THE REPUBLIC OF UGANDA

Lwengo 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.

I extend my sincere thanks to the Department of Relief, Disaster Preparedness and Management, under the leadership of the Commissioner, Mr. Martin Owor, for the oversight and management of the entire exercise.

The HRV assessment team was led by Ms. Ahimbisibwe Catherine, Senior Disaster Preparedness Officer supported by Ogwang Jimmy, Disaster Preparedness Officer and the team of consultants (GIS/DRR specialists); Dr. Bernard Barasa, and Mr. Nsiimire Peter, who provided technical support.

Our gratitude goes to UNDP for providing funds to support the Hazard, Risk and Vulnerability Mapping. The team comprised of Mr. Steven Goldfinch – Disaster Risk Management Advisor, Mr. Gilbert Anguyo - Disaster Risk Reduction Analyst, and Mr. Ongom Alfred-Early Warning system Programmer.

My appreciation also goes to Lwengo District Team:

1.   Mr. Kiruhiira Godfrey Akiiki- Chief Administrative Officer

2.   Mr. Mutemba Godfrey – Senior Environment Officer

3.   Ms. Bacia Kezia – Senior Agricultural Officer

4.   Mr. Kagumire Wilson –Senior Planner

5.   Ms. Nakawooya Joan- Bio-statistician

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, 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 shifting 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 is situated about 40 kms, away from the equator, with an average altitude of 1150m above sea level. Sembabule boards the District in the north, Lyantonde in the North West, Bukomansimbi in the North East, Masaka in the East, Rakai in the south. The District has a total area of about 1023.7 sq kms. The landscape and topography in general is rolling and falling with valley bottom swamps including streams flowing to swamps. Most parts of the District are dotted with bear hills. The Climate of Lwengo District is tropical in nature, being modified by relief and nearness to Lake Victoria. The rainfall pattern is bimodal having two seasons with long dry spells between May and August, and January to March. The major ones are Agriculture , livestock keeping, and trade, with farming being the most important activity in terms of revenue contribution to the District.

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 Lwengo 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 human and wildlife conflicts, crop pests/ animal parasites and diseases

  iv. Technological hazards including road accidents

  v.   Environmental including wetland degradation, bush fires and land conflicts

In conclusion, counteracting 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.

Table of contents

List of tables

List of figures

List of plates

List of acronyms

GIS   :   Geographical Information Systems

UNDP :   United Nations Development Programme

ToR   :   Terms of Reference

HRV   :   Multi hazard, Risk and Vulnerability

DLG   :   District Local Government

OPM   :   Office of the Prime Minister

NEMA :   National Environmental Authority

DWRM: District Water Resources Management

UBOS :   Uganda Bureau of Statistics

UNRA :   Uganda National Roads Authority

NFA   :   National Forestry Authority

MWE   :   Ministry of Water and Environment

NARO :   National Agricultural Research Organisation

SRTM :   Shuttle Radar Topography Mission

UWA   :   Uganda Wildlife Authority

FDG   :   Focus Group Discussion

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 range from drought, 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 mainstreaming of disaster risk management in development planning and contingency planning at National and Local levels.

Since 2013 Office of the Prime Minister with support from UNDP has been developing district hazard risk and vulnerability profiles in Sub regions of Rwenzori, Karamoja, Teso, Lango, Acholi, West Nile, Central and South western. During the exercise, local government officials and community members actively participated in the data collection and analysis through focus group 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 analyze the field data using GIS in close collaboration and coordination with OPM in Lwengo 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 gender 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 Lwengo District

Lwengo District is situated about 40kms, away from the equator, with an average altitude of 1150m above sea level. Sembabule boarders the District to the North, Lyantonde in the North West, Bukomansimbi in the North East, Masaka in the East, Rakai in the South. Location in terms of longitudes and latitudes should indicated

The District has a total area of about 1,023.7 sq kms. The landscape and topography in general is rolling and falling with valley bottom swamps including streams flowing to swamps. Most parts of the District are dotted with bear hills.

The Climate of Lwengo District is tropical in nature, being modified by relief and nearness to Lake Victoria. The rainfall pattern is bimodal having two seasons with long dry spells between May and August, and January to March. The two seasons of rain occur in the months of March to April, and September to December. Most parts of the District lie in the dry cattle corridor with low humidity levels and devastating winds thus prolonged periods of drought.

The total geographical area of the District is about 1,023.7 sq km out of which 85% hectares are under cultivation. The total gazetted forest estate is about 21 hectares (Lwengo local forest reserve) constituting about 0.021% of the total land area of the District.

Lwengo District is endowed with good climate and an industrious population. With this, a lot of economic activities are taking place in the District. The major ones are Agriculture , livestock keeping, and trade, with farming being the most important activity in terms of revenue contribution to the District. Employment income contributes the second largest portion of the revenue to the District followed by trading, property income tax and finally cottage industry.
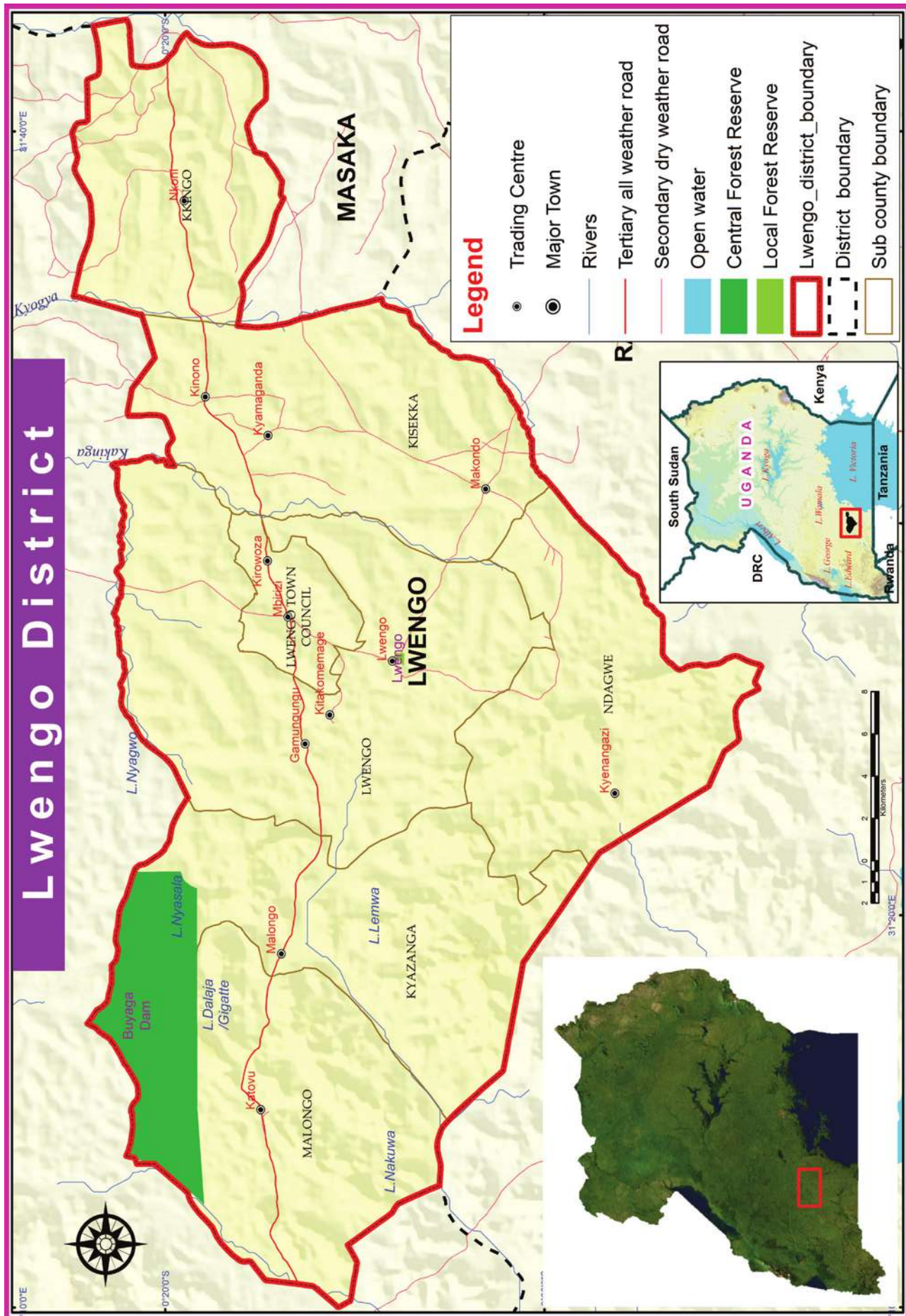
Figure 1: Map showing Lwengo District

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

3.1.1.3 Socio economic investigation

The socio economic assessment of hazards, risks and vulnerability was threefold: the consultations, key informant interviews and Focus Group Discussions. 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 administer to out on the sub county officials for evidence based discovery. A total of two focus group discussions were also conducted in the sub counties: Kyazanga farmers' cooperative society in Kyazanga Subcounty and PELIDO farmers group in Kisekka Sub County. 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 participatorily 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.

