THE REPUBLIC OF UGANDA

Namutumba District

Hazard, Risk and Vulnerability Profile

2016

Acknowledgment

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

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The HRV assessment team was led by Mr. Kirungi Raymond Disaster Preparedness Officer and the team of consultants (GIS/DRR specialists); Mr. Emmanuel M.O.Matua; Mr. Festus Kakungulu Mukasa; Mr. Ambrose Buyinza, and Mr. Benon Nabaasa Baguma who provided technical support.

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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 as wel as other stakeholders. The report is presented in 3 chapters with chapter one detailing the background of the report which comprises of the Government of Uganda shifting the disaster management paradigm from the traditional emergency response focus 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 in Southeastern part of Uganda and it is approximately 140km from Kampala City. It borders Iganga District in the South, Bugiri in the South East, Kaliro and Kibuku in the North, Butalejja in the East. The District enjoys a tropical climate and is characterized by comparatively small seasonal variations in temperatures. The rain falls for 160 – 170 days each year with two peaks from March – May and October – November. The terrain upon which Namutumba District is located is that of remnant Busoga surfaces and valleys. Physiographical, it rises from lowlands of 3,830ft (1,167 meters) to hilly surroundings of 4,100ft 91,2249 meters) above sea level.

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 Namutumba 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, Lightning and strong winds
iii. Ecological or biological hazards including; human and wildlife conflicts, pests, parasites and diseases, and invasive species
iv. Technological hazards including; road accidents
v. Environmental hazards 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;

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

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

Definition of key terms

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

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

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

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

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

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

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

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

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

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

CHAPTER ONE

1.1 Background

Uganda has over the past years experienced frequent disasters that ranges from drought, to floods, landslides, human and animal diseases, pests, animal attacks, earthquakes, fires, conflicts and other hazards which in many instances resulted in death, property damage and loss of livelihood. With the increasing negative effects of hazards that accompany population growth, development and climate change, public awareness and proactive engagement of the whole spectrum of stakeholders in disaster risk reduction, are becoming critical. The Government of Uganda is shifting the disaster management paradigm from the traditional emergency response focus 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 risk 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

The objectives of the assignment were to:

1) Collect and analyze the field data using GIS in close collaboration and coordination with OPM in Namutumba 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

1.1 Overview of Namutumba District

Namutumba District is located in South-eastern part of Uganda and it is approximately 140km from Kampala city. It boarders Iganga District in the South, Bugiri in the South East, Kaliro and Kibuku in the North, Butalejja in the East. The district Headquarters are located at formerly Saza Headquarters, Busiki County, Kaiti village. The meteorological data for Namutumba District is Typical of eastern region of Uganda. The District enjoys a tropical climate and is characterized by comparatively small seasonal variations in temperatures. The rain falls for 160 – 170 days each year with two peaks from March – May and October – November. The temperature ranges from 22^0C to 27^0C with an annual average of 25° Celsius. The annual temperature range is 23 - 27° Celsius. The mean annual rainfall is 1000mm with a range from 900 mm- 1150mm. The district is of bi-annual season with the 1st rains covering March-June and 2nd rains August –November.

The terrain upon which Namutumba District is located is that of remnant Busoga surfaces and valleys. Physiographical, it rises from lowlands of 3,830ft (1,167 meters) to hilly surroundings of 4,100ft 91,2249 meters) above sea level. Elsewhere are valley sediments eroded from higher grounds, which form part of the District Basement Valley of varying gradients that separate the steep slopes of Namutumba District, these valleys form essential natural drains of the district downstream towards Mpologoma

Agriculture is the main economic activity in Namutumba District. There are many small producers engaged in a wide range of crops like; Cotton, coffee which are grown purely for cash while maize,beans, groundnuts, cassava,. Rice, sweet potatoes, millet and bananas are both major food and cash crops. Other crops grown include Simsim, yam, Soya beans, sunflower, vegetables and fruits. Over 80% of the farmers practice subsistence agriculture and in most cases the production is not economically viable. Animal population is about 36,850 cattle, 28550 goats, 4250 sheep, 4900 pigs, 1220 rabbits, 1480 dogs, 257300 chickens, 4750 turkeys, 1975 ducks and 432 domestic cats (UBOS, 2009).

There are a variety of many small –scale industries namely agro- processing industries in coffee, maize cassava, millet and rice. However there is the untapped potential for processing of milk, hides and skin and clay mining industry for the production of roofing tiles. Petty trading in general merchandise, produce, domestic animals, all types of domestic birds is lucrative and vibrant in all sub counties and should be natured as well as sustained.

CHAPTER THREE

Materials and methods
Multi-hazard, risk and vulnerability profile assessment

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.

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: Magada and Kibale. 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 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-hazards

3.2.1 Introduction

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

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

Thirty one per cent of the total land area (801sq.km) is covered by the wetlands. The wetlands are most productive natural resources. The wetland types found in Namutumba District are classified 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. However it's imperative to note that major activity is paddy rice cultivation. The major causes of wetland degradation include land shortage, reduced soil fertility, political interference, soil erosion, drought, poor farming methods, assumed ownership, and change in land use (paddy rice cultivation), ignorance, resource conflicts, brick making, sand mining and invasion by invasive species (Plate 1).

Plate 1: Paddy rice growing in wetland, Namutumba sub county

The degradation is associated with silting of wetlands, 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 weak 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, increased incidences of pests, parasites and diseases, loss of property, livestock and human life. It must also be noted that the wetland degradation cases reported are widespread throughout all the sub counties in the District (figure 1).

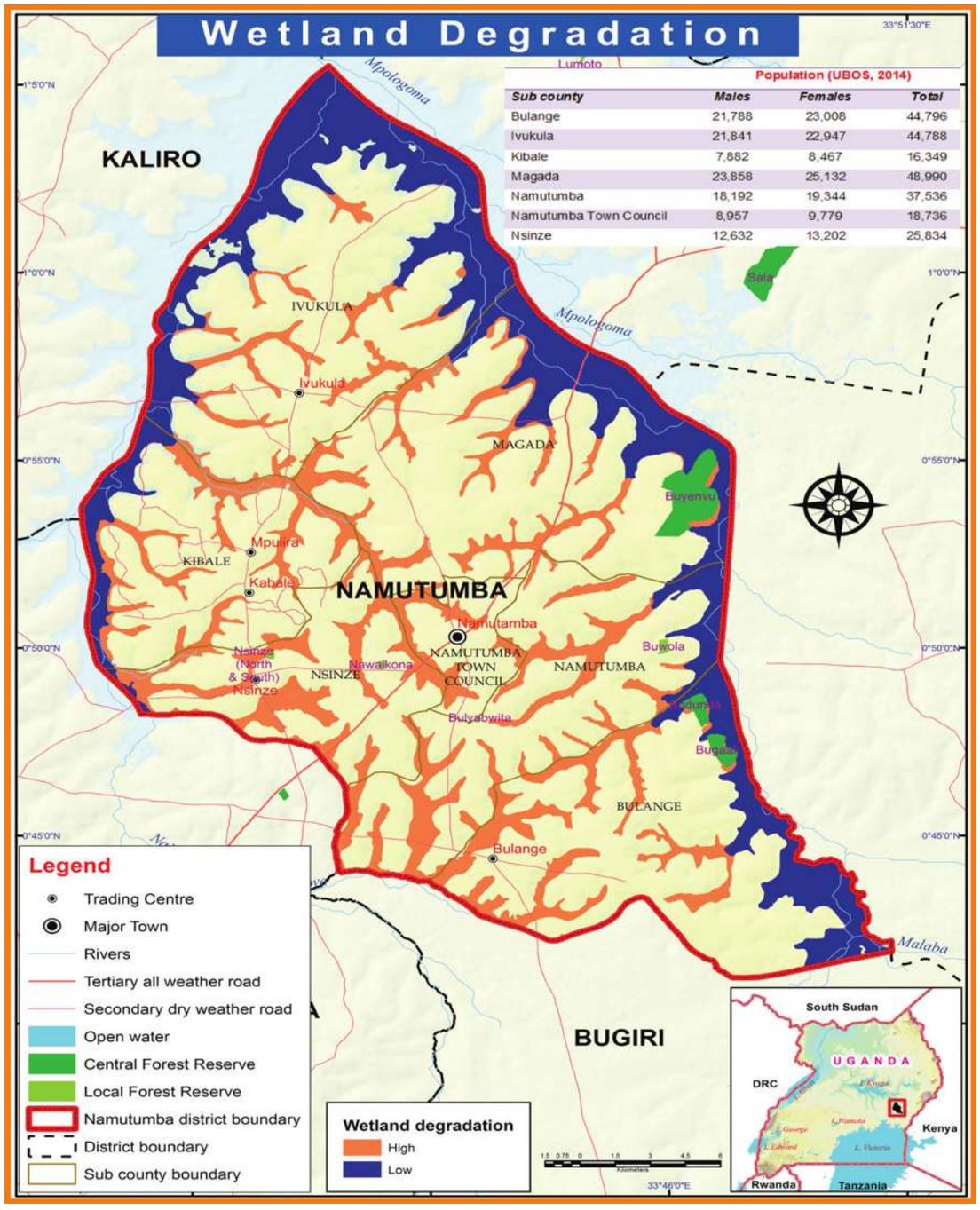

Figure 1: Levels of wetland degradation

3.2.3 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.

