, Melia and Bathedavea).<br>• Sensitization on wetland degradation<br>• Wetland demarcation<br>• Enforce buffer zone<br>• Proper wastage management<br>• Routine unflagging water drainage |
| 11 | Pollution | • Promotion of organic farming<br>• Sensitization, one on one basis<br>• Law enforcement on waste treatment | • Promote organic farming<br>• Increase sensitization on waste disposal and treatment |
| 12 | Invasive Species | • Mixed planting<br>• Crop rotation<br>• Uprooting<br>• Planting resistant crops<br>• sensitization | • More research on invasive species<br>• Planting resistant improved seeds e.g in Maize Longe 7-H to control striga<br>• Legislation on the movement of seeds<br>• Provision of improved seedlings |

## CHAPTER FOUR

### 4.1 Risk Assessment

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

**Table 6: Risk assessment of multi-hazards for Jinja District**

| | PROBABILITY | SEVERITY OF IMPACTS | RELATIVE RISK | VULNERABLE SUB COUNTIES |
|---|---|---|---|---|
| | *Relative likelihood this will occur* | *Overall Impact (Average)* | *Probability x Impact Severity* | |
| Hazard | *1 = Not occur*<br>*2 = Doubtful*<br>*3 = Possible*<br>*4 = Probable*<br>*5 = Inevitable* | *1 = Very Low*<br>*2 = Low*<br>*3 = Moderate*<br>*4 = High*<br>*5 = Very High* | *1 - 10 = Low*<br>*11 - 20 = Moderate*<br>*21 - 25 = High* | |
| Floods/ Runoffs | 2 | **3** | **6** | Bugembe Town Council, Busedde, Kakira Town Council, Mafubira, Jinja Central Division, Budondo,Butagaya, Buwenge, Buwenge Town Council, Kimaka/ Mpumudde/ Nalufenya Division,Masese/ Walukuba Division, Buyengo |
| Droughts | 4 | **5** | **20** | Bugembe Town Council, Busedde, Kakira Town Council, Mafubira, Jinja Central Division, Budondo,Butagaya, Buwenge, Buwenge Town Council, Kimaka/ Mpumudde/ Nalufenya Division,Masese/ Walukuba Division, Buyengo |

| | | | | |
|---|---|---|---|---|
| Hail storms | **5** | **5** | **25** | Bugembe Town Council, Busedde, Kakira Town Council, Mafubira, Jinja Central Division, Budondo,Butagaya, Buwenge, Buwenge Town Council, Kimaka/ Mpumudde/ Nalufenya Division,Masese/ Walukuba Division, Buyengo |
| Man made fires | **3** | **3** | **9** | Kakira Town Council, Jinja Central Division, Butagaya |
| Lightning | **2** | **3** | **6** | Busedde, Budondo |
| Pests, parasites and diseases | **5** | **5** | **25** | Bugembe Town Council, Busedde, Kakira Town Council, Mafubira, Jinja Central Division, Budondo,Butagaya, Buwenge, Buwenge Town Council, Kimaka/ Mpumudde/ Nalufenya Division,Masese/ Walukuba Division, Buyengo |
| Land conflicts | 4 | 4 | **16** | Jinja municipality |
| Strong winds | | | | |
| Invasive species | 3 | 4 | **12** | Bugembe Town Council, Busedde, Kakira Town Council, Mafubira, Jinja Central Division, Budondo,Butagaya, Buwenge, Buwenge Town Council, Kimaka/ Mpumudde/ Nalufenya Division,Masese/ Walukuba Division, Buyengo |

| | | | | |
|---|---|---|---|---|
| Road, water accidents | 3 | 5 | **15** | Bugembe Town Council, Busedde, Kakira Town Council, Mafubira, Jinja Central Division, Budondo,Butagaya, Buwenge, Buwenge Town Council, Kimaka/ Mpumudde/ Nalufenya Division,Masese/ Walukuba Division, Buyengo |
| Soil erosion | 4 | 3 | **12** | Bugembe Town Council, Busedde, Kakira Town Council, Mafubira, Jinja Central Division, Budondo,Butagaya, Buwenge, Buwenge Town Council, Kimaka/ Mpumudde/ Nalufenya Division,Masese/ Walukuba Division, Buyengo |
| Human wild life conflicts | | | | |
| Wetland degradation | 5 | 5 | **25** | Bugembe Town Council, Busedde, Kakira Town Council, Mafubira, Jinja Central Division, Budondo,Butagaya, Buwenge, Buwenge Town Council, Kimaka/ Mpumudde/ Nalufenya Division,Masese/ Walukuba Division, Buyengo |
| Pollution | 3 | 2 | **6** | Kakira Town Council, Jinja municipal |