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

Table 1: Sources of spatial datasets obtained and utilized in the HRV process

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

3.1.1.5   Validation

The hazard, risk and vulnerability prone areas were identified and studied in the field. The Spectra Precision hand held 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 hazards

3.2.1 Introduction

The multi hazards that are experienced in Lwengo 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; human and wildlife conflicts, crop pests/ animal parasites and diseases

 iv.   Technological hazards including road accidents

  v.   Environmental including wetland degradation, bush 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 Drought

Lwengo is one of the districts partly located in the cattle corridor. The experienced drought events are manifested as prolonged dry spells that cause shifts in the onset of rain seasons.

The frequency and severity of drought episodes are perceived to be caused by; global warming, wetland degradation, changes in land use, poor farming methods and deforestation . Drought occurrences are associated with deficit soil moisture, reduction of surface water sources, withering of crops, inadequate pasture, reduced productivity 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 September – December and March – June 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, invasion of pests and diseases theft of crops in gardens, wetland degradation, famine, transactional sex for food, illness and loss of livestock. The distribution of drought affects all the sub counties but severely affected are Malongo, Kyazanga, Ndagwe and Lwengo

3.2.3 Crop pests/animal parasites and diseases

The occurrence, severity, frequency and distribution of crop pests/animal 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, Irish and sweet potatoes, millet maize bananas as food/cash crops and coffee as cash crops. In livestock production, farmers are enganged in Cattle, piggery, poultry and small ruminants. However, their production has drastically reduced over time due to increasing pests and diseases and emergence of new ones.

The high pest and disease incidences in crops/livestock is mainly attributed to changes in weather patterns, deforestation, inadequate extension services, inadequate regulation and surveillance, trans boundary movement, soil exhaustion, poor farming methods, high costs and sub standard agrochemicals, and poor storage facilities. The changes in weather patterns favour the life cycle of pests that continuously destroy crops/livestock resulting into reduced yield, food insecurity, famine. On the other hand, poor farming methods are attributed to, ignorance and poor mind sets.

Plate 1: Coffee twig borer in Lwengo s/c

The factors that have contributed to the vulnerability of farmers include: poor planting materials, 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 (Plate: 2) and diseases are indicated here below (table 4). The effects of pests and diseases were evident in all the sub counties (figure 3).

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 virus
4	Sorghum	sorghum midge, stem borers, sorghum shoot fly
5	Cowpeas	Aphids
6	Soybean	Web worm, rust
7	Bananas	Banana Bacterial Wilt, banana weevils, sigatoka, banana streak virus
8	Horticulture	Blight, cut worms, root rot, caterpillars
9	Rice	Stem borers, rice yellow mortal virus
10	Beans	Aphids, root rot disease
11	Citrus	Rot, fruit fly, hard scab
12	Coffee	Coffee wilt disease, coffee twig borer
13	Mangoes	Fruit fly, hard scab, Powderly mildew

In livestock production, Lwengo District lies in an endemic Tsetse and trypanosomiasis zone. The occurrences of parasites and diseases was basically caused by communal grazing, 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, tsetse flies, worms, mites in poultry, New castle, Swine fever, Nagana, East Coast fever, foot and mouth disease among others. The livestock parasite and disease incidences are reported in all the sub counties (figure 2).

Figure 2: Distribution of pests, parasites and diseases

Legend

Trading Centre
Major Town
Rivers
All Weather Road
Dry Weather Road
Open water
Central Forest Reserve
Local Forest Reserve
Lwengo_district_boundary
District boundary
Sub county boundary

Pests and diseases
Very high
High
Low

Population (UBOS, 2014)			
Sub county	Males	Females	Total
Kisekka	23467	25718	49185
Kkingo	16674	17673	34347
Kyazanga	16953	17794	34747
Lwengo	24092	25840	49932
Lwengo Town Council	7259	8268	15527
Malongo	18030	19875	37905
Ndagwe	18356	19920	38276