Plate 2: Galleys cause by soil erosion in Namutumba sub county

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

The adverse effects of soil erosion experienced in the District include: reduced 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, 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 2).

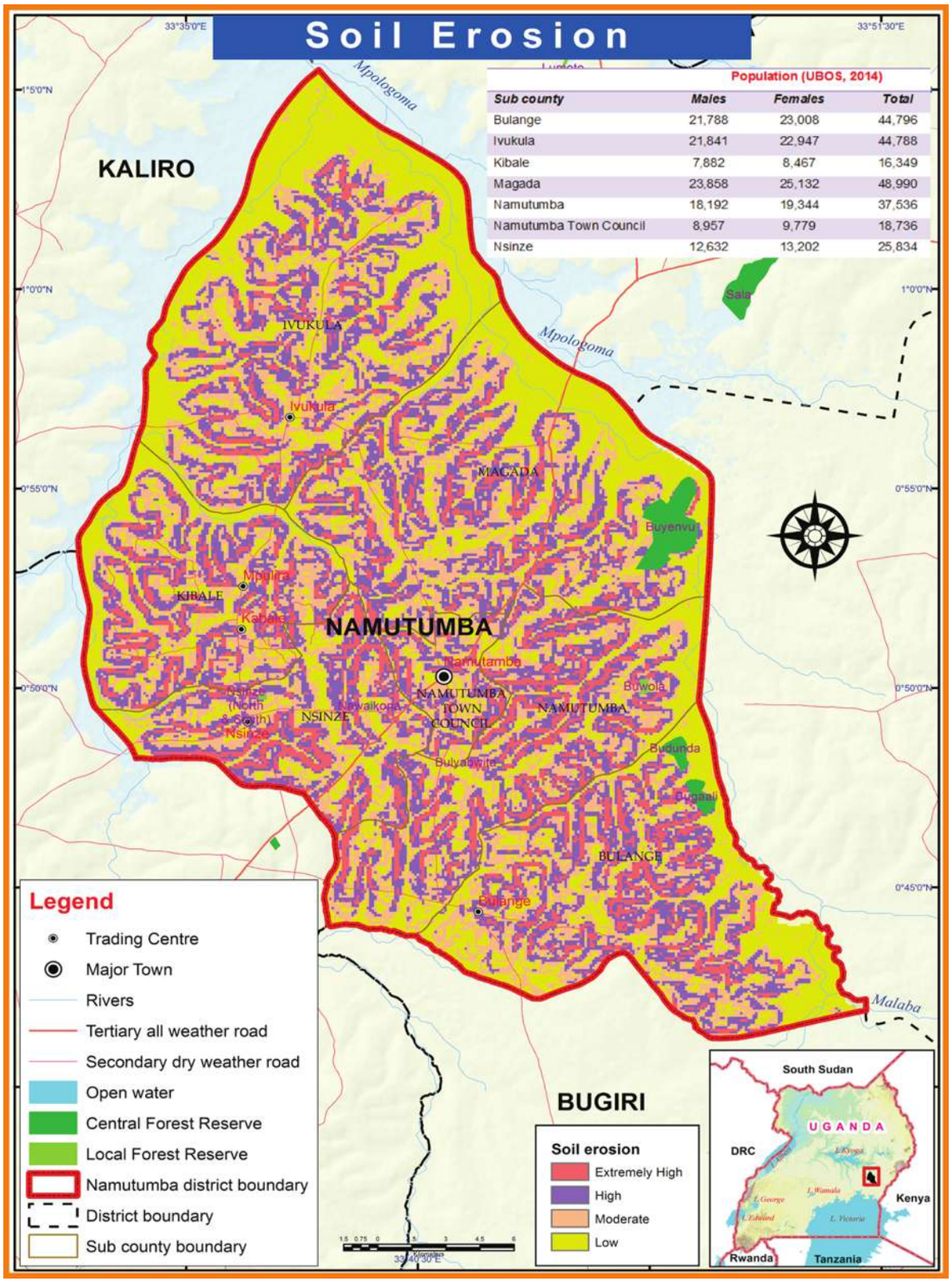

Figure 2: Soil erosion prone areas

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 as food and cash crops, however, their production has drastically reduced over time due to increasing and emergence of new pests, parasites and diseases.

Plate 3 : Stunted cassava affected by cassava mosaic disease in Bulange sub county

The high pre-and post-harvest pest and disease incidences in crops is mainly attributed to changes in weather patterns, deforestation, 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 pests, parasites 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 seedlings, substandard pesticides and limited extension services. The adverse effects have resulted into low crop yields, low income levels, build-up of pests and soil degradation among others. Some of the notable ests, parasites and diseases are indicated here below (table 4). The effects of pests, parasites 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	Striga, stem borers, maize smurt, maize streak
4	Sorghum	Striga, sorghum midge, stem borers, sorghum shoot fly
5	Finger millet	Striga
6	Cowpeas	Aphids
7	Bananas	Banana Bacterial Wilt, banana weevils, sigatoka
8	Tomatoes	Tomato Blight
9	Rice	Stem borers, rice yellow mortal virus
10	Beans	Aphids
11	Citrus	Rot, fruit-fly, hard scab
12	Coffee	Coffee wilt disease, coffee twig borer
13.	Mangoes	Fruit fly

In livestock production, Namutumba 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, 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 3).