**Key for Relative Risk**

| | |
|---|---|
| | High |
| | Moderate |
| | Low |

## 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 | Disasters | Number of Events (last 30 years) | Years in record | Recurrence Interval per year | Hazard Frequency (%) Chance/year |
|---|---|---|---|---|---|
| 1 | Pests, parasites and diseases | 2002-2016 | 14 | 12 | 85 |
| 2 | Drought | 2011-2016 | 5 | 2 | 40 |
| 3 | Hailstorms | 2009-2013 | 4 | 2 | 50 |
| 4 | Invasive species | 1986-2016 | 30 | 12 | 40 |
| 5 | Wetland degradation | 1986-2016 | 30 | 12 | 40 |
| 6 | Soil erosion | 2001-2016 | 15 | 12 | 40 |
| 7 | Land conflicts | 1996-2016 | 20 | 12 | 60 |
| 8 | Floods | 2006-2016 | 10 | 2 | 50 |
| 9 | Man-made fires | 2001-2016 | 5 | 1 | 20 |
| 10 | Lightning | 2006-2016 | 10 | 2 | 20 |
| 11 | Road accidents | 1986-2016 | 30 | 12 | 40 |
| 12 | Pollution | 1986-2016 | 30 | 12 | 40 |

## 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 Jinja 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 including soil erosion; climatological or hydro-meteorological including flash floods, hailstorms, lightning and drought; ecological or biological hazards including crop pests/animal parasites and diseases, and invasive species; technological hazards including road accidents, pollution; environmental hazards including wetland degradation, fires and land conflicts predispose the community to high vulnerability state in the Jinja district (table 8).