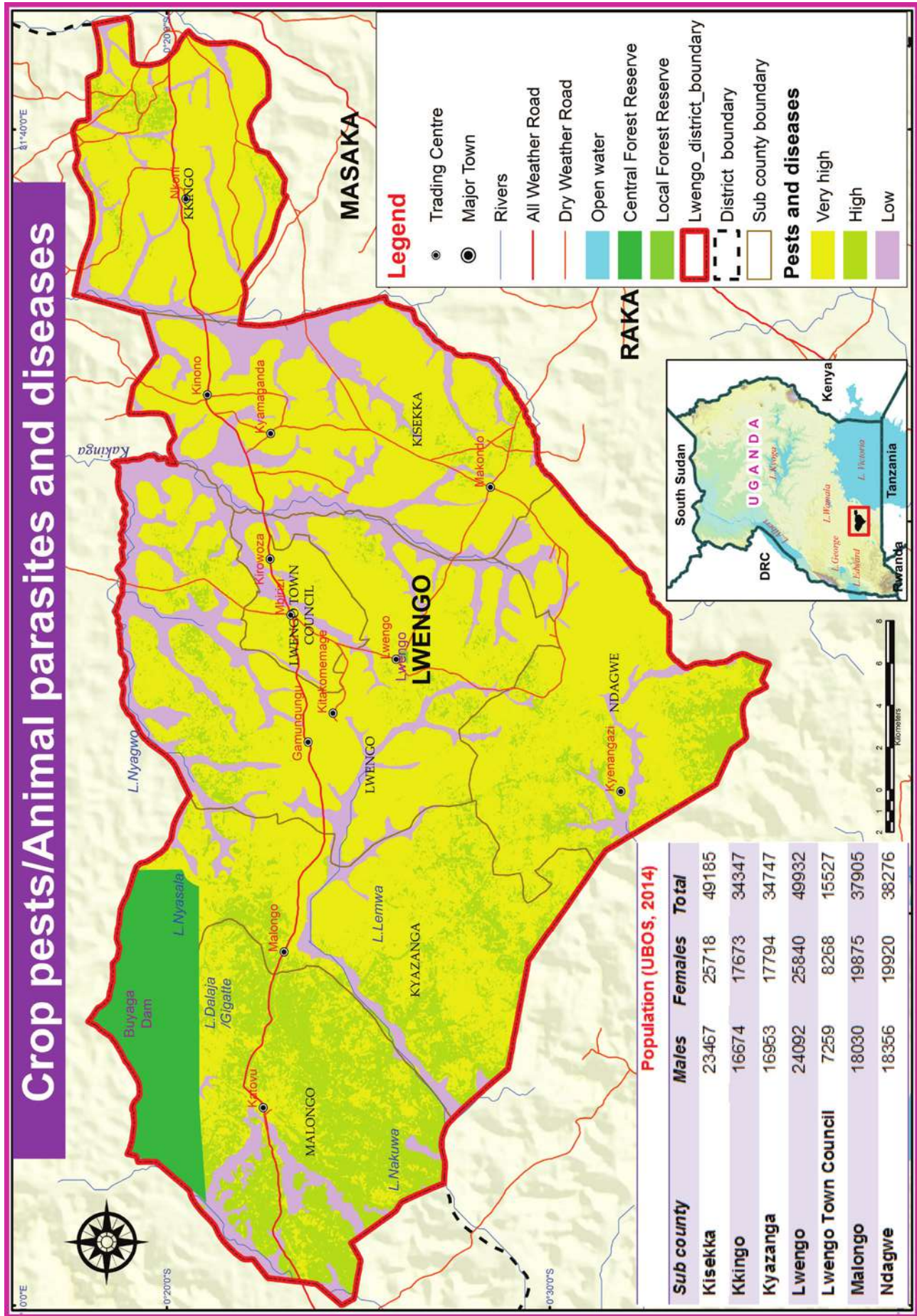Crop pests/Animal parasites and diseases

3.2.4 Wetland degradation

Plate 2: Kiyanja wetland- Kyazanga sub county

The wetland types found in Lwengo District are characterized 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 (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 escalated the vulnerability of wetlands include limited funds for enforcement mechanism 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 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).
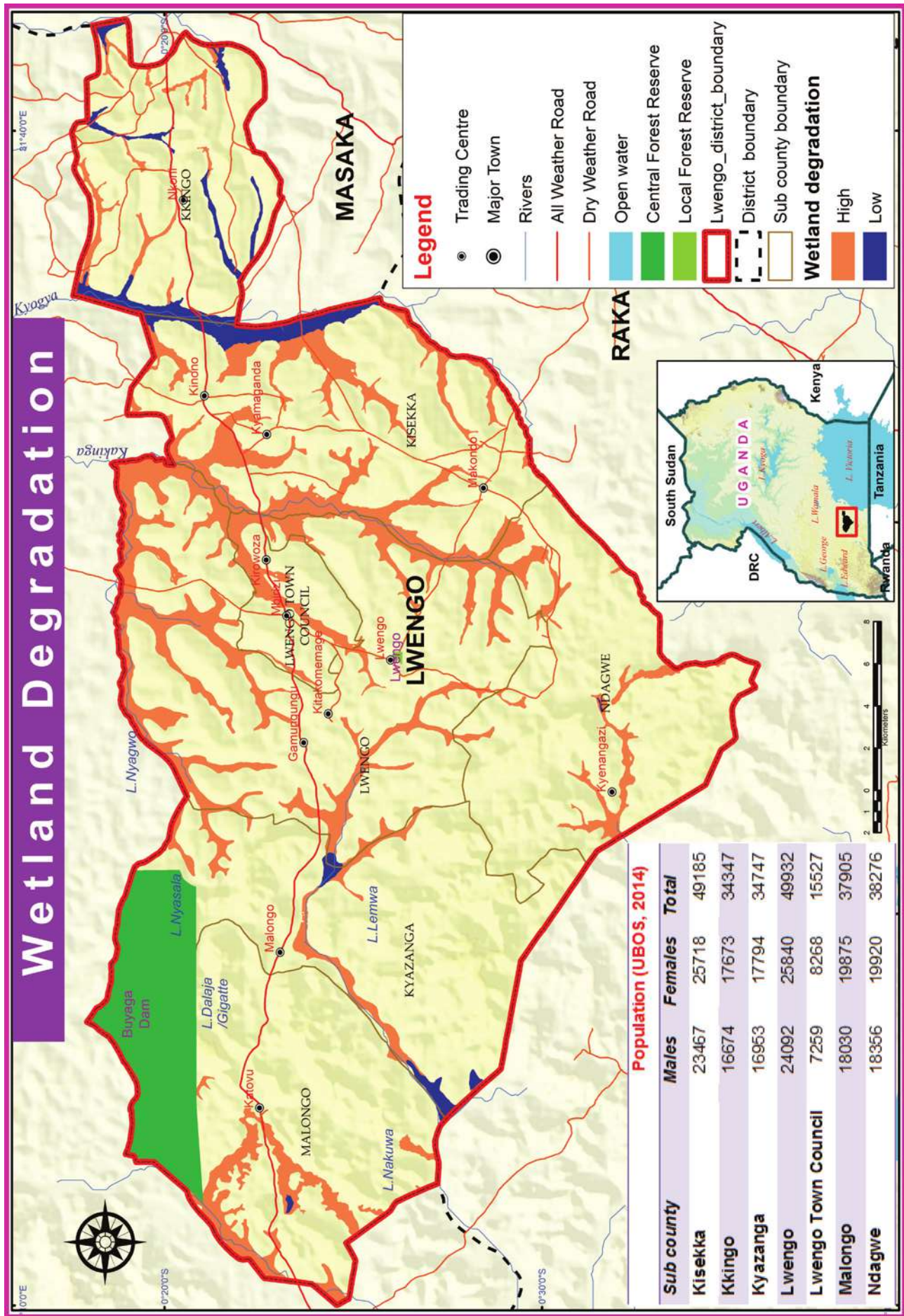
Figure 3: Levels of wetland degradation

Sub county	Males	Females	Total
Kisekka	23467	25718	49185
Kkingo	16674	17673	34347
Kyazanga	16953	17794	34747
Lwengo	24092	25840	49932
Lwengo Town Council	7259	8268	15527
Malongo	18030	19875	37905
Ndagwe	18356	19920	38276

3.2.5 Soil erosion

Plate 3: Soil erosion in Kyazanga sub county

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.

The adverse effects of soil erosion experienced in the district include: siltation of wetlands, invasion of wetland, 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 and diseases, loss of landscape beauty, land conflicts, introduction of new invasive species and famine. The occurrences and severity of soil erosion equally affects Malongo, Kyazanga, Ndagwe and Kkingo sub counties in the district (figure 4).

Figure 4: Soil erosion prone areas

Soil Erosion

Legend

- Trading Centre
- Major Town
- Rivers
- All Weather Road
- Dry Weather Road
- Open water
- Central Forest Reserve
- Local Forest Reserve
- Lwengo_district_boundary
- District boundary
- Sub county boundary

Soil erosion

- Extremely high
- High
- Moderate
- Low

Population (UBOS, 2014)

Sub county	Males	Females	Total
Kisekka	23467	25718	49185
Kkingo	16674	17673	34347
Kyazanga	16953	17794	34747
Lwengo	24092	25840	49932
Lwengo Town Council	7259	8268	15527
Malongo	18030	19875	37905
Ndagwe	18356	19920	38276

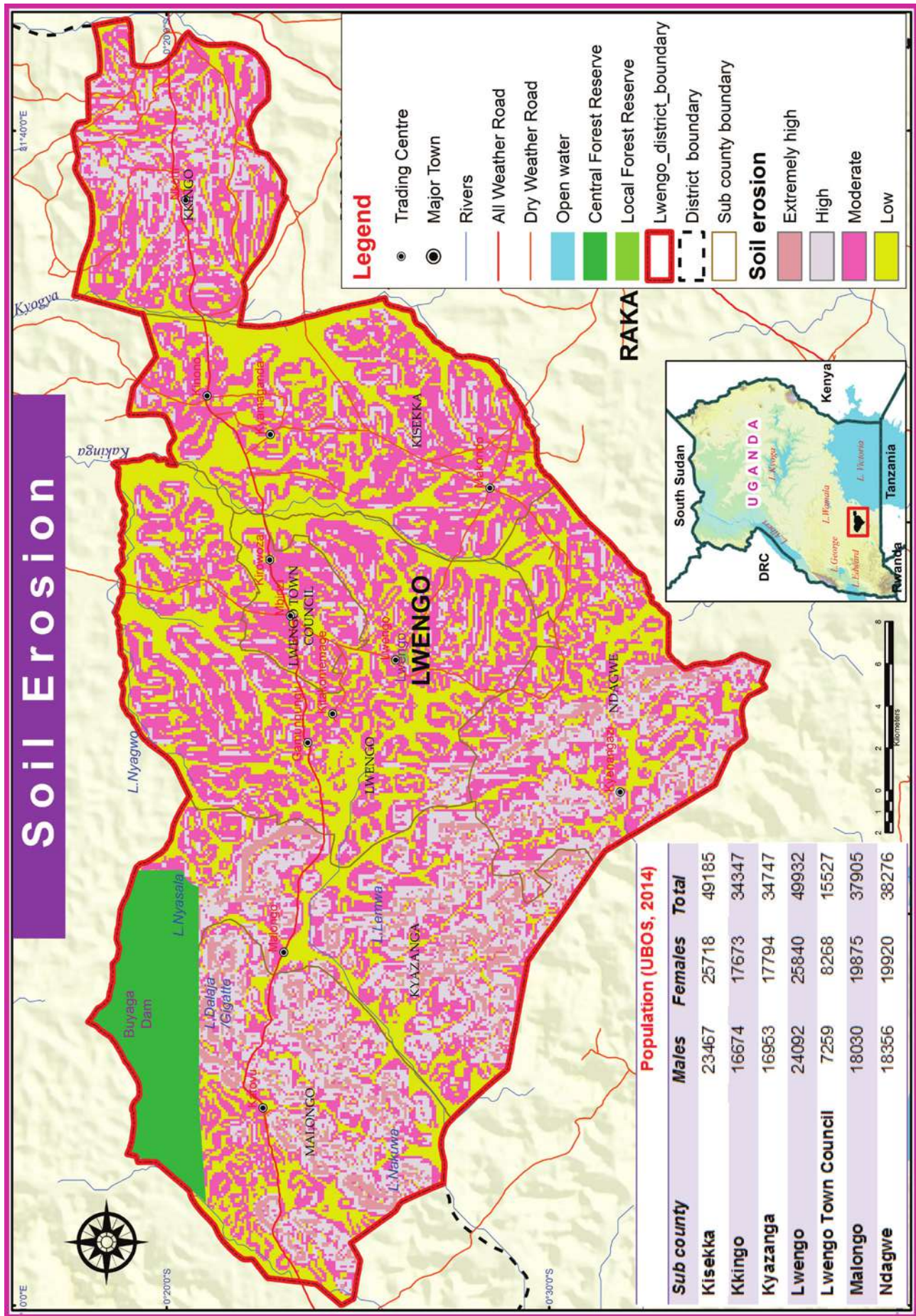## 3.2.6 Road accidents

Plate 4: Along Lwengo-mbarara high way

Road and water accidents claim a number of lives in the district of recent than before. The prevalence of road accidents is attributed to the driving of cars in dangerous mechanical conditions, reckless driving, lack of road sign posts, bad weather, overloading,,ivestock grazing in the road reserves, narrow roads, incompetent drivers and over speeding.

The road accidents mainly involve pedestrians, cars, bicycles, motorcycles.