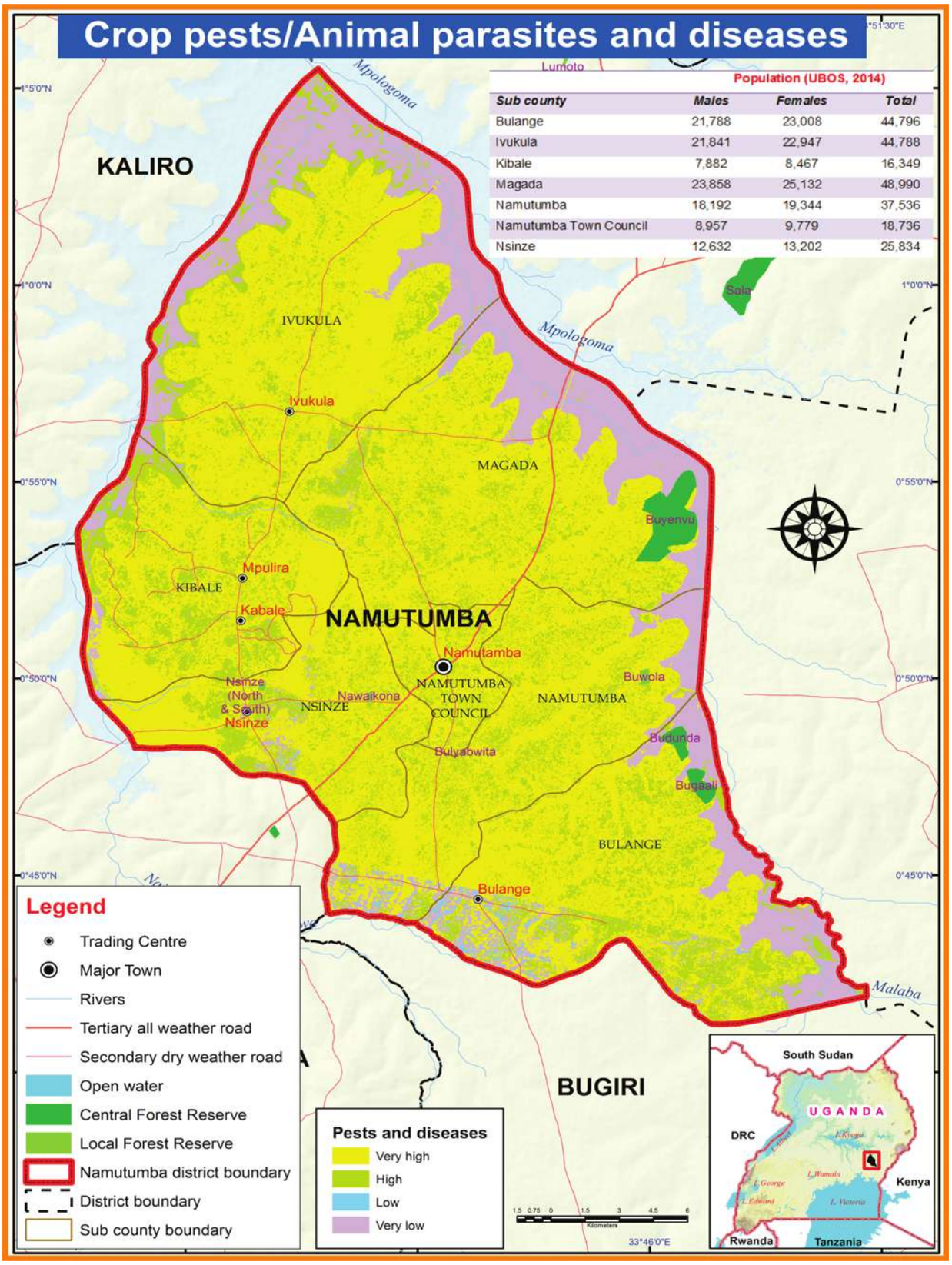

Figure 3: Pests, parasites and diseases

3.2.5 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, 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. In addition, the tenure arrangements are associated with over exploitation by several implemented land use options such as overgrazing and land fragmentation on the allocated piece of land. The prevalence of land conflicts is widespread in Ivukula, Kibale, Magada and Bulange Sub County (Figure 4).

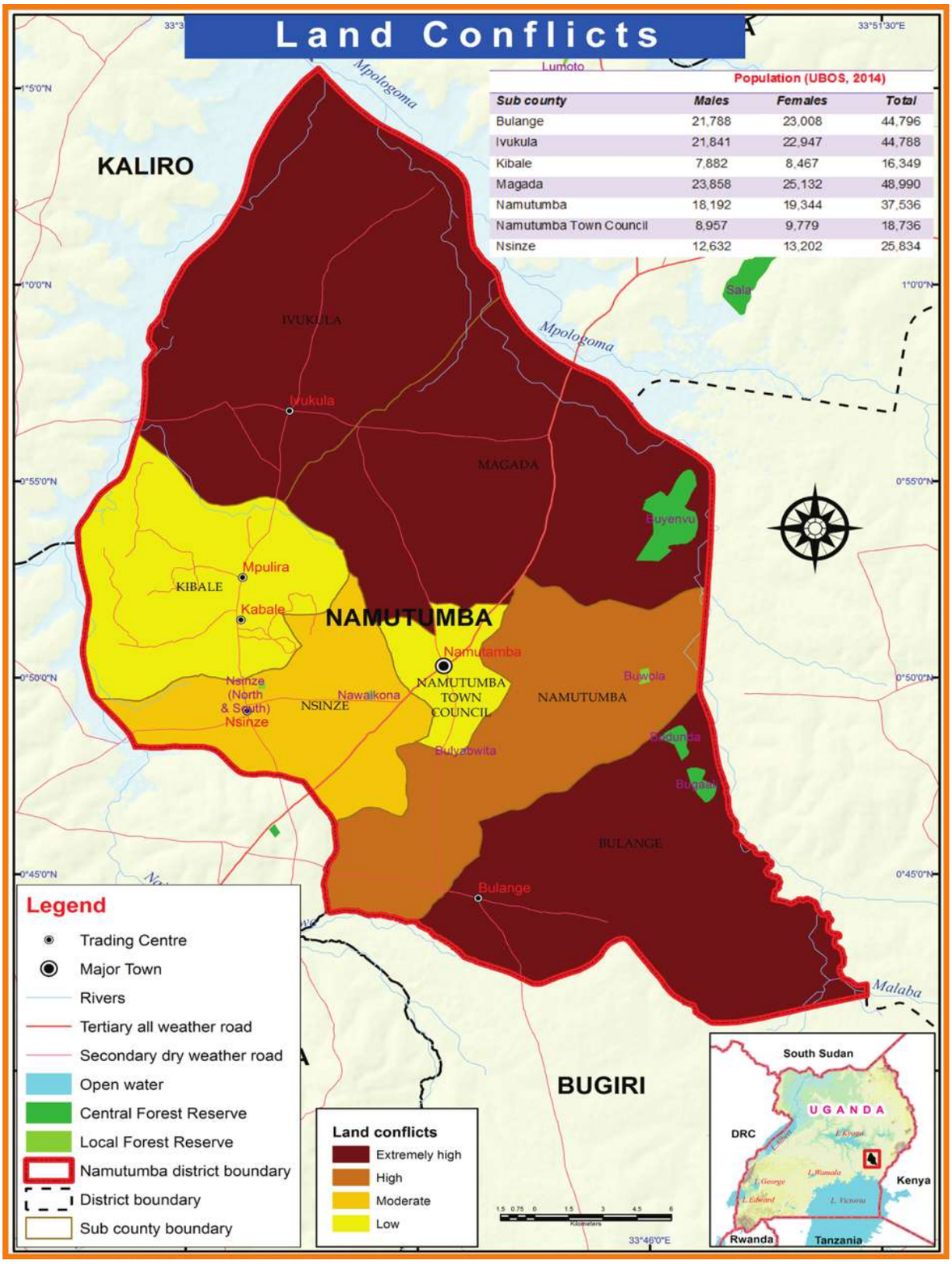

Figure 4: Severity of land conflicts

3.2.6 Hailstorms

The occurrence and severity of hailstorms are a frequent phenomenon in Namutumba 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 timber for brick making and 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 are destruction of property, reduced household income levels, food shortages, loss of life for people and livestock. The episodes affected every sub county in the District but intense in Nsinze, Bulange, Namutumba, Namutumba Town Council and Magada (figure 5)