**Table 8: Components of vulnerability in Jinja District**

| **Vulnerability Components** | Exposure | | | Susceptibility | | Resilience | |
|---|---|---|---|---|---|---|---|
| | **Hazards** | • **Elements at risk** | **Geographical Scale** | • **Potential impacts** | **Geographical Scale** | • **Coping strategies** | **Geographical Scale** |
| **Social components** | Land conflicts | • Human population<br>• Crops | District | • Loss of property<br>• Displacement of people | District | • Sensitise people on land developments and land use<br>• Clearly demarcating and defining land owner ship<br>• Court | District |
| | Invasive species | • Crops<br>• Fish | Sub county | • Interfere with water transport.<br>• Accidents<br>• Loss crop yields | Sub county | • Crop rotation<br>• Uprooting<br>• Appling fertilizers<br>• Planting stringer go resistant varieties | Sub county |
| | Soil erosion | • Human population<br>• Crops | Sub county | • Stunted crop growth<br>• Reduced yields<br>• Poor crop production<br>• River siltation<br>• Decreased biodiversity<br>• decrease in soil fertility | Sub county | • Tree planting<br>• Sensitization<br>• Soil and water conservation i.e. bridges, trenches | District |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Pests, parasites and diseases | • Human and livestock populations<br>• Crops | District | • Loss of livestock<br>• Reduced livestock productivity<br>• Complete crop failure<br>• Stunted growth of crops | District | • Vaccination<br>• Spraying<br>• Sensitization<br>• Crop rotation<br>• Planting disease resistant crops<br>• Quarantine | District |
| | Hail storms | • Human and livestock populations<br>• Crops | District | • Loss of livestock<br>• Complete crop failure<br>• Stunted growth of crops | District | | District |
| | Wetland degradation | • Lakes<br>• Crops<br>• Human population | District | • Flooding<br>• Drying of water sources<br>• Bio diversity destruction<br>• climatic change<br>• Loss of grazing lands<br>• Diseases<br>• Pollution | District | • Sensitisation through radios<br>• Enforcement of wetland laws<br>• Demarcation of wetlands | District |
| | Water, Road accidents | • Human and livestock populations | District | • Human deaths<br>• Disabilities after injuries | District | • Regular guidance by traffic officers<br>• Construction of humps and road signs<br>• Reflector jackets, seat belts and helmets | District |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Floods/Water logging | • Human and livestock populations<br>• Crops<br>• Infrastructure including roads | District | • Loss of lives<br>• Stunted growth of crops<br>• Destruction of roads<br>• Diseases<br>• Poor quality water for domestic use<br>• Pollution | District | • Raising of roads by use of culverts<br>• Water treatment | District |
| | Drought | • Human and livestock populations<br>• Crops | District | • Stunted growth of crops<br>• Food insecurity<br>• Drying of water points | District | • Drought resistant crops<br>• Storage of food<br>• Making hay/silage<br>• Sensitization<br>• Early warning communication<br>• Farming in wetlands<br>• Water harvesting | District |
| | Human wild life conflicts | | | | | | |
| | Man made fires | • Human and livestock populations | Sub county | • Loss of property<br>• Loss of lives<br>• Displacement of people<br>• Conflicts | Sub county | • Install fire extinguishers<br>• Awareness | District |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Pollution | • Human and livestock populations | Sub county | • Destroy breeding grounds for fish<br>• Loss of biodiversity<br>• Diseases (cancer) | Sub county | • Sensitization<br>• Promote organic farming | Sub county |
| | Lightning | • Human and livestock populations<br>• Crops<br>• Infrastructure including homes, schools and hospitals<br>• Natural vegetation including trees | District | • Death of livestock<br>• Loss of human lives<br>• Tension | District | • Install lightning conductors | District |
| | Strong winds | | | | | | |
| **Economic component** | Invasive species | • Crops | Sub county | • Low income in the long run as a result of poor yield and low productivity<br>• High costs of removal<br>• Increased costs of production | Sub county | • Crop rotation<br>• Uprooting<br>• Appling fertilizers<br>• Planting stringer go resistant varieties | Sub county |
| | Land conflicts | • Human population | District | • Retards personal and community development<br>• High court expenses | District | • Sensitise people on land developments and land use<br>• Clearly demarcating and defining land owner ship<br>• Court | District |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Wetland degradation | • Lakes<br>• Crops<br>• Human population | District | • Loss of income<br>• Loss of government revenue | District | • Sensitisation through radios<br>• Enforcement of wetland laws<br>• Demarcation of wetlands | District |
| | Pests, parasites and diseases | • Human and livestock populations<br>• Crops | District | • Loss of income<br>• Loss of government revenue<br>• Increased expenditure on pesticides and drugs | District | • Vaccination<br>• Spraying<br>• Sensitization<br>• Crop rotation<br>• Planting disease resistant crops<br>• Quarantine | District |
| | Soil erosion | • Human population<br>• Crops | Sub county | • Loss of income<br>• Loss of government revenue | Sub county | • Tree planting<br>• Sensitization<br>• Soil and water conservation i.e. bridges, trenches | District |
| | Hailstorms | • Human and livestock populations<br>• Crops | District | • Loss of income<br>• Loss of government revenue | District | | District |
| | Drought | • Human and livestock populations<br>• Crops | District | • Loss of income due to low productivity<br>• Loss of government revenue | District | • Drought resistant crops<br>• Storage of food<br>• Making hay/silage<br>• Sensitization<br>• Early warning communication<br>• Farming in wetlands<br>• Water harvesting | District |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Water, Road accidents | • Human populations | District | • Loss of lives hence low incomes | District | • Regular guidance by traffic officers<br>• Construction of humps and road signs<br>• Reflector jackets, seat belts and helmets | District |
| | Water logging | • Human and livestock populations<br>• Crops<br>• Natural vegetation<br>• Infrastructure including roads | Sub county | • Loss of income<br>• Loss of government revenue | Sub county | • Raising of roads by use of culverts<br>• Water treatment | Sub county |
| | Wetland degradation | • Crops<br>• Human and livestock population | District | • Loss of biodiversity<br>• Reduced water quality<br>• Increased incidences of water borne diseases | District | • Tree planting along the wetland area<br>• Awareness | District |
| | Human wild life conflicts | | | | | | |
| | Man made fires | • Human and livestock populations | Sub county | • Low income<br>• Loss of government revenue | Sub county | • Install fire extinguishers<br>• Awareness | District |
| | Pollution | • Human and livestock populations | Sub county | • High costs of water treatment | Sub county | • Sensitization<br>• Promote organic farming | Sub county |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Lightning | • Human and livestock populations<br>• Crops<br>• Infrastructure including homes, schools and hospitals<br>• Natural vegetation including trees | Sub county | • Low income<br>• Loss of government revenue | Sub county | • Install lightning conductors | District |
| | Strong winds | | | | | | |
| **Environmental component** | Invasive species | • Crops | Sub county | • Loss and stunted growth of crops | Sub county | • Crop rotation<br>• Uprooting<br>• Appling fertilizers<br>• Planting stringer go resistant varieties | Sub county |
| | Land conflicts | • Crops<br>• Human population | District | • Destruction of crops | District | • Sensitise people on land developments and land use<br>• Clearly demarcating and defining land owner ship<br>• Court | District |
| | Wetland degradation | • Lakes<br>• Crops<br>• Human population | District | • Loss of bio diversity<br>• Drying of water resources | District | • Sensitisation through radios<br>• Enforcement of wetland laws<br>• Demarcation of wetlands | District |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Soil erosion | • Human population<br>• Crops | Sub county | • Loss of vegetation cover including trees and crops<br>• Land degradation | Sub county | • Tree planting<br>• Sensitization<br>• Soil and water conservation i.e. bridges, trenches | District |
| | Pests, parasites and diseases | • Human and livestock populations<br>• Crops | District | • Loss of crops and animals | District | • Vaccination<br>• Spraying<br>• Sensitization<br>• Crop rotation<br>• Planting disease resistant crops<br>• Quarantine | District |
| | Hailstorms | • Human and livestock populations<br>• Crops | District | • Loss of vegetation cover including trees and crops | District | | District |
| | Drought | • Human and livestock populations<br>• Crops | District | • stunted growth of crops | District | • Drought resistant crops<br>• Storage of food<br>• Making hay/silage<br>• Sensitization<br>• Early warning communication<br>• Farming in wetlands<br>• Water harvesting | District |
| | Human wild life conflicts | | | | | | |
| | Man made fires | • Human and livestock populations | Sub county | • Destruction of crops | Sub county | • Install fire extinguishers<br>• Awareness | District |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Lightning | • Human and livestock populations<br>• Crops<br>• Infrastructure including homes, schools and hospitals<br>• Natural vegetation including trees | Sub county | •<br>• Destroy natural vegetation and crops | Sub county | •<br>• Instaling<br>• lightning conductors<br>• Planting trees | District |
| | Strong winds | | | | | | |
| | Pollution | • Human and livestock populations | Sub county | • Destroy breeding grounds for fish<br>• Loss of biodiversity | Sub county | • Sensitization<br>• Promote organic farming | Sub county |
| | Water logging | • Human and livestock populations<br>• Crops<br>• Natural vegetation<br>• Infrastructure including roads | District | • Loss of biodiversity<br>• Destruction of crops | Sub county | • Raising of roads by use of culverts<br>• Water treatment | Sub county |
| **Physical components** | Invasive species | • Crops | Sub county | • Low fish production<br>• Harbours snakes<br>• Blocks transport | Sub county | • Crop rotation<br>• Uprooting<br>• Appling fertilizers<br>• Planting stringer go resistant varieties | Sub county |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Pests, parasites and diseases | • Human and livestock populations<br>• Crops | District | • Loss of livestock<br>• Reduced livestock productivity<br>• Complete crop failure<br>• Stunted growth of crops | District | • Vaccination<br>• Spraying<br>• Sensitization<br>• Crop rotation<br>• Planting disease resistant crops<br>• Quarantine | District |
| | Wetland degradation | • Lakes<br>• Crops<br>• Human population | District | • Drying of water sources<br>• Bio diversity destruction | District | • Sensitisation through radios<br>• Enforcement of wetland laws<br>• Demarcation of wetlands | District |
| | Soil erosion | • Human population<br>• Crops | Sub county | • Stunted crop growth<br>• Decreased biodiversity | Sub county | • Tree planting<br>• Sensitization<br>• Soil and water conservation i.e. bridges, trenches | Sub county |
| | Water, Road accidents | • Human populations | District | • Loss of lives | District | • Regular guidance by traffic officers<br>• Construction of humps and road signs<br>• Reflector jackets, seat belts and helmets | District |
| | Hailstorms | • Human and livestock populations<br>• Crops | District | • Loss of livestock<br>• Complete crop failure<br>• Stunted growth of crops | District | | District |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Land conflicts | • Human population<br>• Crops | District | • Loss of lives<br>• Destruction of properties | District | • Sensitise people on land developments and land use<br>• Clearly demarcating and defining land owner ship<br>• Court | District |
| | Drought | • Human and livestock populations<br>• Crops | District | • Loss of vegetation cover<br>• Lowering of water levels<br>• Death of livestock<br>• Scarcity of water<br>• Proliferation of livestock diseases<br>• Limited pasture | District | • Drought resistant crops<br>• Storage of food<br>• Making hay/silage<br>• Sensitization<br>• Early warning communication<br>• Farming in wetlands<br>• Water harvesting | District |
| | Water logging | • Human and livestock populations<br>• Crops<br>• Natural vegetation<br>• Infrastructure including roads | Sub county | • Loss of lives<br>• Stunted growth of crops<br>• Destruction of homes<br>• Outbreaks of diseases, cholera | Sub county | •<br>• Raising of roads by use of culverts<br>• Water treatment | Sub county |
| | Human wild life conflicts | | | | | | |
| | Man made fires | • Human and livestock populations | Sub county | • Destruction of crops<br>• Loss of property | Sub county | • Install fire extinguishers<br>• Awareness<br>• Ordinances and bi-laws | District |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Lightning | • Human and livestock populations<br>• Crops<br>• Infrastructure including homes, schools and hospitals<br>• Natural vegetation including trees | Sub county | • Death and injury of human and livestock<br>• Destroy properties | Sub county | • Installing lightning conductors | District |
| | Strong winds | | | | | | |
| | Pollution | • Human and livestock populations | Sub county | • Destroy breeding grounds for fish | Sub county | • Sensitization<br>• Promote organic farming | Sub county |
| | Wetland degradation | • Crops<br>• Human and livestock population | Sub county | • Loss of biodiversity<br>• Reduced water quality<br>• Increased incidences of water borne diseases | Sub county | • Raising of roads by use of culverts<br>• Water treatment | Sub county |

## CONCLUSION AND RECOMMENDATION

It was established that Jinja district has over the last 20 years increasingly experienced multi-hazards including floods, drought, invasive species, Pests, parasites and diseases for crops and livestock, soil erosion, land conflicts, lightning, pollution , fires, 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 Jinja district increase their vulnerability to multi-hazard exposure necessitating urgent external support.

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

i. Geomorphological and geological hazards including; soil erosion
ii. Climatological or hydro-meteorological including; flash floods, hailstorms, lightning and drought.
iii. Ecological or biological hazards including; pests/animal parasites and diseases, and invasive species.
iv. Technological hazards including; road accidents, pollution.
v. Environmental hazards including; wetland degradation, fires 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 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 decentralize their activities at the district level
vii. OPM should strengthen the district disaster committees by developing guidelines and trainings
viii. Establishment of disaster fund at the district levels
ix. Fund and equip recruited extension workers
x. Establish a fund aimed at disaster preparedness and management at district levels

xi. Removal of taxes on the importation of lightning conductors
xii. Support establishment of a disaster risk early warning systems
xiii. Review laws on bush burning
xiv. Provide support in form of free seedlings to promote afforestation and reforestation
xv. Increase funding and staff to monitor wetland degradation and non-genuine agro inputs
xvi. Promote observation of the principle of rangeland carrying capacity among livestock keepers

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