The road accidents are associated with injuries, disabilities and arrests death 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 accidents include: loss of human life and livestock, illness, disabilities, loss of property and documentation, reduction of labour force in crop and livestock production and loss of income in compensations. The accident incidents are reported along Masaka mbarara highway, in Kisekka, Malongo, Kyazanga, Kkingo, Lwengo, Kyazanga town council and Lwengo town council throughout the year (figure 5). *NB all major trading centers and sharp bends(malongo, degeya, kabalungi) are hot spots for road accidents*
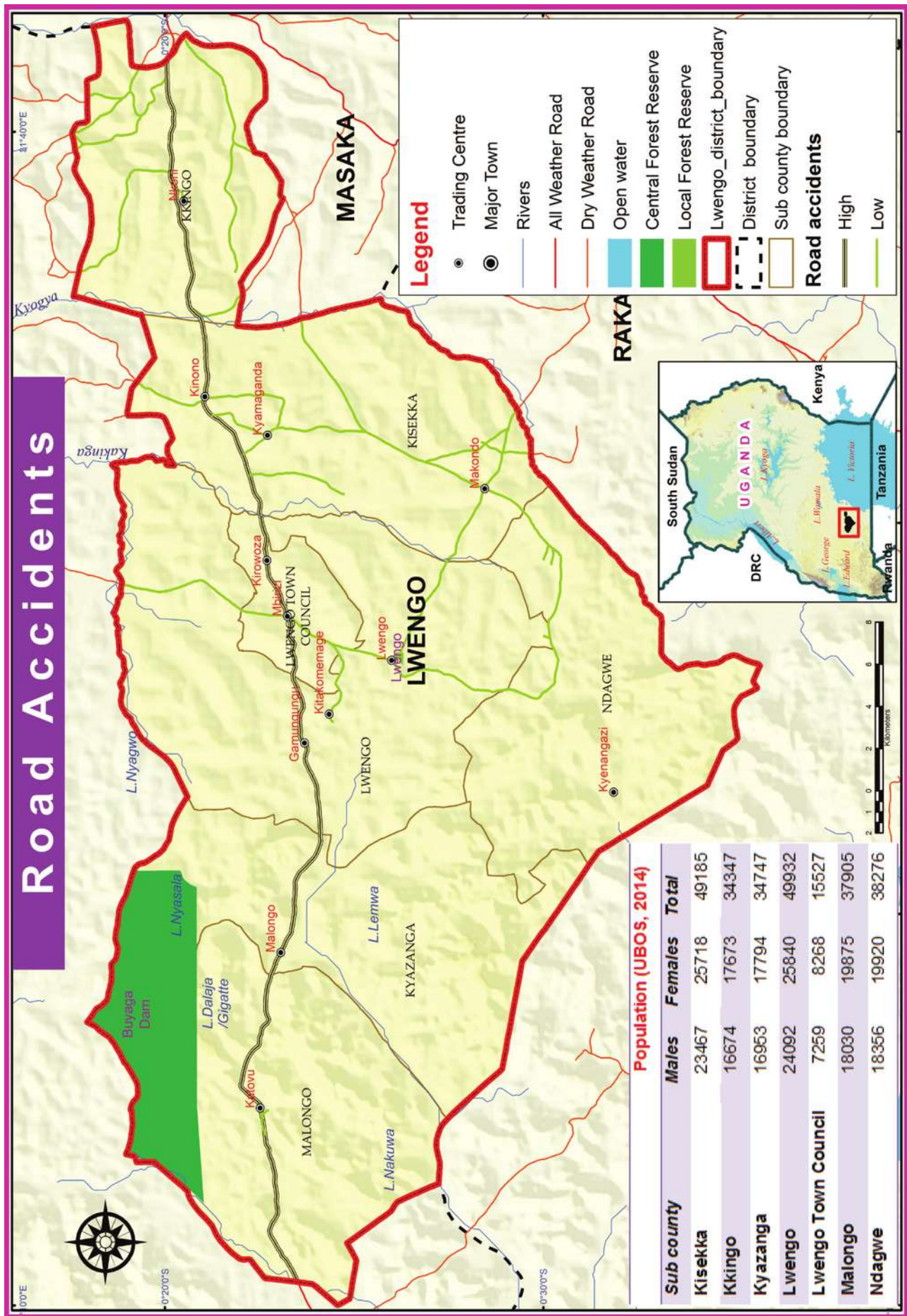
Road Accidents

Figure 5: Road accidents distribution

Legend

- ⊙ Trading Centre
- ◉ Major Town
- Rivers
- All Weather Road
- Dry Weather Road
- Open water
- Central Forest Reserve
- Local Forest Reserve
- Lwengo_district_boundary
- District boundary
- Sub county boundary

Road accidents
- High
- Low

Sub county	Population (UBOS, 2014)		
	Males	Females	Total
Kisekka	23467	25718	49185
Kkingo	16674	17673	34347
Kyazanga	16953	17794	34747
Lwengo	24092	25840	49932
Lwengo Town Council	7259	8268	15527
Malongo	18030	19875	37905
Ndagwe	18356	19920	38276

Figure 5: Road accidents distribution

3.2.7 Hailstorms

The occurrence and severity of hailstorms are a frequent phenomenon in Lwengo 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 fuelwood, brick making and timber for construction.

Plate 5: Hailstorms in Ndagwe sub county Dec 2014

The famers are vulnerable to the effects of hailstorms due to the massive clearance of trees without replanting, limited availability of tree seedlings, unreliable seasonal weather forecasts among others.

The adverse effects of hailstorms include destruction of food and property, low household income levels, loss of district revenue, food shortages, loss of human life and livestock. The episodes severely affect Kyazanga, Kisekka, Ndagwe, Lwengo and Malongo sub counties (figure 6).
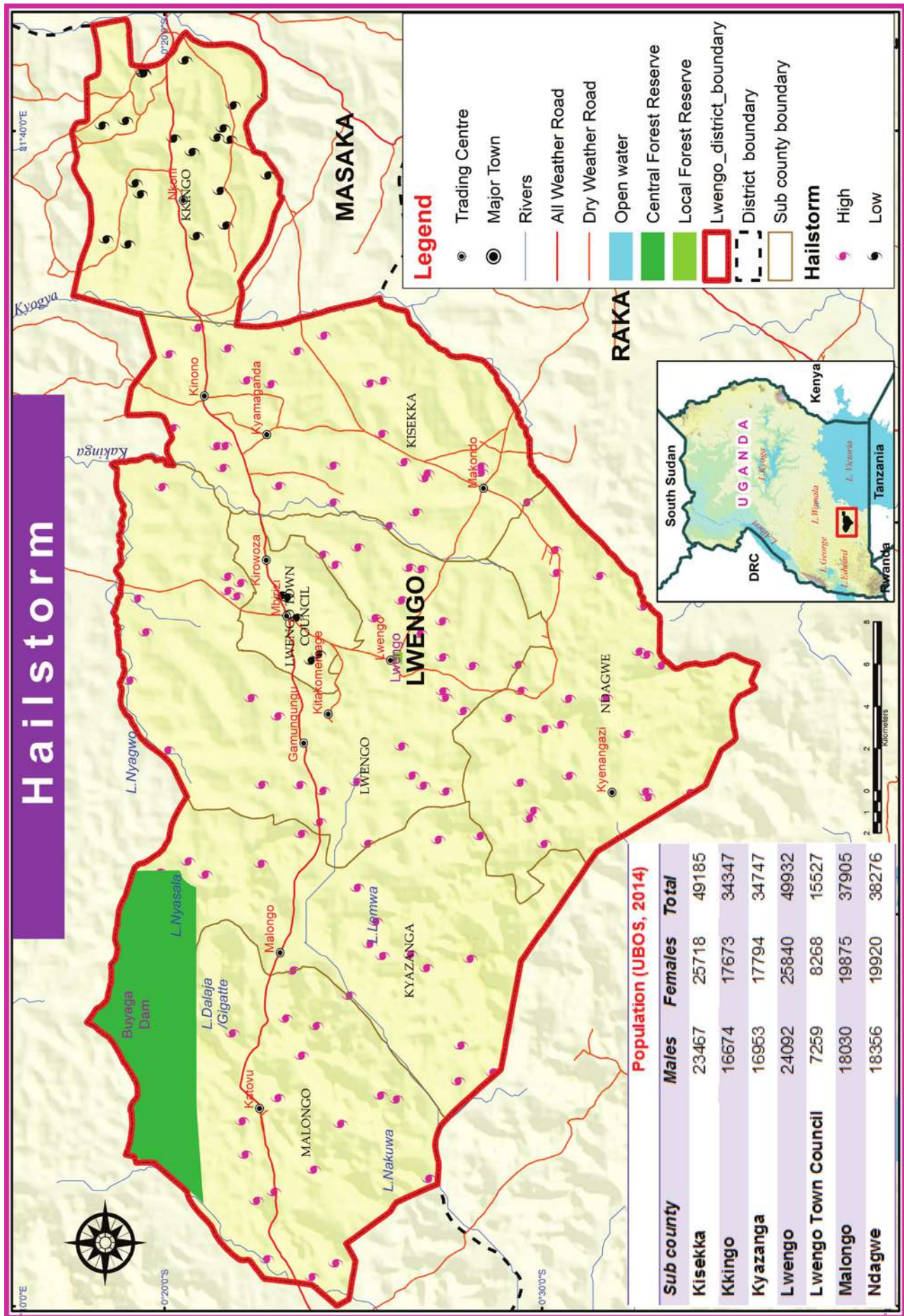
Figure 6 : Distribution of hailstorms

Legend

- Trading Centre
- Major Town
- Rivers
- All Weather Road
- Dry Weather Road
- Open water
- Central Forest Reserve
- Local Forest Reserve
- Lwengo_district_boundary
- District boundary
- Sub county boundary

Hailstorm
- High
- Low

Population (UBOS, 2014)			
Sub county	*Males*	*Females*	*Total*
Kisekka	23467	25718	49185
Kkingo	16674	17673	34347
Kyazanga	16953	17794	34747
Lwengo	24092	25840	49932
Lwengo Town Council	7259	8268	15527
Malongo	18030	19875	37905
Ndagwe	18356	19920	38276

3.2.8 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, presence of water bodies, wetland degradation, changes in the onset of rainy seasons and poor farming methods among others.