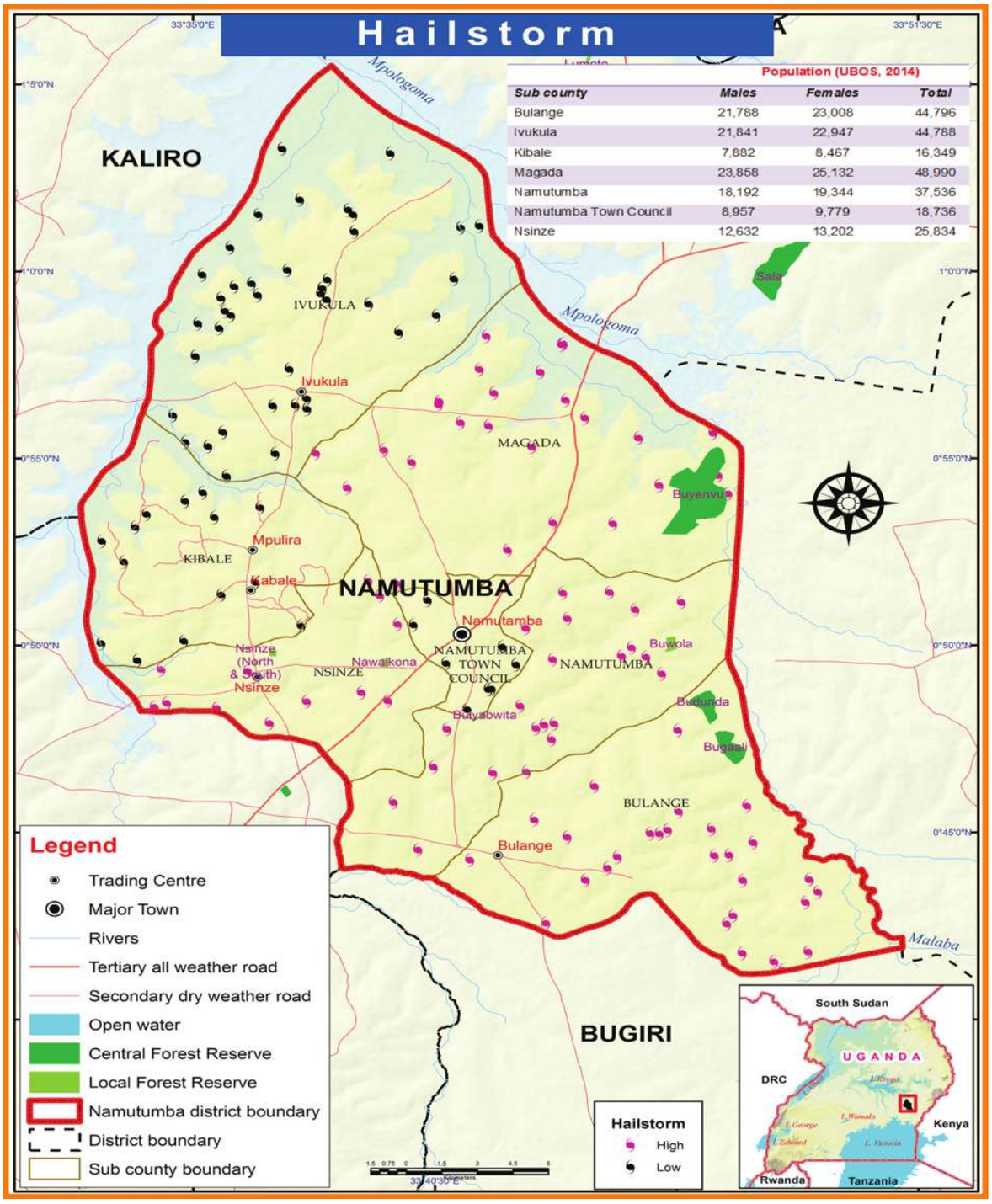

Figure 5: Distribution of hailstorms

3.2.7 Strong winds

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

The occurrences and severity of strong winds are characterised with heavy showers, falling of crops, high rates of surface runoff, breakage of trees and destruction of houses. The winds are more common during the rainy season especially in the months of September and October of each seasonal year. The communities have become vulnerable due to inadequate tree cover, unreliable seasonal weather forecasts and clearance of vegetation among others (plate 4)

Plate 4 : Rooftop blown off by strong winds in Bulange sub county

The strong winds have destroyed crops and property, blocked roads, reduced crop yields and income levels etc. The most severe impacts have been reported in the sub counties of Kibale and Nsinze (figure 6).

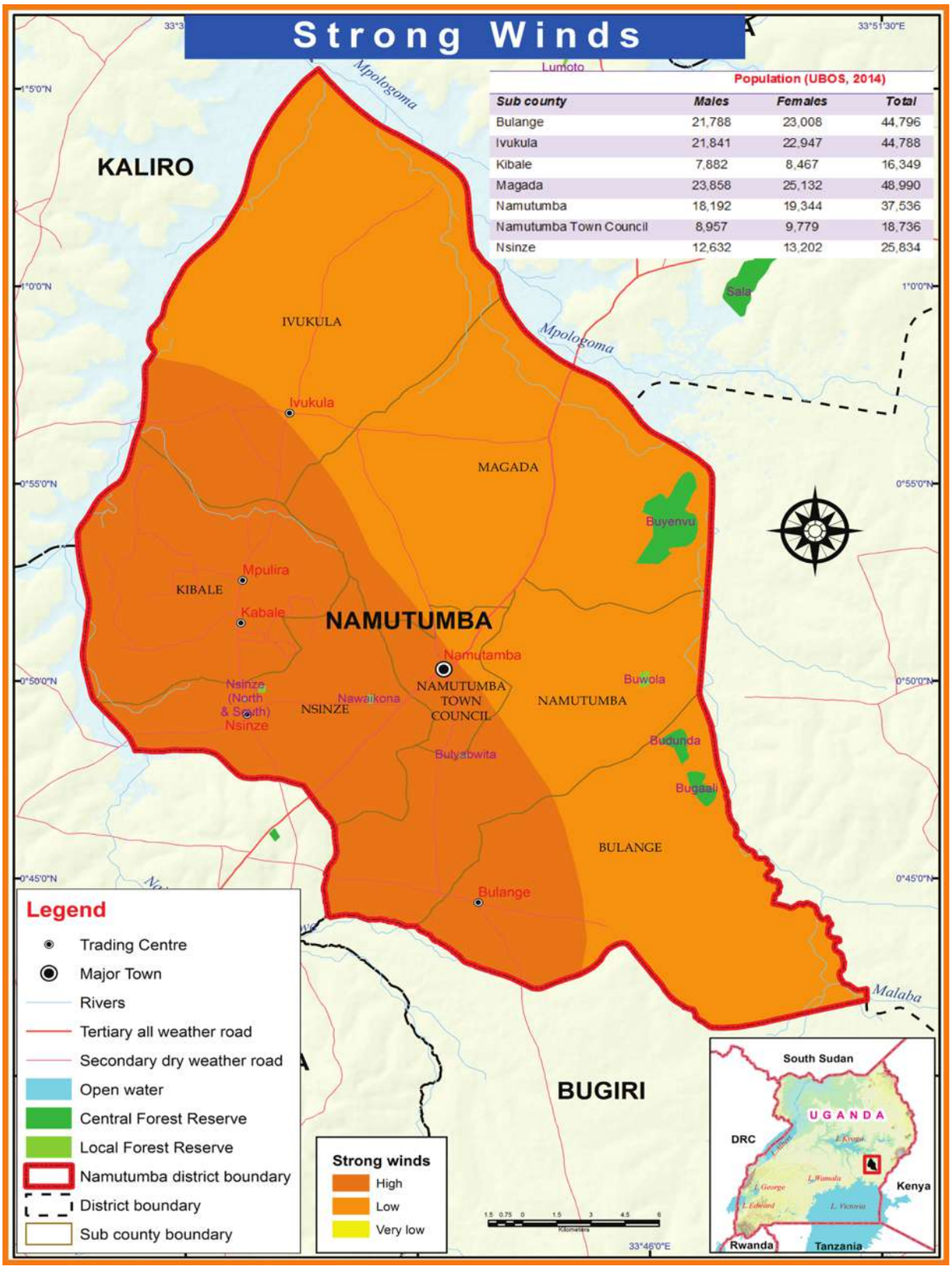

Figure 6: Strong winds levels

3.2.8 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 Nsinze, Bulange, Namutumba and Magada (figure 7).

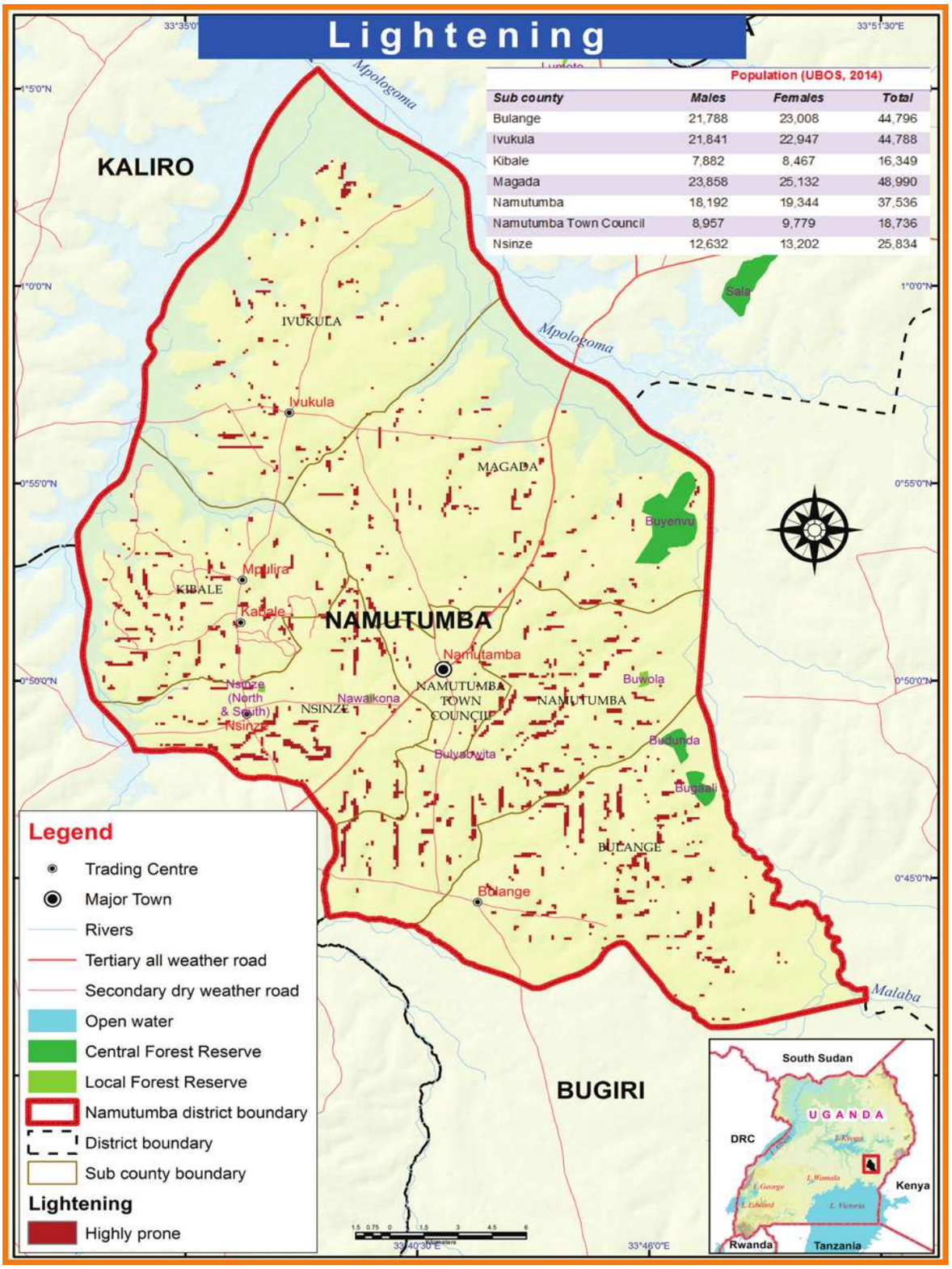

Figure 7: Lightning prone areas

3.2.9 Invasive species

The occurrence of invasive species in the District is twofold: those that are land and water based. The invasions on land are mainly in farmlands while the water based can be seen on the 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, paper mulberry among others.

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

The adverse effects of land based species include loss of biodiversity, loss of livestock, low income levels, poor crop yields and encroachment of public land among others (figure 8).

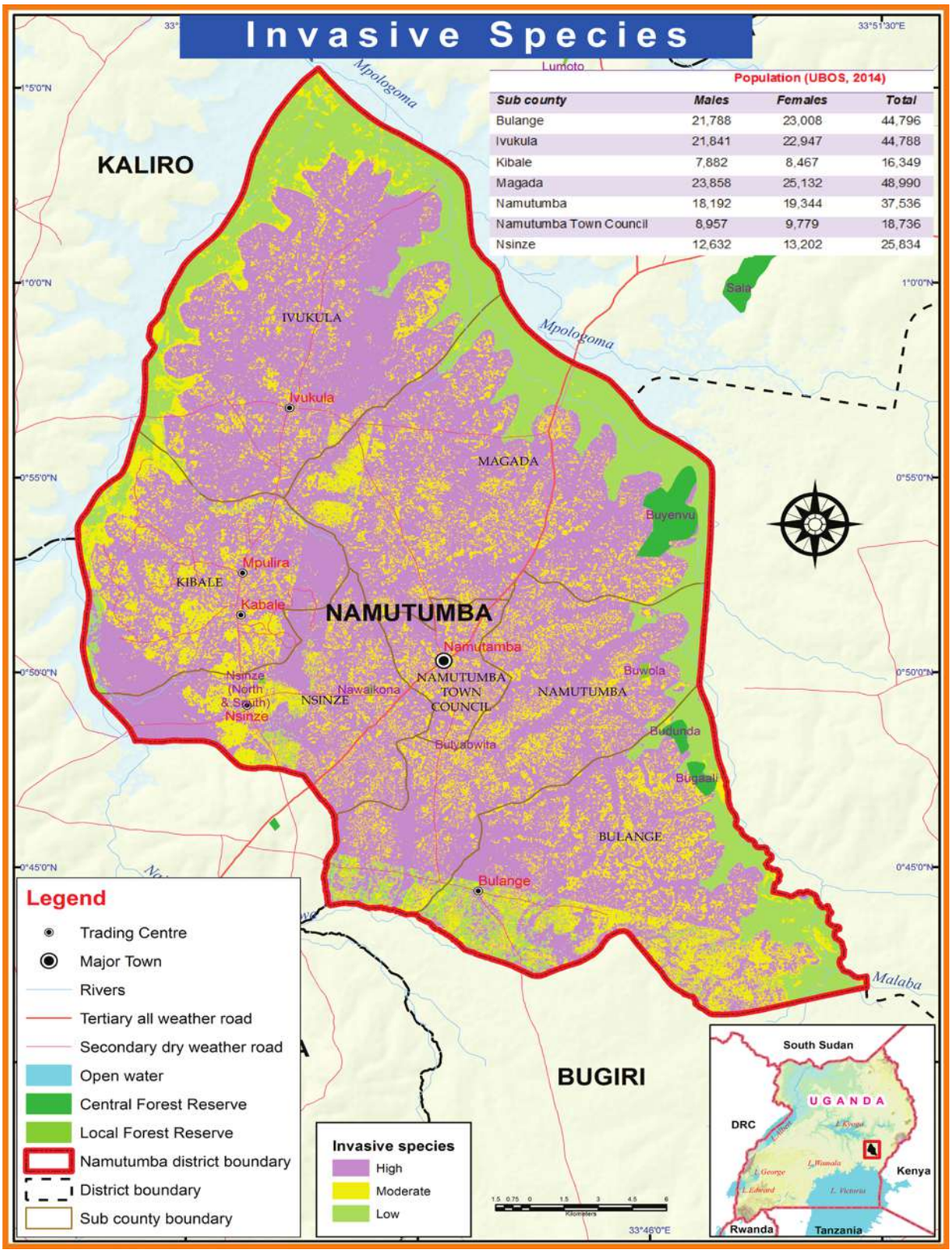

Figure 8: Distribution of invasive species

3.2.10 Road accidents

Road accidents claim a number of lives in the District of recent than before. The prevalence of road accidents are attributed to the driving of cars in dangerous mechanical conditions, reckless driving, lack of road sign posts, 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 road 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 (Plate 5).

Plate 5: Road accident along Tiriniyi road

The notable effects of road accidents include: loss of human life and livestock, illness, disabilities, loss of property and documentation, reduction in crop and livestock production and loss of income in compensations. The accident incidents are reported in all the sub counties throughout the year (figure 9).

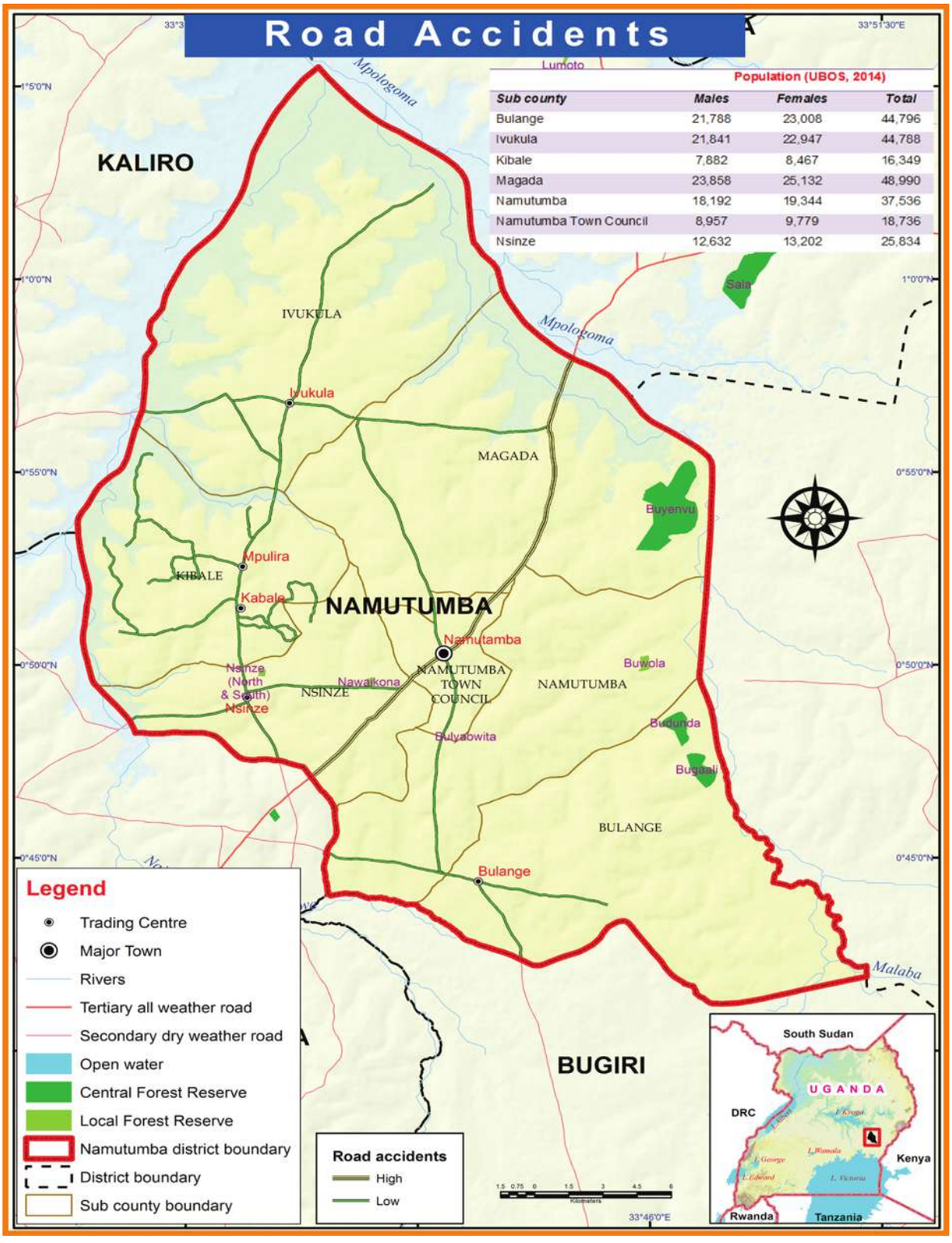

Figure 9: Road accidents distribution

3.2.11 Flash floods

Namutumba district experiences flash floods that destroy several acres of crops and properties. In addition to erratic/heavy rainfall, wetland degradation 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 to create cultivable fields for paddy rice growing and establish settlements. In their happening, the wetland vegetation is deforested resulting into excess water not being absorbed. The massive cultivation of rice with the application of poor farming methods is causing blockage of stream channels that make excess water to inundate. The nature of clay soil type which exhibits hard soil structure does not easily allow runoff water to percolate resulting into stagnation of water.

Plate 7: Murrum roads washed away by floods

The characteristics of flash floods is associated with water logging of rice 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 were reduced income for farmers, reduced yield, increased prices of staple food, illness, destruction of water wells, destruction of roads, property and livestock. The flash flood phenomenon affects all subcounties but severely affects Magada, Ivukula and Magada Sub Counties (figure 10).

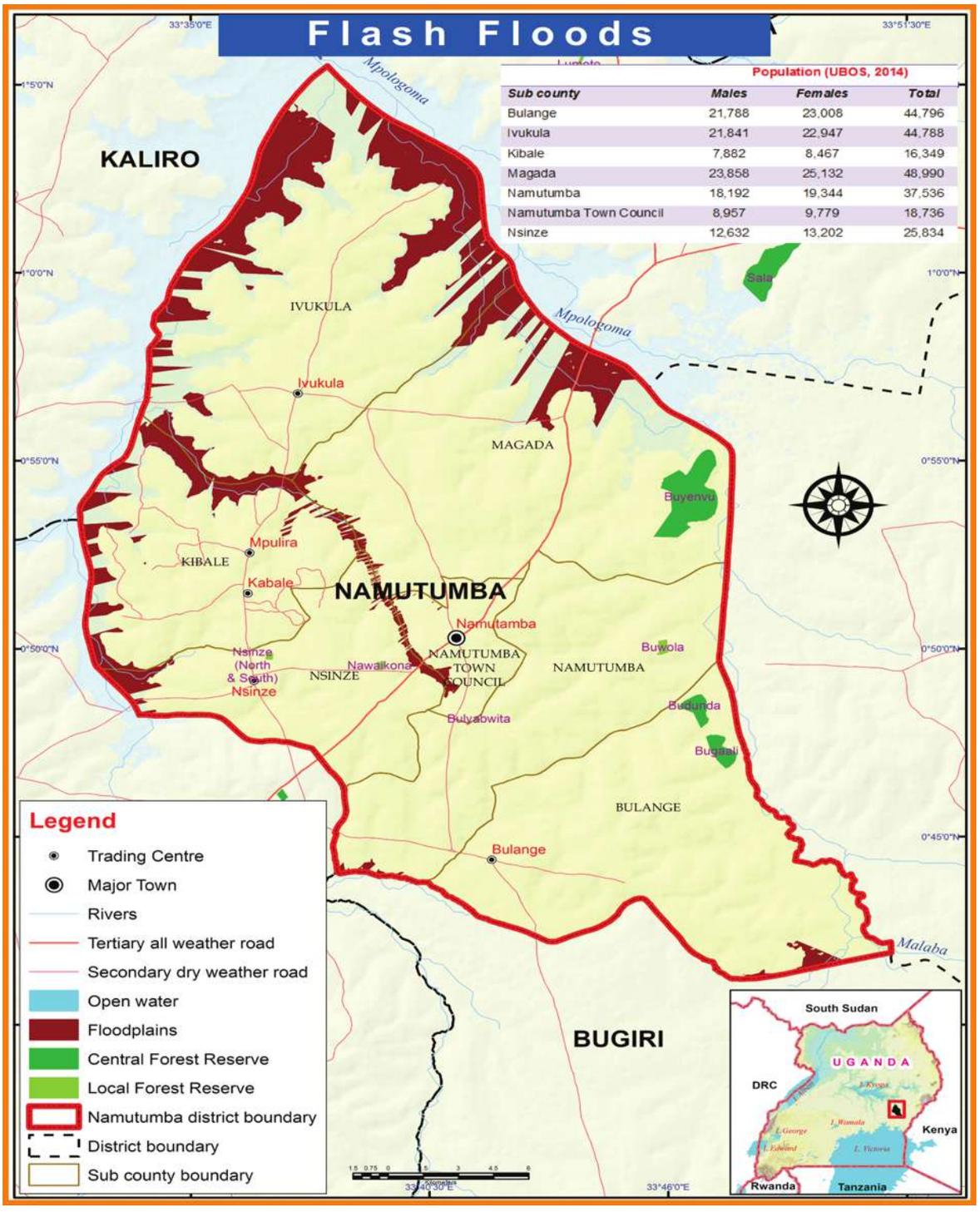

Figure 10: Flood prone/inundation areas

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 are characterized by crop destruction, increase in disease incidences, death of wild animals (monkeys etc) and loss of human life. The conflicts are more common during

the crop harvesting period of each year. The factors that contribute to the vulnerability of these conflicts include the types of crops grown, wetland degradation, deforestation, unclear boundaries of protected areas and population pressure.

The encounters have resulted into the loss of household income and, low crop yields. The fatalities have been highly reported in all sub counties except Namutumba Town Council (figure 11)

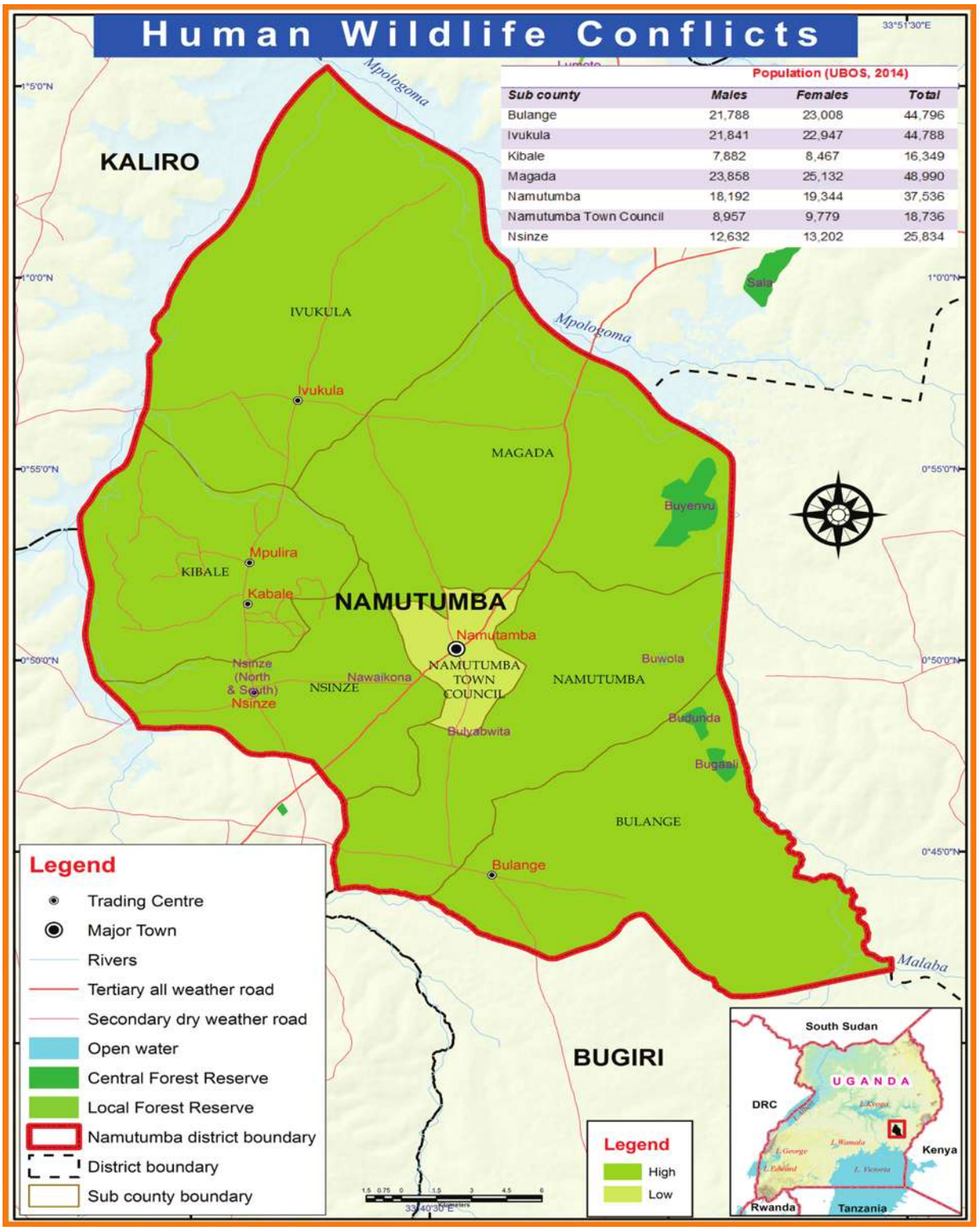

Figure 11: Levels of human wildlife conflicts

3.2.13 Drought

Namutumba is one of the Districts found in the cattle corridor. The cattle corridor is characterized with low rainfall of between 300-700mm which makes them semi-arid and therefore constituting the dry lands of the country. 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 and deforestation. Drought occurrences are associated with deficit soil moisture, reduction of surface water sources, rotting of crops and reliance on imported foods. It is aggravated by low adaptive capacity of farmers and reduced soil fertility. Predictably, the most affected months are those from December – March and July – September of each seasonal calendar.

Notably, the most adverse effects of drought include reduced income for farmers, reduced farm yield, reduced inputs and investment in the agricultural sector. In addition, it causes increased prices of staple food, food insecurity, migration, theft of crops in gardens and illness, loss of livestock. The severity and distribution of drought affects all the sub counties.

3.3 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	Wetland degradation	•Sensitization on the dangers of encroaching wetlands •Bi-law enforcement •Tree planting •Upland rice growing •Practicing conservation agriculture	•Provision of highly yielding upland rice •Funding the district natural resource department •Strict enforcement of wetland laws •Diversify sources of livelihood e.g. Apiary •Improved irrigation technologies •Demarcation of wetlands •Water harvesting for agriculture •Upscale climate smart agriculture technologies
2	Soil erosion	•Mixed cropping •Tree planting •Crop spacing •Growing of cover crops •Sensitization (farmer visits) •Minimum tillage	•Sensitization of the farmers on proper farming methods •Recruitment and training of extension workers
3	Pests, parasites and diseases	•Crop rotation •Spraying of vegetables •Vaccination of livestock •Treatment of animals •Using disease resistant varieties •Distribution of nets (mosquito and tsetse flies)	•Subsidizing pesticides and vaccines •Sensitization on control measures •Provide improved breeds and resistant crop varieties •Recruitment of more extension workers •Construction of valley dams •Establish demonstration gardens •Subsidize the costs of pesticides and fertilizers
4	Land Conflicts	•Law courts like Clan, LC's, magistrate courts •Demarcation of land •Acquisition of land titles •Sensitization on land ownership	•Reducing the costs involved in acquiring land titles •Reforms on land ownership •Revisit the land act •Quick/optimal judgments of land cases •Mediation between warring parties
5	Hailstorms	•Tree planting •Food aid	•Food and seedlings provision on occurrence •Provision of tree seedlings •Provision of weekly weather forecasts
6	Strong winds	•Tree planting •Planned constructions •Sensitization	•Provision of tree seedlings •Sensitization of the community on a village level about tree planting •Construction of planned houses
7	Lightning	•Installation of arrestors •Tree planting	•Subsidization of Lightning arrestors •Rural electrification •Provision of tree seedlings

8	Invasive Species	•Mixed planting •Crop rotation •Planting resistant crops •Sensitization	•More research on invasive species •Planting resistant improved seeds e.g in IR Maize (Kayongo go) to control striga •Legislation on the movement of seeds •Provision of improved seedlings •Provision of fruit fly traps
9	Road accidents	• Law enforcement • Installation of road signs • Recommendations from the driving school for licence acquisition • Road maintenance • Wearing reflectors and helmets	• Enforcement of traffic laws • Sensitization on road safety use • Frequent maintenance of roads • Prioritizing the permit licensing sector • Using reputable constructors • Screening boda-boda riders • Installation of humps to all busy places Tirinyi Road
10	Floods	• Channeling water (trenches) • Installation of road culverts • Sensitization	• Tree planting • Sensitization on wetland degradation • Wetland demarcation • Enforce buffer zone • Evicting encroachers
11	Human wildlife conflicts	• Community sensitization • Use of scare crows • Conservation law enforcement	• Uganda Wildlife Authority should be vigilant • Equip vermin control staff • Conduct massive awareness campaigns
12	Drought	• Tree planting • Irrigation • Planting drought resistant crops • Establishment of alternative income generating activities like business • Food preservation and storage • Planting quick maturing seeds	• Food relief • Construction of valley dams • Fund irrigation technologies • Diversify sources of livelihood • Construction of food storage facilities • Extraction of underground water • Law enforcement on wetland degradation • Fund tree planting through NFA

CHAPTER FOUR

4.1Risk 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 Namutumba 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	**3**	**2**	**6**	**Bulange, Ivukula, Kibaale, Magada, Nsinze**
Droughts	**3**	**4**	**12**	**Bulange, Ivukula, Kibaale, Magada, Nsinze**
Invasive species	**4**	**3**	**12**	**Bulange, Ivukula, Kibaale, Magada, Nsinze**
Human wild life conflicts	**2**	**1**	**2**	**Bulange, Ivukula, Kibaale, Magada, Nsinze**
Hail storms	**4**	**3**	**15**	**Bulange, Magada, Nsinze,**
Man-made fires	**1**	**1**	**1**	**Bulange, Ivukula, Kibaale, Magada, , Nsinze**
Lightning	**3**	**3**	**9**	Bulange, Ivukula, Kibaale, Magada, , Nsinze
Pests, parasites and diseases	**5**	**4**	**20**	Bulange, Ivukula, Kibaale, Magada, , Nsinze
Soil erosion	**5**	**5**	**25**	**Bulange, Ivukula, Kibaale, Magada, Nsinze**
Strong winds	**4**	**3**	**12**	Bulange, Namutumba T/Council, Magada, , Nsinze
Land conflicts	**4**	**5**	**20**	Bulange, Ivukula, Kibaale, Magada, Nsinze
Wetland degradation	**5**	**5**	**25**	Bulange, Ivukula, Kibaale, Magada, Nsinze
Road accidents	**3**	**2**	**6**	**Namutumba,Namutumba Town Council , Magada, , Nsinze**

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 6).

Table 7: Frequency of multi-hazards

No	Multi-hazard	Number of Events (last 30 years)	No. years in record	Recurrence Interval per year (months/ seasons)	Hazard Frequency (%) Chance/year
1	Pests, parasites and diseases	1986-2016	30	12	40
2	Drought	2006-2016	10	2	20
3	Hailstorms	2000-2015	15	2	13.3
4	Invasive species	2004-2016	12	12	100
5	Human wildlife conflicts	2010-2015	5	2	40
6	Wetland degradation	1995-2016	20	12	60
7	Soil erosion	1986-2016	30	2	6.6
8	Strong winds	1986-2016	30	2	6.6
9	Land conflicts	2006-2016	10	12	120
10	Floods	2006-2016	5	2	40
11	Lightning	2006-2016	10	2	20
12	Road accidents	2006-2016	10	12	120

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 Namutumba 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, Lightning and strong winds; Ecological or biological hazards including human and wildlife conflicts, pests, parasites and diseases, and invasive species; technological hazards including road accidents; environmental hazards including wetland degradation and land conflicts predispose the community to high vulnerability in the Namutumba District (table 7).

Table 8: Components of vulnerability in Namutumba District

Vulnerability Components	Exposure	-		Susceptibility	-	Resilience	
	Hazards	• Elements at risk	Geographical Scale	• Potential impacts	Geographical Scale	• Coping strategies	Geographical Scale
	Invasive species	• Crops	District	• Poor yields	District	• Uprooting • Burning	District
	Strong winds	• Human and livestock populations, • Crops • Infrastructure including houses, schools and hospitals	District	• Loss of lives, • Destruction of homes, • Injuries • Blockage of roads	Sub county	• Planting trees • Building stronger structures	Sub county
	Pests, parasites and diseases	• Human and livestock populations • Crops	District	• Loss of livestock • Reduced livestock and crop productivity • Complete crop failure • Stunted growth of crops • Loss of moral in farmer to stay in the farming business	District	• Vaccination • Spraying • Planting disease resistant crops	District
Social Components	Hailstorms	• Human and livestock populations • Crops	District	• Loss of livestock and • crops, failure • Stunted growth of crops • Injuries • Destruction of properties like houses • Famine	District	• Relief aid from government and other NGO's	District
	Lightning	• Human and livestock populations • Crops • Natural vegetation • Infrastructure including houses	District	• Loss of human lives and livestock • Destruction of properties	District	• Planting of trees • Installation of Lightning insulators especially on government institutions	District
	Land conflicts	• Human and livestock populations	District	• Loss of human lives • Imprisonment • Family break down • Migration	District	• Appealing to court • Sensitization at village level	District
	Human and wild life conflicts	• Human population • -Crops	Sub county	• Destruction of crops • Reduction of crop yields	District	• Hunting them • Trapping • Scare crows	Sub county
	Soil erosion	• Crops • Human population	District	• Loss of soil fertility • Low production of crops • Accidents	District	• Sensitization • Digging of trenches	District

Vulnerability Components **Social Components**	Road accidents	• Human population	District	• Death and injuries • Destruction of properties like cars, boda boda	District	• -Public awareness • Construction of humps	District
	Wetland degradation	• Crops • Human and livestock population	District	• Water scarcity • Disease outbreak in both animals and humans • Water logging	District	• Report to relevant authorities • Buffering • Sensitize on the use of wetland use	District
	Drought	• Human and livestock populations • Crops	District	• Stunted growth of crops • Famine • Disease like Malnutrition	District	• Creating water reserves for watering • Local means of irrigation	District
	Water logging	• Human and livestock populations • Crops • Natural vegetation • Infrastructure including roads	District	• Loss of lives • Stunted growth of crops • Destruction of roads • Low land for cultivation • Accidents	District	• Digging trenches	District
Economic component	Strong winds	• Human and livestock populations • Crops • Infrastructure including houses, schools	District	• Loss of income • Loss of government revenue	District	• Sensitization • Planting trees • Building stronger structures	District
	Pests, parasites and diseases	• Human and livestock populations • Crops	District	• Loss of income • Loss of government revenue • Increased expenditure on pesticides and drugs	District	• Vaccination • Spraying • Planting disease resistant crops	District
	Hailstorms	• Human and livestock populations • Crops	District	• Loss of income • Loss of government revenue	District		District
	Lightning	• Human and livestock populations • Crops • Natural vegetation • Infrastructure including houses	District	• Loss of income • Loss of government revenue	District	• Planting of tress • Encouraging installation of Lightning insulators	District

Economic component	Land conflicts	• Human and livestock population	District	• High costs incurred in settling land cases	District	• Appealing to law suites	District
	Human and wild life conflicts	• Human and livestock population	District	• Loss of income	Sub county	• Hunting them • Trapping • Scare crows	
	Soil erosion	• Crops	Sub county	• Loss of income	Sub county	• Sensitization • Digging of trenches	Sub county
	Road accidents	• Human population	District	• Expensive in terms of compensation	District	• Sensitization • Public awareness	District
	Wetland degradation	• Human and livestock • Crops	District	• Poverty due to reduced fishing	District	• Report to relevant authorities • Buffering • Sensitize on the use of wetland use	District
	Drought	• Human and livestock • Crops	District	• Loss of income • Loss of government revenue	District	• Planting drought resistant crops • Promotion of small scale irrigation	District
	Water logging	• Human and livestock populations • Crops • Natural vegetation • Infrastructure including roads	District	• Loss of income • Loss of government revenue	District	• Dig trenches	District

Environmental component	Strong winds	• Human and livestock populations • Crops • Infrastructure including houses, schools and hospitals	District	• Loss of vegetation cover including trees	District	• Sensitization • Planting trees • Building stronger structures	District
	Pests, parasites and diseases	• Human and livestock populations • Crops	District	• Loss of crops	District	• Vaccination • Use of mosquito nets • Spraying	District
	Hailstorms	• Human and livestock populations • Crops	District	• Loss of vegetation cover including trees	District		District
	Lightning	• Human and livestock populations • Crops • Natural vegetation • Infrastructure including houses	District	• Loss of vegetation cover including trees	District	• Planting of trees • Encouraging installation of Lightning insulators	District
	Water logging	• Human and livestock populations • Crops • Natural vegetation • Infrastructure including houses	District	• Loss of bio diversity • Destruction of homes • Diseases like malaria, diarrhea, cholera	District	• Dig trenches	District
	Land conflicts	• Human and livestock populations	District		District	• Law suites	District
	Human and wild life conflicts	• Human and livestock populations • Crops	Sub county	• Destruction of crops and biodiversity	District	• Hunting them • Trapping • Scare crows	District
	Road accidents	• Human and livestock populations	District		District	• Sensitization • Public awareness	District

Environmental component	Drought	• Human and livestock populations • Crops	District	• Destruction of crops and vegetation	District	• Planting crop resistant crops	District
	Soil erosion	• Human and livestock populations • crops	Sub county	• Siltation of wetlands • Reduced soil and crop productivity	Sub county	• Community • Sensitization • Digging trenches	District
	Strong winds	• Human and livestock populations • Crops • Infrastructure including houses, schools and hospitals	District	• Loss of lives • Complete crop failure • Destruction of homes	District	• Migration • Sensitization	District
Physical components	Pests, parasites and diseases	• Human and livestock populations • Crops	District	• Loss of livestock • Reduced livestock productivity • Complete crop failure • Stunted growth of crops	District	• Vaccination • Use of mosquito nets • Culling off affected crops and animals • Quarantine	District
	Strong winds	• Human and livestock populations • Crops • Infrastructure including houses, schools and hospitals	District	• Loss of lives • Complete crop failure • Crop logging • Destruction of homes	District	• Sensitization • Planting trees • Building stronger structures	District
	Hailstorms	• Human and livestock populations • Crops	District	• Loss of livestock • Complete crop failure • Stunted growth of crops	District		District
	Lightning	• Human and livestock populations • Crops • Natural vegetation • Infrastructure including houses	District	• Loss of lives • Destruction of crops	District	• install Lightning conductors	District

Physical components	Water logging	• Human and livestock populations • Crops • Natural vegetation • Infrastructure including roads	District	• Loss of lives • Stunted growth of crops • Destruction of homes • Outbreaks of diseases like malaria, diarrhoea, cholera	District	• Dig trenches	District
	Land conflicts	• Human and livestock populations	District	• Loss of human lives • Permanent hatred • Migration	District	• Appealing to court	Sub county
	Human and wild life conflicts	- Human population • -Crops	Sub county	• -Destruction of crops	District	• Hunting them • Trapping • Scare crows	Sub county
	Soil erosion	• Crops	Sub county	• Loss of soil fertility • Low production of crops	District	• Digging of trenches	District
	Road accidents	• Human population	District	• Death and injuries • Hatred	District	• Sensitization • Public awareness	District
	Drought	• Human and livestock populations • Crops	District	• Stunted growth of crops • Famine	District	• Planting drought resistant crops	District
	Wetland degradation	• Crops • Human and livestock population	District	• Water scarcity • Disease outbreak in both animals and humans • Water logging	District	• Report to relevant authorities • Buffering	District

CONCLUSION AND RECOMMENDATION

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

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

i. Geomorphological and geological hazards including; soil erosion
ii. Climatological or hydro-meteorological including; flash floods, hailstorms, drought, lightning and strong winds
iii. Ecological or biological hazards including; human and wildlife conflicts, pests, parasites and diseases and invasive species
iv. Technological hazards including; road accidents
v. Environmental including; wetland degradation 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, and S/counties
iv. Periodic maintenance of feeder roads to reduce road accidents and enforce water transport safety measures
v. Promotion of drought and disease resistant crop seeds
vi. Compensate individual victims of wildlife attacks
vii. Support extensive research on the occurrence and frequency of disasters prior to disaster management
viii. Improve the communication channel between the disaster department and local communities
ix. Office of the Prime Minister should decentralize their activities at the district level

x. OPM should strengthen the District Disaster Committees by developing guidelines and trainings
xi. Establishment of disaster fund at the district levels
xii. Fund and equip recruited extension works
xiii. Establish a fund aimed at disaster preparedness and management at district levels
xiv. Removal of taxes on the importation of lightning conductors
xv. Support establishment of a disaster risk early warning systems
xvi. Provide support in form of free seedlings to promote afforestation and reforestation especially on bare hills
xvii. Increase funding and staff to monitor wetland degradation and non-genuine agro-inputs
xviii. Promote observation of the principle of rangeland carrying capacity among livestock keepers

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