Plate 6: Strong Winds in Ndagwe Sub County

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 buidings. 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 extreme cutting of trees without replanting, 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 weeds and low income levels etc. The most severe impacts have been reported in all sub counties. (figure 7).
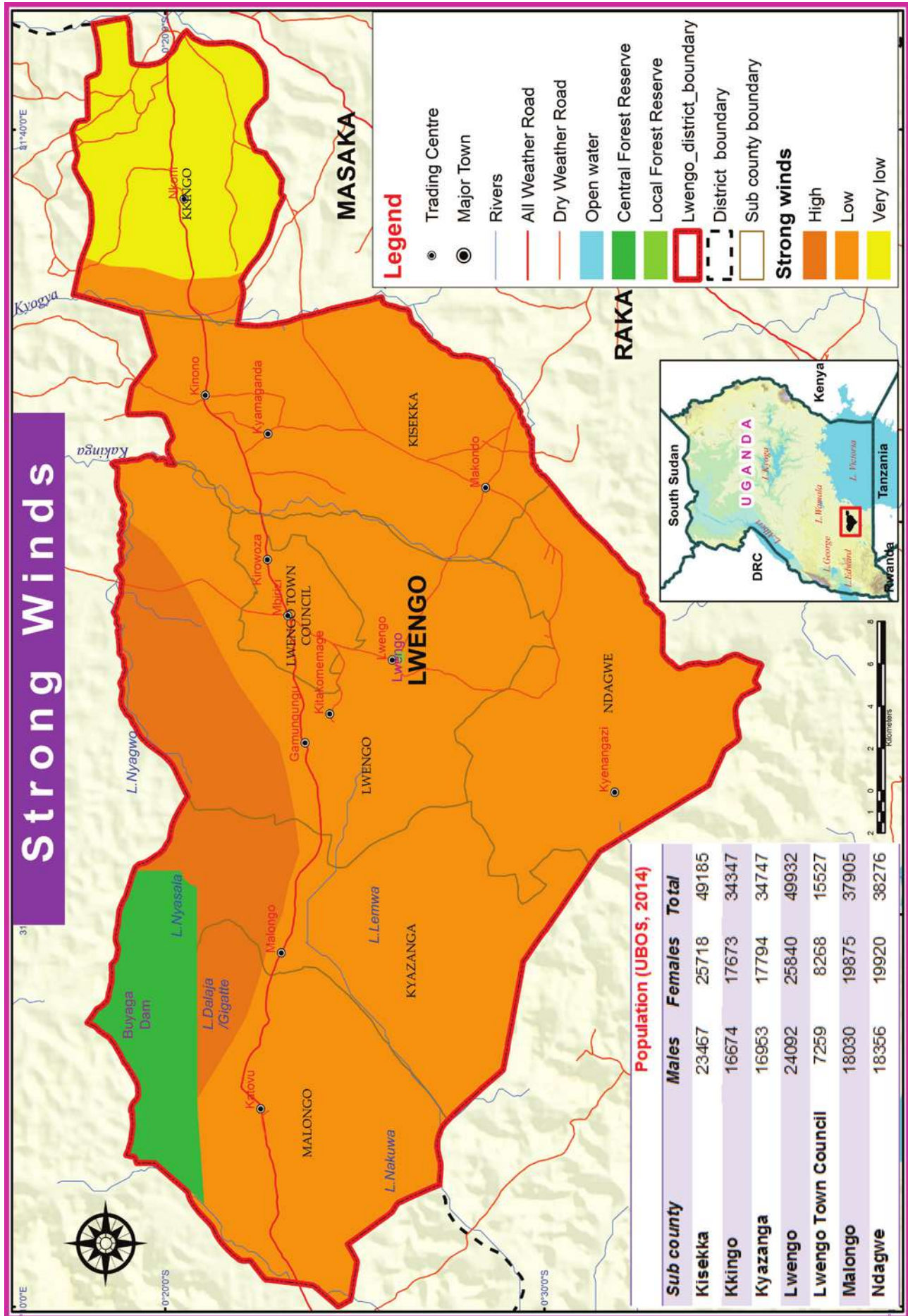
Figure 7: Strong winds levels

The map includes the following legend:

Legend
- Trading Centre
- Major Town
- Rivers
- All Weather Road
- Dry Weather Road
- Open water
- Central Forest Reserve
- Local Forest Reserve
- Lwengo_district_boundary
- District boundary
- Sub county boundary

Strong winds
- High
- Low
- Very low

Population (UBOS, 2014)

Sub county	Males	Females	Total
Kisekka	23467	25718	49185
Kkingo	16674	17673	34347
Kyazanga	16953	17794	34747
Lwengo	24092	25840	49932
Lwengo Town Council	7259	8268	15527
Malongo	18030	19875	37905
Ndagwe	18356	19920	38276

3.2.9 Land conflicts

Land conflicts have now become rampant in the district for the last 30 years. Most of the land in the district is under unregistered customary ownership with an increasing number of leaseholds and freeholds. The conflicts are among the people, Government establishments and , communities and cultural institutions and vice versa.

The land conflicts in the district are fuelled by unclear ownership of wetlands, population pressure, land inheritance, overlapping land policies, ignorance, unclear administrative and protected area boundaries, absentee 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. 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 in all sub counties as indicated in (figure 8).
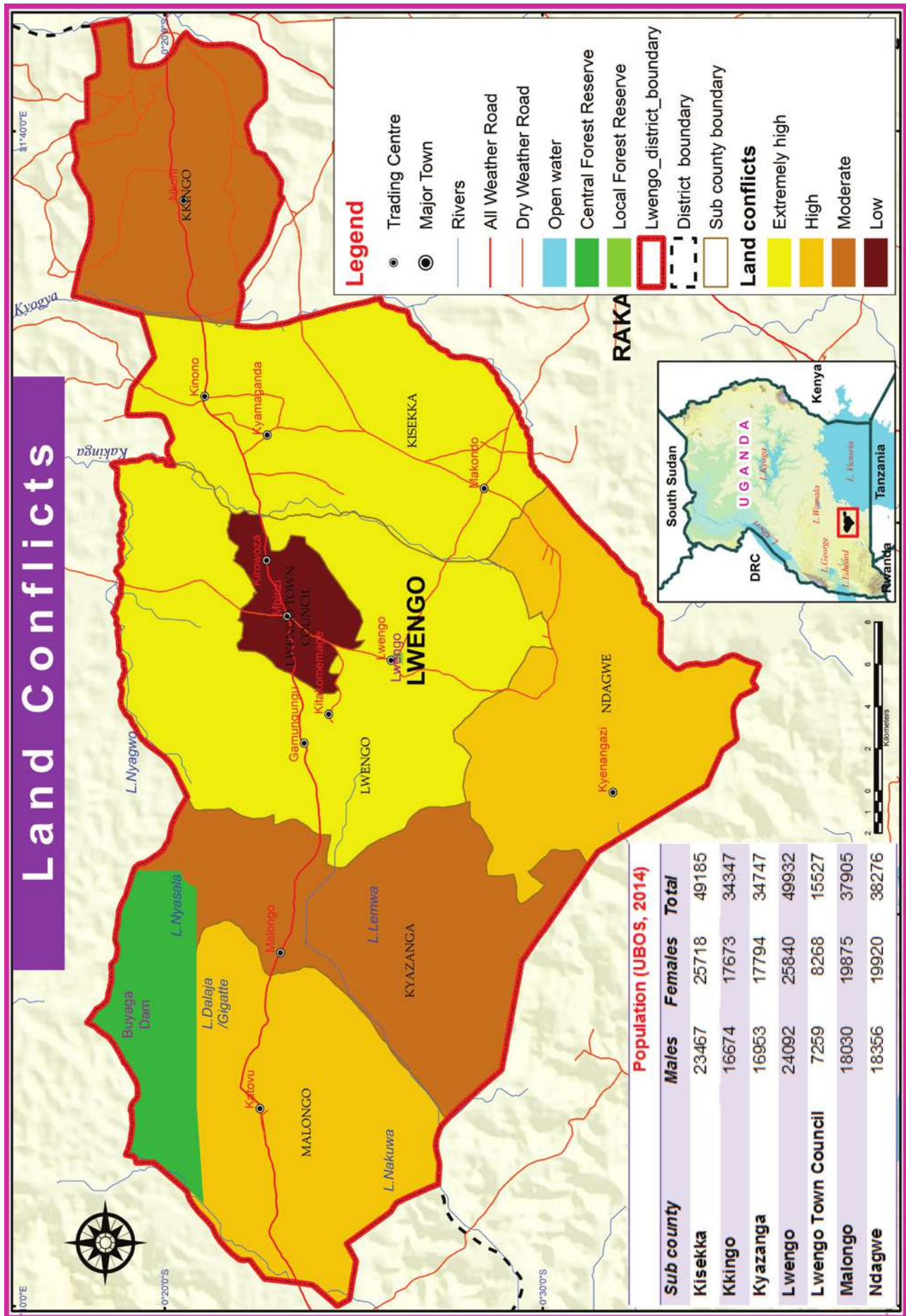
Figure 8: Severity of land conflicts

3.2.10 Flash floods

Lwengo 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 to May and September to 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 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 make 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 Lwengo town council, Kyazanga and Kisekka sub counties (Figure 9).
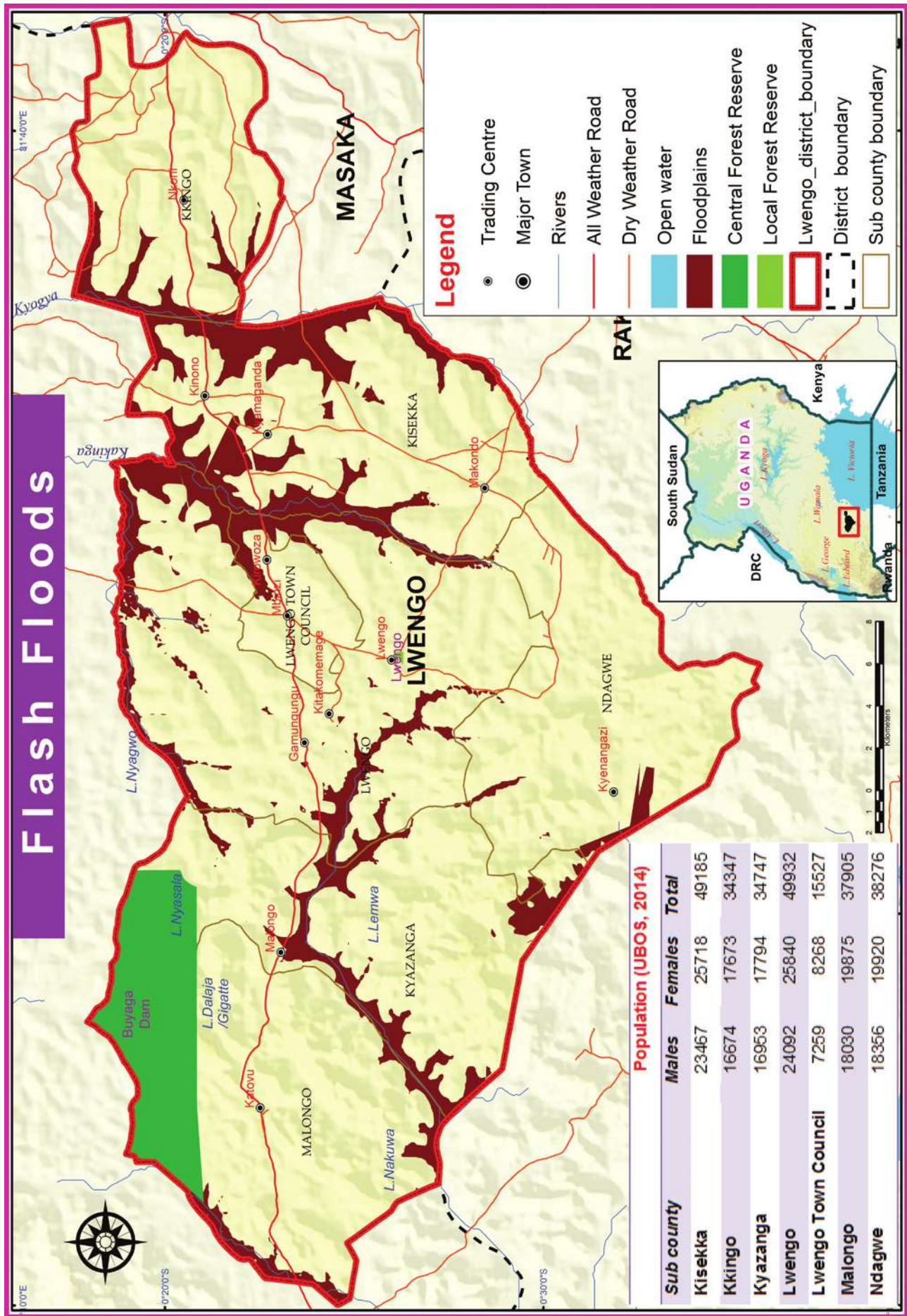
Figure 9: Flood prone/inundation areas

Population (UBOS, 2014)

Sub county	Males	Females	Total
Kisekka	23467	25718	49185
Kkingo	16674	17673	34347
Kyazanga	16953	17794	34747
Lwengo	24092	25840	49932
Lwengo Town Council	7259	8268	15527
Malongo	18030	19875	37905
Ndagwe	18356	19920	38276

3.2.11 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. Some of the fires are attributed to poverty, charcoal burning, poor farming methods, hunting 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.

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 Malongo, Lwengo, Ndagwe and Kyazanga sub counties.

3.2.12 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 timber 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, Hippopotamus, warthogs, Antelopes) 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 potential, migration, illness, low crop yields and modification of local climate. The fatalities have been highly reported in Kyazanga, Malongo and Kisekka sub counties. (Figure:10)
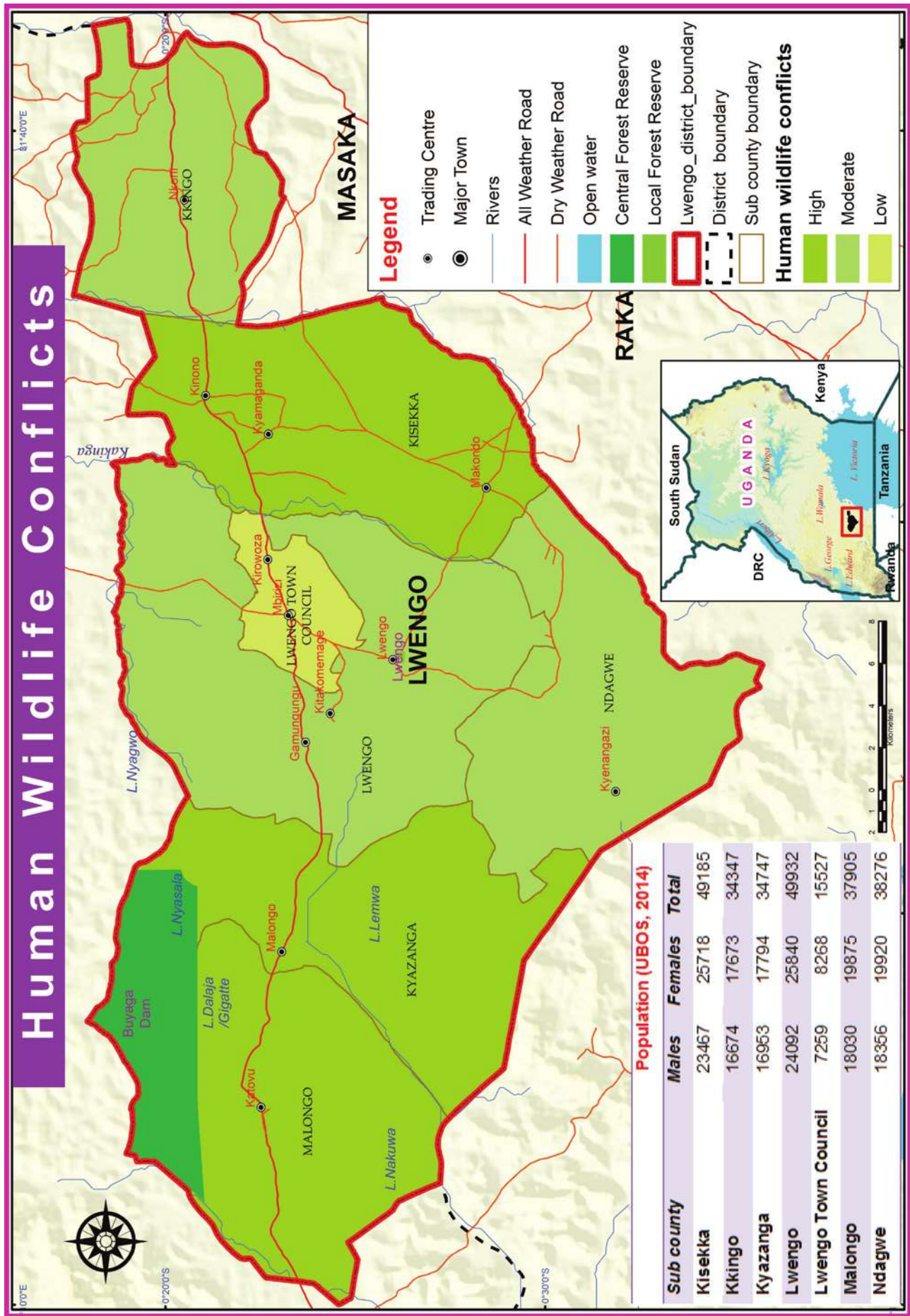
Figure 10: Levels of human wildlife conflicts

The map titled "Human Wildlife Conflicts" shows the Lwengo District with the following legend:

Legend
- Trading Centre
- Major Town
- Rivers
- All Weather Road
- Dry Weather Road
- Open water
- Central Forest Reserve
- Local Forest Reserve
- Lwengo_district_boundary
- District boundary
- Sub county boundary

Human wildlife conflicts
- High
- Moderate
- Low

Population (UBOS, 2014)

Sub county	Males	Females	Total
Kisekka	23467	25718	49185
Kkingo	16674	17673	34347
Kyazanga	16953	17794	34747
Lwengo	24092	25840	49932
Lwengo Town Council	7259	8268	15527
Malongo	18030	19875	37905
Ndagwe	18356	19920	38276

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	Drought	• Irrigation innovations • Water harvesting • Tree planting • Planting drought resistant crops • Diversification of production • Early planting • Involving in village SAACOs • Advocacy and sensitization • Food preservation and storage • Planting quick maturing crops • Use of energy saving stoves • Use of solar and other technologies	• Provision of tree seedlings • Provision quick maturing crop planting materials • Construction of valley dams • Regular Weather forecasts per region • Make disaster preparedness system functional at a district level • Roof top water harvesting • Embrace irrigation • Provision of resistant varieties of crops • Put up early warning systems at a district level
2	Pests/ parasites and Diseases	• NARO demonstration gardens • Planting clean seeds and seedlings • Spraying • Vaccination of livestock • Treatment of animals • Use of quarantine measures • Counseling and provision of drugs • Enacting by laws and Ordinances at sub county and district level respectively • Functionalizing the health centers • Mobile plant clinics in the markets • Mosquito nets provision	• Strengthen the drug authority inspections • Establish agricultural laboratories at district level • Recruitment of extension workers • Recruitment of veterinary doctors at sub county level • Subsidizing agricultural inputs • Increase sensitization on control measures • More funds to the natural resource department • Establish communal dams and dips • Develop district ordinances • Strengthening the plant clinic strategy • Promotion of the use Integrated Pest Management Strategy
3	Wetland degradation	• Sensitization on the dangers of encroaching wetlands • Wetland restoration • Tree planting • Encourage fish farming in ponds • Wetland gazetting and demarcations • Issuance of Wetland use permits	• More funds to the natural resource department • Strict enforcement of wetland laws • Improved irrigation technologies • Gazetting and demarcation of wetlands • Water harvesting for agriculture • Mapping and acquisition of land titles for wetlands by Local governments • Soil erosion control measure put in place • Evicting people from wetlands
4	Soil erosion	• Tree planting especially on bare hills • Growing of cover crops • Sensitization of farmers • Establishment of soil and water conservation structures • Digging across contours • Mulching • Terracing	• Sensitization of the farmers on proper farming methods • Funding the community outreach department • Provision of machinery for contour ploughing • Increasing extension workers • Put Emphasis on farm planning • Promotion of sustainable soil and land management technologies

No	Multi Hazards	Adaptation Reponses	Recommendations
5	Road accidents	• Installation of road signs • Installation of humps • Community policing Making feeder roads motorable	• Strengthen Law enforcement • Frequent maintenance and widening of roads • Sensitization on the use of roads and road signs • Monitoring road constructions • Strengthen check points
6	Hailstorms	• Tree planting • Green house farming	• Intensifying greenhouse farming • Strengthening the metrological department for early detection and mitigation
7	Strong winds	• Tree planting • Planned constructions	• Enforcing physical planning procedures • Encourage tree planting at household level and institutions • Provision of resistant species to wind breaks
8	Land Conflicts	• Local courts like Clan, LC's, magistrate courts • Land surveying and titling • Functional district land boars and area land committees at sub county levelIntervention of the district probation officers	• Shorten the bureaucracy of land document acquisition • More funds for the land committees • Subsidization of the land registration • Let the landlords give the tenants first priority when selling land • Sensitization on land management committees at district level • Facilitating the district surveyors with equipmets that can subsidize the fees for surveying and titling
9	Floods	• Sensitization on wetland usage • Demarcations and restoration of wetlands • Wetland users evictions • Use of trenches	• Sensitization on wetland degradation • Road environment assessment before construction • Funding the drainage system establishment • Construction of lagoons
10	Bush fires	• Sensitization	• Law enforcement • Need for more extension workers
11	Human wildlife conflicts	• Involving Wildlife authority • Trapping and hunting	• Equip vermin control staff • Conduct massive awareness campaigns • Re gazetting encroached wild life habitants • More resource allocation for sensitization • Demarcation of game parks

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 Lwengo 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* *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	3	6	Lwengo Town Council and Kyazanga Town Council, Kisekka
Droughts	5	5	25	Malongo, Lwengo, Kyazanga, Ndagwe, Kkingo and Kisekka
Hail storms	3	3	9	Malongo, Lwengo, Kyazanga, Ndagwe and Kisekka
Bush fires	3	3	9	Malongo, Lwengo, Kyazanga, Ndagwe
Pests and diseases	5	5	25	Lwengo Town Council, Malongo, Lwengo, Kyazanga, Ndagwe, Kkingo, Kisekka and Kyazanga Town council
Land conflicts	4	5	20	Lwengo Town Council, , Malongo, Lwengo, Kyazanga, Ndagwe, Kkingo, Kisekka and Kyazanga Town council
Strong winds	2	4	8	Lwengo Town Council, Malongo, Lwengo, Kyazanga, Ndagwe and Kisekka
Road accidents	3	5	15	Lwengo Town Council, , Malongo, Lwengo, Kyazanga, Kkingo, Kisekka and Kyazanga Town council
Soil erosion	4	3	12	Lwengo Town Council, , Malongo, Lwengo, Kyazanga, Ndagwe, Kkingo, Kisekka and Kyazanga Town council
Human wild life conflicts	2	2	4	Malongo, Lwengo, Kyazanga, Ndagwe,
Wetland degradation	5	5	2520	Lwengo Town Council, , Malongo, Lwengo, Kyazanga, Ndagwe, Kkingo, Kisekka and Kyazanga Town council

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 and diseases	1986 2016	30	12	40
2	Drought	2006 2016	10	2	20
3	Hailstorms	2010 2016	6	2	33
4	Bush fires	1996 2016	20	2	10
5	Invasive species	1986 2016	30	12	40
6	Human wildlife conflicts	1986 2016	30	12	40
7	Wetland degradation	2000 2016	16	24	150
8	Soil erosion	2006 2016	10	2	20
9	Strong winds	2011 2016	15	2	13
10	Land conflicts	2011 2016	15	12	80
11	Floods	1996 2016	20	2	10
12	Lightning	2013 2016	3	2	66
13	Road accidents	2011 2016	5	24	480

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 Lwengo 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, drought, and strong winds; ecological or biological hazards including human and wildlife conflicts, crop pests/animal parasites and diseases; technological hazards including road accidents; environmental including wetland degradation, bush fires and land conflicts predispose the community to high vulnerability state in the Lwengo district (table 8).

Table 8: Components of vulnerability in Lwengo 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 • Crops	District	• Death of people • Displacement of people • Loss of livelihood	District	• Sensitise people on land developments and land use • Clearly demarcating and defining land owner ship • Court • Other income generating jobs	District
	Soil erosion	• Human population • Crops	District	• Stunted crop growth • Reduced yields • Poor crop production • River siltation • Decreased biodiversity	Sub county	• Tree planting • Sensitization • Soil and water conservation i.e. bridges, trenches	Sub county
	Pests and diseases	• Human and livestock populations • Crops	District	• Increase in crime related to food • food insecurity • Malnutrition • Increased drop out in schools	District	• Vaccination • Spraying • Sensitizations • Crop rotation • Planting disease resistant crops	District
	Hail storms	• Human and livestock populations • Crops	Sub county	• Loss of livestock • Complete crop loss and failure • Stunted growth of crops	Sub county	• None	Sub county

	Hazard	Elements at risk	Level	Impacts	Level	Interventions	Level
Social components	Wetland degradation	• Lakes • Crops • Human population	District	• Flooding • Drying of water sources • Bio diversity destruction • Drought • Loss of grazing lands • Diseases • Loss of fish	District	• Sensitisation through radios • Enforcement of wetland laws • Promotion of regulated fish farming in wetland to promote conservation	District
	Road accidents	• Human and livestock populations	District	• Human and livestock deaths • Disabilities after injuries • Loss of livelihoods	District	• Regular guidance by traffic officers • Construction of humps and road signs • Reflector jackets, seat belts and helmets	District
	Floods/Water logging	• Human and livestock populations • Crops • Infrastructure including roads	Sub county	• Loss of lives • Stunted growth of crops • Destruction of roads • Diseases • Poor quality water for domestic use	Sub county	• Raising of roads by use of culverts • Water treatment	Sub county
	Drought	• Human and livestock populations • Crops	District	• Loss of lives • Stunted growth of crops • Loss of livelihoods • increased distances and time for collecting water	District	• Drought resistant crops • Migration to areas where there is water • Water harvesting	District
	Human wild life conflicts	• Human and livestock populations • Crops	Sub county	• Destruction of crops	Sub county	• Hunting • Killing the animals	Sub county

Component	Hazard	Elements at risk	Level	Effects	Level	Mitigation measures	Level
Social components	Bush fires	• Human and livestock populations • Crops	Sub county	• Loss of lives • Loss of soil fertility • Soil erosion	Sub county	• Awareness • Creation of Fire lines	Sub county
	Strong winds	• Human and livestock populations • Crops • Infrastructure including houses, schools and hospitals	Sub county	• Loss of lives • Destruction of homes • Injures • Displacement of persons	Sub county	• Planting trees • Building strong approved houses • Supervision of construction process	District
	Land conflicts	• Human population	District	• Retards personal and community investment and development	District	• Sensitise people on land developments and land use • Clearly demarcating and defining land owner ship • Court • Other income generating jobs • Hiring land for production • Buying of food	District
Economic component	Wetland degradation	• Lakes • Crops • Human population	District	• Loss of income • Loss of government revenue • Loss of water for production	District	• Sensitisation through radios • Encourage fish farming • Enforcement of wetland laws	District
	Pests and diseases	• Human and livestock populations • Crops	District	• Loss of income • Loss of government revenue • Increased expenditure on pesticides and drugs	District	• Vaccination • Spraying • Crop rotation • Physical removal of infected crops • Sensitizations of communities	District

Hazard	Elements at risk	Level	Effects/Impacts	Level	Interventions	Level
Soil erosion	• Human population • Crops	Sub county	• Loss of income • Loss of government revenue	Sub county	• Tree planting • Sensitization on conservation methods • Soil and water conservation i.e. bridges, trenches	Sub county
Hailstorms	• Human and livestock populations • Crops	Sub county	• Loss of income • Loss of government revenue	Sub county	• None	Sub county
Drought	• Human and livestock populations • Crops	District	• Loss of income due to low productivity • Loss of government revenue • Loss of crops and livestock • Increased production costs	District	• Drought resistant crops • Migration to areas where there is water • Water harvesting • Simple and appropriate irrigation systems	District
Road accidents	• Human populations	District	• Loss of lives	District	• Regular guidance by traffic officers • Construction of humps	District
Water logging	• Human and livestock populations • Crops • Natural vegetation • Infrastructure including roads	Sub county	• Loss of income • Loss of government revenue	Sub county	• Raising of roads by use of culverts • Water treatment	Sub county
Human wild life conflicts	• Human and livestock populations • Crops	Sub county	• Low income • Loss of government revenue	Sub county	• Hunting	Sub county

Hazard	Elements at risk		Effects		Interventions	
Bush fires	• Crops • Human and livestock population	Sub county	• Low income • Loss of government revenue	Sub county	• Awareness • Fire line establishment	Sub county
Strong winds	• Human and livestock populations • Crops • Infrastructure including houses, schools and hospitals	District	• Low income • Loss of government revenue • Loss of property	District	• Planting trees • Building strong approved houses • Enforce building approved plans • Improve inspections	District
Environmental component						
Land conflicts	• Crops • Human population	District	• Destruction of crops • Pushing people to occupy wetland • Promote land degradation	District	• Sensitise people on land developments and land use • Clearly demarcating and defining land owner ship • Court • Other income generating jobs	District
Wetland degradation	• Lakes • Crops • Human population	District	• Loss of bio diversity • Loss of grazing land • Drying of water resources • Pollution of water sources	District	• Sensitisation through radios • Promote fish farming • Enforcement of wetland laws	District
Soil erosion	• Human population • Crops	Sub county	• Loss of vegetation cover including trees and crops • Land degradation • Increase in use of fertilizers	Sub county	• Tree planting • Sensitization • Soil and water conservation i.e. bridges, trenches	Sub county

Hazard	Elements at risk	Level	Effects	Level	Coping mechanisms	Level
Pests and diseases	• Human and livestock populations • Crops	District	• Loss of crops and animals • Continued pollution due use of pesticide	District	• Vaccination • Spraying • Planting pest resistant crops • Promoting physical and biological control measures	District
Hailstorms	• Human and livestock populations • Crops	Sub county	• Loss of vegetation cover including trees and crops	Sub county	• None	Sub county
Drought	• Human and livestock populations • Crops	District	• Wetland reclamation and/or degradation • Loss of vegetation cover thus affecting the micro climate • Reduction in water table thus affecting the availability of ground water	District	• Drought resistant crops • Migration to areas where there is water • Water harvesting	District
Human wild life conflicts	• Human and livestock populations • Crops	Sub county	• Destruction of crops	Sub county	• Hunting	Sub county
Bush fires	• Sub county	Sub county	• Loss of soil fertility • Soil erosion • Loss of bio diversity	Sub county	• Awareness • Fire trenches	Sub county
Strong winds	• Human and livestock populations • Crops • Infrastructure including houses, schools and hospitals	District	• Destruction of animal/ crops and natural vegetation reources	District	• Planting trees • Building strong approved houses	District

Physical components

Hazard	Elements at risk	Level	Effects	Level	Measures	Level
Water logging	• Human and livestock populations • Crops • Natural vegetation • Infrastructure including roads	District	• Loss of bio diversity • Destruction of crops	Sub county	• Raising of roads by use of culverts • Water treatment	Sub county
Pests and diseases	• Human and livestock populations • Crops	District	• Loss of livestock • Reduced livestock productivity • Complete crop failure • Stunted growth of crops	District	• Vaccination • Spraying • Planting pest resistant crops	District
Wetland degradation	• Lakes • Crops • Human population	District	• Drying of water sources • Bio diversity destruction • Loss of grazing lands	District	• Sensitisation through radios • Promotion of fish farming • Enforcement of wetland laws • Support supervision of the resources	District
Soil erosion	• Human population • Crops	Sub county	• Stunted crop growth • Decreased biodiversity • Reduced soil productivity • Increased application of fertilisers	Sub county	• Tree planting • Sensitization • Soil and water conservation i.e. bridges, trenches	Sub county

Hazard	Elements at risk		Effects		Interventions	
Road accidents	• Human populations	District	• Loss of lives • Loss of property(vehicles, houses)	District	• Regular guidance by traffic officers • Construction of humps and road signs • Reflector jackets, seat belts and helmets	District
Hailstorms	• Human and livestock populations • Crops	Sub county	• Loss of livestock • Complete crop failure • Stunted growth of crops	Sub county		Sub county
Land conflicts	• Human population • Crops	District	• Loss of lives of both people and animals • Destruction of properties • Displacement of families	District	• Sensitise people on land developments and land use • Clearly demarcating and defining land owner ship • Court • Other income generating jobs	District
Drought	• Human and livestock populations • Crops	District	• Loss of vegetation cover • Lowering of water levels • Death of livestock • Scarcity of water • Proliferation of livestock diseases • Limited pasture • Migration of communities	District	• Drought resistant crops • Migration to areas where there is water • Water harvesting • Improving the water infrastructure e.g. dams	District

Hazard	Elements at risk		Effects/Impacts		Interventions	
Water logging	• Human and livestock populations • Crops • Natural vegetation • Infrastructure including roads	Sub county	• Loss of lives • Stunted growth of crops • Destruction of homes • Outbreaks of diseases, cholera	District	• Migration • Dig trenches	District
Human wild life conflicts	• Human and livestock populations • Crops	Sub county	• Destruction of crops • Death of livestock and humans	Sub county	• Hunting	Sub county
Bush fires	• Crops • Human population	Sub county	• Loss of lives • Soil erosion • Loss of soil fertility • Loss of pasture	Sub county	• Awareness • Fire line establishment	Sub county
Strong winds	• Human and livestock populations • Crops • Infrastructure including houses, schools and hospitals	District	• Loss of lives • Destruction of homes • Injures	District	• Planting trees • Building strong approved houses	District

CONCLUSION AND RECOMMENDATIONS

It was established that Lwengo district has over the last 30 years increasingly experienced multi hazards including flash floods, drought, invasive species, strong winds, pests and diseases for crops and livestock, soil erosion, human and wildlife conflicts, bush fires, lightning, 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 Lwengo district increase their vulnerability to multi hazard exposure necessitating urgent external support.

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

vi. Geomorphological and geological hazards including soil erosion

vii. Climatological or hydro meteorological including flash floods, hailstorms, drought, and strong winds

viii. Ecological or biological hazards including human and wildlife conflicts, crop pests/ animal parasites and diseases

ix. Technological hazards including road accidents

x. Environmental including wetland degradation, bush fires and land conflicts

However, counteracting vulnerability at community, local government and national levels should be a threefold effort hinged on:

i. Reducing the effects 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:

Local Governments

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 and facilitation of disaster risk committees at the district levels

iv. Periodic maintenance of feeder roads and enforce road safety measure to reduce road accidents.

v. Promotion of drought and disease resistant crop varieties/animal breeds

vi.   Demarcate the boundaries of wildlife/game reserves to reduce conflicts

vii.   Improve the communication channel between the Relief, Disaster Preparedness & Management department and local communities

viii.   Establishment of disaster grant at the district levels

ix.   Review laws on bush burning

x.   Fund and equip recruited extension works

xi.   OPM should strengthen the district disaster management committees by developing guidelines and trainings

xii.   Office of the Prime Minister should decentralize their activities at the district level

xiii.   Compensate individual victims of wildlife attacks

xiv.   Support extensive research on the occurrence and frequency of disasters prior to disaster management

xv.   Support establishment of disaster risk early warning systems

xvi.   Increase funding and staff to monitor wetland degradation and non genuine agro inputs

xvii.   Promote observation of the principle of rangeland carrying capacity among livestock keepers

xviii.   Establish weather stations at regional or district level to ensure updated information on weather related disasters

REFERENCES

Bunting, W. F., & Smith, B. E. (1993). A guide for conducting convective windstorm surveys. US Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Scientific Services Region.

Fistikoglu, O., & Harmancioglu, N. B. (2002). Integration of GIS with USLE in assessment of soil erosion. Water Resources Management, 16(6), 447 467.

Homer Dixon, T. F. (1994). Environmental scarcities and violent conflict: evidence from cases. International security, 19(1), 5 40.

Kamijo, S., Matsushita, Y., Ikeuchi, K., & Sakauchi, M. (2000). Traffic monitoring and accident detection at intersections. IEEE transactions on Intelligent transportation systems, 1(2), 108 118.

Venette, R. C., Kriticos, D. J., Magarey, R. D., Koch, F. H., Baker, R. H., Worner, S. P., & De Barro, P. J. (2010). Pest risk maps for invasive alien species: a roadmap for improvement. BioScience, 60(5), 349 362.

Yang, J., Townsend, R. D., & Daneshfar, B. (2006). Applying the HEC RAS model and GIS techniques in river network floodplain delineation. Canadian Journal of Civil Engineering, 33(1), 19 28.

Yokoyama, S. (2002, October). Lightning detection and lightning protection of power systems in Japan. In Transmission and Distribution Conference and Exhibition 2002: Asia Pacific. IEEE/PES (Vol. 1, pp. 546 551). IEEE.

Lwengo District Local Government Development Plan 2014/2015 – 2019/2020

Available online: