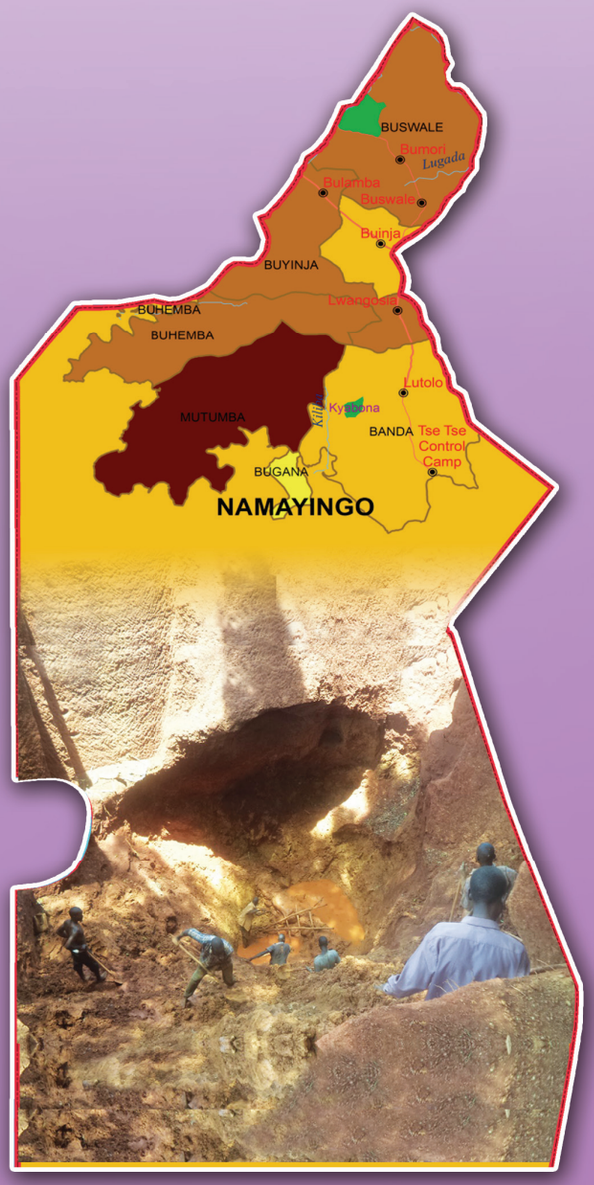
THE REPUBLIC OF UGANDA

Namayingo 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 Mr. 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 Namayingo District Team:

1.	Hajat Sarah Nakalungi	– Ag.Chief Administrative Officer
2.	Mr. Kaleeba Peter Jethro	– Senior Assistant Secretary
3.	Mr. Muganza Emmanuel	– Ag. District Natural Resources Officer
4.	Mr. Busagwa Alex	– District Environment Officer
5.	Ms.Kayenga Irene Nabuti	– District Planner
6.	Mr.Omanyaala Fred	– Population Officer
7.	Ms Nandudu Betty Mubiita	– District Community Development Officer
8.	Mr. Kirya Godfrey	– District Engineer
9.	Mr. Habajja Samuel Nawede	– Senior Agricultural Officer
10.	Mr.Igoma Fred	– District Production Officer
11.	Ms.Ajalo Angella	– Ag.District Information Officer
12.	Mr.Lasuli Osman	– Driver

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 department relief disaster preparedness and management and other stakeholders. The report is presented in 3 chapters with chapter one detailing the background of the report which comprises of the Government of Uganda moving the disaster management paradigm from the traditional emergency response focus toward one of prevention and preparedness. Here the report highlights the objectives of the exercise as to Collect and analyze the field data using GIS and Develop specific multi-hazard, risk and vulnerability profiles using a standard methodology.

Chapter two highlights the overview of the district and its location where the District is located along the Equator and in Eastern Uganda. It is bordered by Bugiri District to the northwest, Busia District to the northeast, the Republic of Kenya to the east and southeast, the Republic of Tanzania to the south and Mayuge District to the west and southwest. The land is generally characterized by gentle undulating hills with few higher residual features. Namayingo district has a mean annual rainfall of 1200mm, with varying precipitation in the central. In general there are two peak rainfall seasons in a year, that is, from March to June and from August to November. The soils covering most of the district are mainly loamy and sandy loams. These soils have fine texture with rather loose structure, which are easily eroded and leached. Prior to 2000, the two main activities in the district were (a) subsistence agriculture on the mainland and (b) commercial fishing on the lakeshores and on the islands in Lake Victoria.

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 Namayingo 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 and soil collapse
ii. Climatological or hydro-meteorological including; flash floods, and drought

iii. Ecological or biological hazards including; human and wildlife conflicts, pests, parasites and diseases, and invasive species

iv. Technological hazards including; water accidents

v. Environmental hazards including; wetland degradation, deforestation and land conflicts

In conclusion, reducing vulnerability at community, local government and national levels should be a threefold effort hinged on:

a) Reducing the impact of the hazard where possible through mitigation, prediction, early warning and preparedness;

b) Building capacities to withstand and cope with the hazards and risks;

c) Tackling the root causes of the vulnerability such as poverty, poor governance, discrimination, inequality and inadequate access to resources and livelihood opportunities.

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
FGD	:	Focus Group Discussion
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 refers to the climatic parameter of a region varying from its long-term mean.

variability 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 atlas of hazard, risk and vulnerability conditions in the country to engage mainstreaming of disaster and risk management in development planning and contingency planning at national and local levels.

Since 2013, UNDP has been supporting the Office of the Prime Minister to develop district hazard risk and vulnerability profiles in sub-regions of Rwenzori, Karamoja, Teso, Lango, Acholi, West Nile, Central and South western sub regions. During the exercise, local government officials and community members actively participated in the data collection and analysis through focus groups discussions and the key informant interviews.

The data collected was used to generate hazard, risk and vulnerability maps and profiles for each district. Validation workshops were held in close collaboration with the district local government (DLG) technocrats, development partners, agencies and academic/research institutions. The developed maps show the local geographical distribution of hazards and vulnerabilities up to sub county level of the district.

1.2 Justification

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

1.3 Objectives of the consultancy

The objectives of the assignment were to:

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

1.4 Scope of the assignment

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

CHAPTER TWO

2.1 Overview of Namayingo District

Namayingo District is located along the Equator and in Eastern Uganda. It is bordered by Bugiri District to the northwest, Busia District to the northeast, the Republic of Kenya to the east and southeast, the Republic of Tanzania to the south and Mayuge District to the west and southwest. Namayingo, where the district headquarters are located, is approximately 95 kilometers (59 mi), by road, southeast of Jinja, the largest city in the Busoga sub-region. This location lies approximately 38 kilometers (24 mi), by road, south of Bugiri, the nearest large town.

2.1.1 Location

The coordinates of the district are:00 17N, 33 51E.The 1991 national population census estimated the district population at about 68,000. In 2002, the next national census put the population of the district at approximately 175,000. The district annual population growth rate was calculated at 2.9% and it is estimated that the population of Namayingo District was approximately 232,300 in 2012.However, the 2014 National Population and Housing Census 2014 estimated the district population at about 215,442, with 106,608 males and 108,834 females.

2.1.2 Topography

The land is generally characterized by gentle undulating hills with few higher residual features. The eastern, southern and south western part of the district forms a watershed of the Lake Victoria drainage. The major hills are in Sigulu islands with wetlands classified as papyrus, palms and thickets, bush lands, grasslands. The wetlands are utilised as livestock grazing fields, extraction of building materials, crop growing, fishing and firewood among others. The major causes of wetland Namayingo district has a mean annual rainfall of 1200mm, with varying precipitation in the central In general there are two peak rainfall seasons in a year, that is, from March to June and from August to November.

2.1.3 Climate

The two are punctuated by a dry season from December to February and July to August. Rainfall is important to the life of the people of the district as they depend on rain fed agriculture, its timing and intensity creates an impact on the agricultural productivity in the district, however rainfall is no longer reliable and difficult to predict making it difficult for farmers to plan for the agricultural seasons properly. The temperatures range of 16.7 to 28.1 with the month of January being the hottest. The average wind speed is 4.4 km/hr, mainly blowing towards the north during March.

2.1.4 Soils and Vegatation

The soils covering most of the district are mainly loamy and sandy loams. These soils have fine texture with rather loose structure, which are easily eroded and leached. Most soils are acidic. Soil types in the district include:

- Yellow - red sandy, clay loams soils varying from dark grey to dark which are slightly acidic and mainly derived from granite, gneissic and sedimentary rocks. They occur on gently undulating - hilly topography.
- Brown - yellow clay loams with laterite horizon with a variety of dark brown to dark greyish brown, which are slightly acidic. These occur on flat ridge tops or as of undulating topography.
- Light - grey- white mottled loamy soils with laterite horizon ground, structure-less loamy sands. They are acidic - allocative and mainly found on the lower and bottom slopes.

2.1.5 Socio-economic activities

Prior to 2000, the two main activities in the district were (a) subsistence agriculture on the mainland and (b) commercial fishing on the lakeshores and on the islands in Lake Victoria. During the 21st century, gold deposits have been discovered in the district. This has attracted many new residents to the area, performing such activities as: miners, washers, grinders, middlemen, buyers as well as salesmen of the hardware used in the artisanal gold mining industry, such as pick axes, shovels, pails, basins, ropes and ladders.

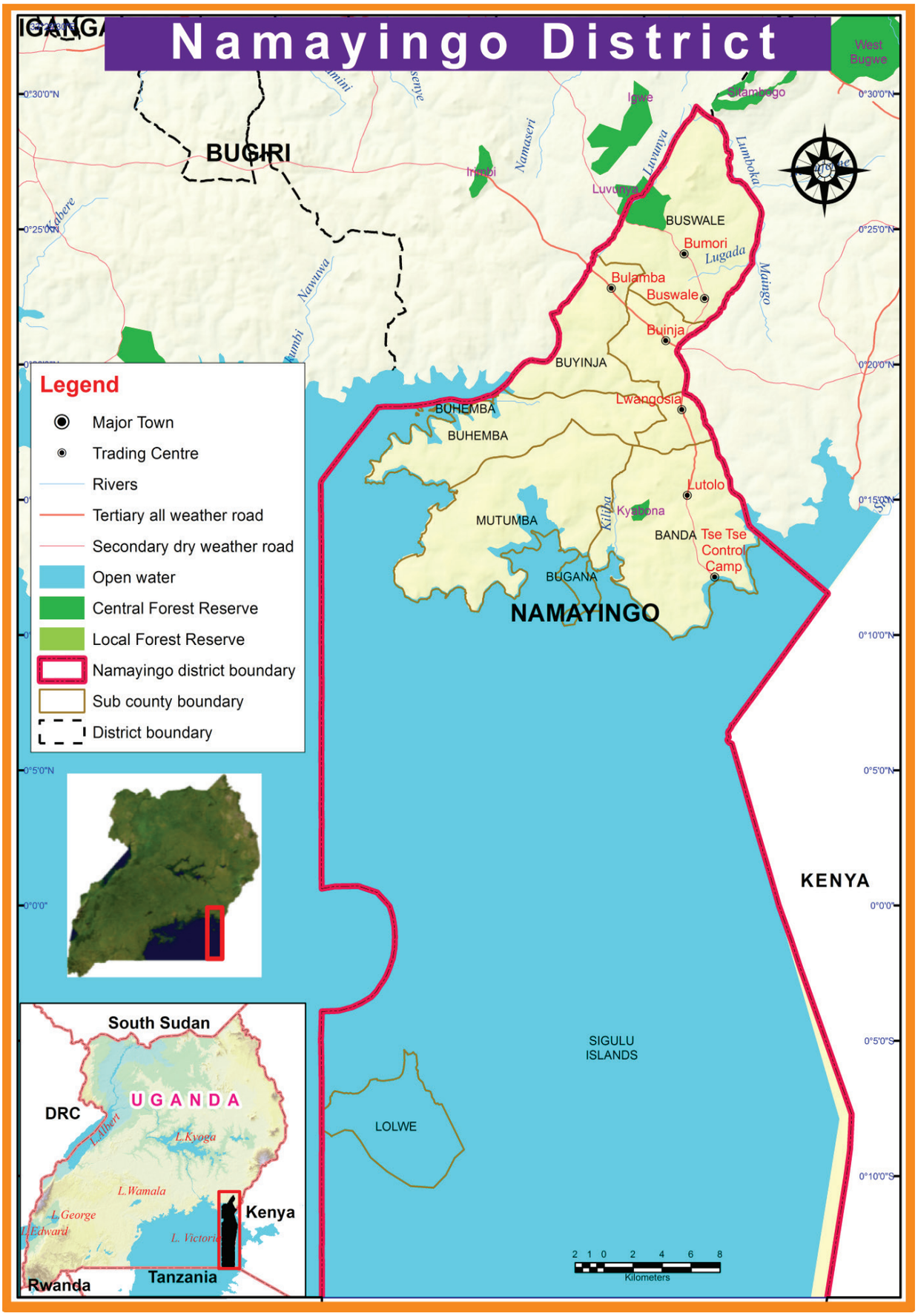


Figure 1: Namayingo District Administrative Units

CHAPTER THREE

3.1 Materials and methods

3.1.1 Multi-hazard, risk and vulnerability profile assessment

3.1.1.1 Approach

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

3.1.1.2 Data collection

3.1.1.2.1 Socio economic investigation

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

In addition to consultations, the key informant interviews were also carried out on the sub county officials for evidence based discovery. A total of two focus group discussions were also conducted in the sub counties: Buyinja and Buswale. 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 utilized in the study

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

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

Table 2: Multi-hazard analytical detailed description of procedures

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

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

Table 3: Multi-hazard severity classes/levels

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

3.1.1.2.3 Validation

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

3.2 Multi-hazard assessment

3.2.1 Introduction

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

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

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

3.2.2 Drought

Drought has been more severe in the last five years. The experienced drought events are manifested as prolonged dry spells that cause shifts in the onset of rainy seasons.

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

Notably, the most adverse effects of drought include reduced income levels for farmers and district revenue, reduced farm yields, reduced inputs and investment in the agricultural sector. In addition, drought increases prices of staple food, food insecurity, migration, theft of crops in gardens, wetland degradation, famine, transactional sex for food, illness and loss of livestock. The severity and distribution of drought affects all the sub counties.

3.2.3 Wetland degradation

The wetland types found in Namayingo District are characterised as papyrus, palms and thickets, bush lands, grasslands, subsistence farming (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, gold mining(Plate1), seasonal fires, over harvesting and invasion by invasive species.

Plate 1: Gold mining in a wetland in Buyinja Sub County

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

The adverse effects of wetland degradation include subsequent occurrences of flash floods, erratic rains and drought, reduced water quality and quantity in water sources, loss of wetland biodiversity, drought, increased incidences of pests, parasites and diseases, loss of property, livestock and human life. The effects have been severe in Buswale, Banda, Buhemba and Mutumba, Sigulu and Bukana sub counties (figure 2).

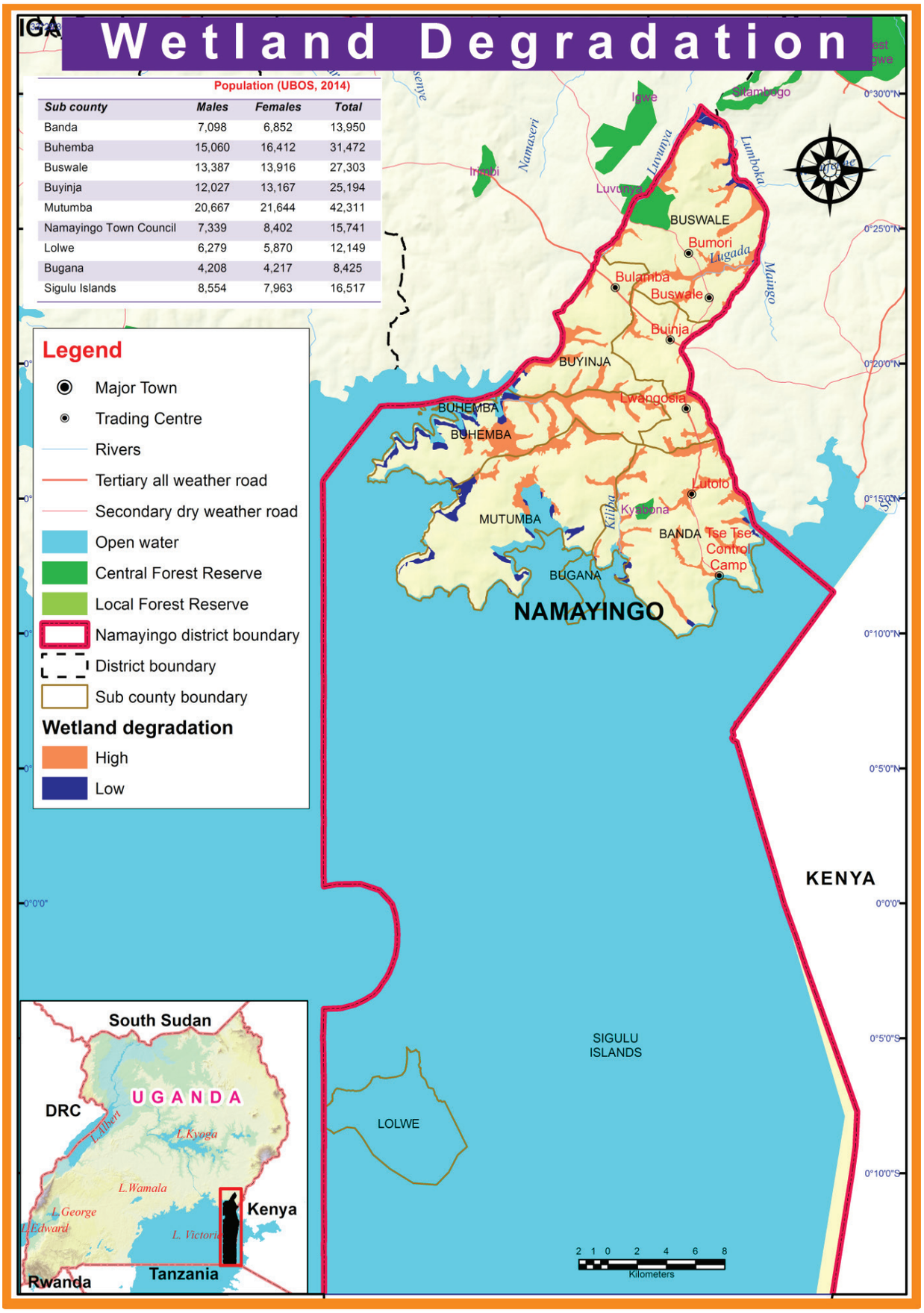


Figure 2: Levels of wetland degradation

3.2.4 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: Soil erosion gulley in Nakudi village, Bujwanga parish Banda 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 low lying flood prone areas.

The adverse effects of soil erosion experienced in the district include: low crop yields, low income levels, land abandonment, reduction in the quality and quantity of surface water sources, high costs of transport, increased incidences of pests, parasites and diseases, loss of landscape beauty, land conflicts, introduction of new invasive species and famine. The occurrences and severity of soil erosion affects all the sub counties in the district but severe in Sigulu. (figure 3).

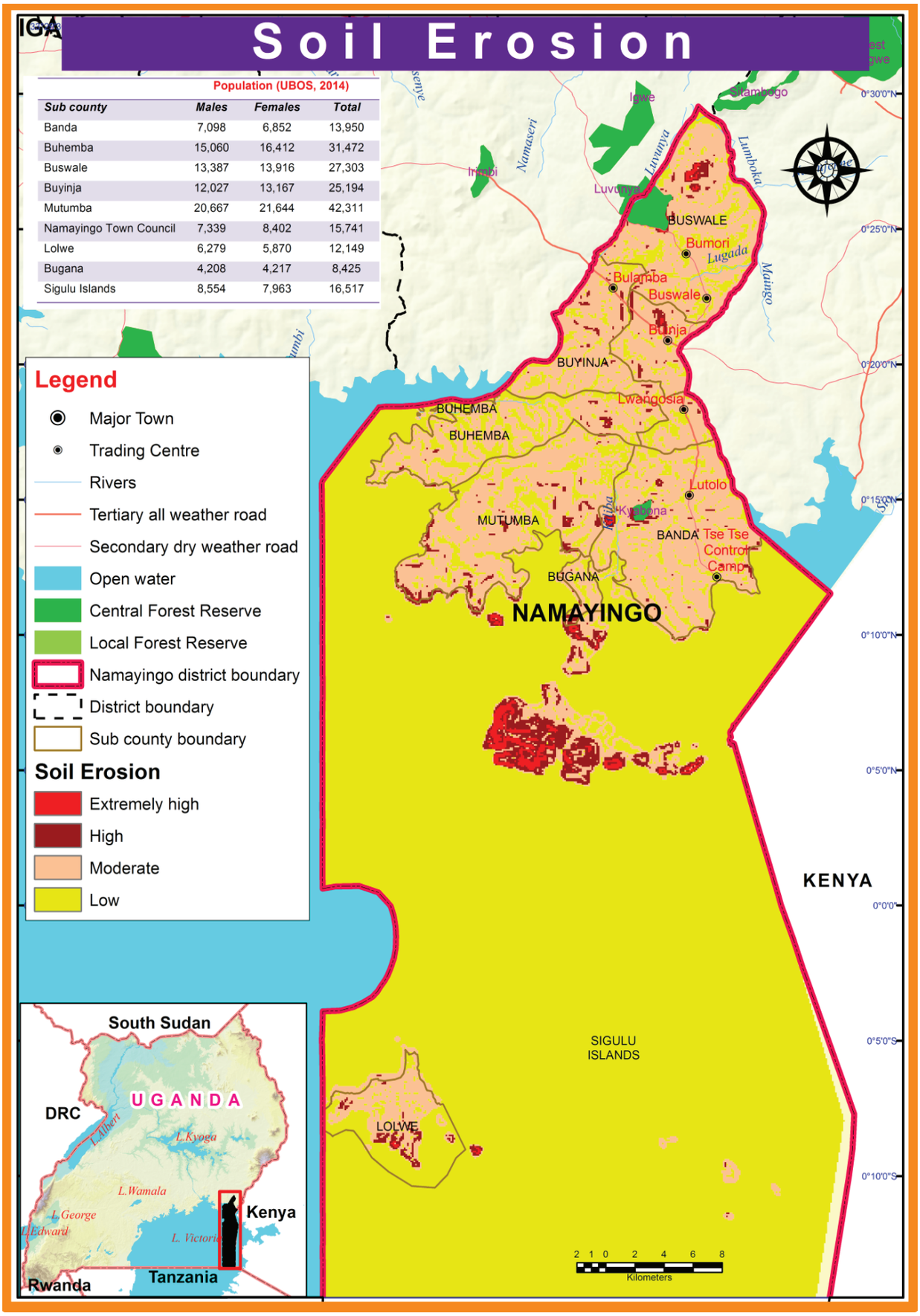


Figure 3: Soil erosion prone areas

3.2.5 Pests, parasites and diseases

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

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

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

Table 4: Major pests and diseases

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

In livestock production, the occurrences of parasites and diseases was basically caused by ignorance, poor on-farm management, deforestation, mixing of livestock due to limited pasture fields, wetland degradation, animal movement, grazing along road reserves and reduced surface water quality.

The parasites and diseases are associated with low milk yield, low meat products, slow growth in livestock and encroachment of marginal lands such as wetlands among others. The predictability of the parasites and diseases is on the increase of each year. The livestock keepers are apparently vulnerable due to sub-standard pesticides, unreliable weather patterns, limited extension services, water and pasture.

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

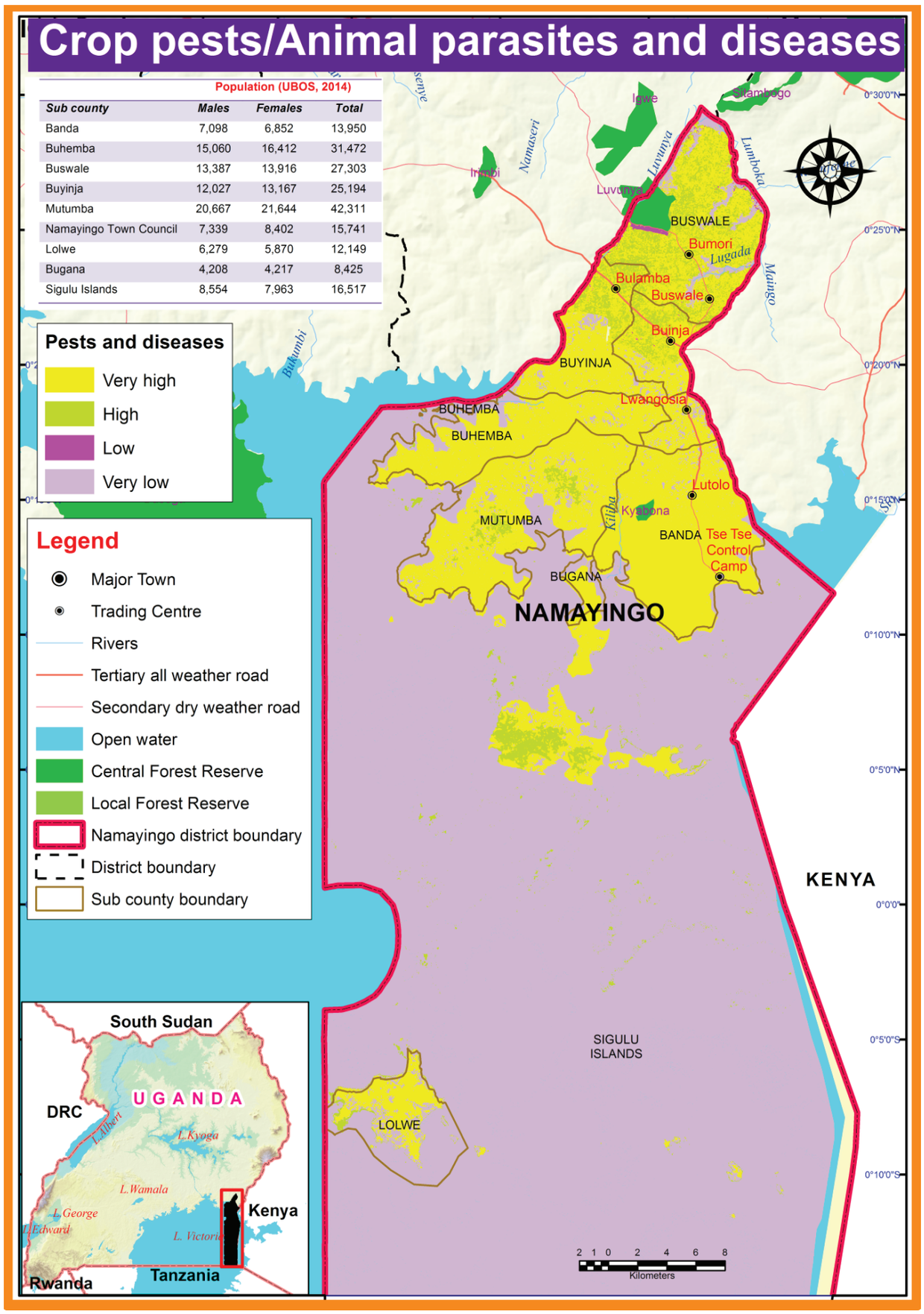


Figure 4: Distribution of pests, parasites and diseases

3.2.6 Invasive species

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

Plate 3: Water hyacinth at Lugala landing site, Banda Sub county

The occurrence of land based species is associated with stunted crop growth, crop failure, frequent weeding, poor yields and land abandonment. The water species are characterised with slow boat movement, migration of fish stocks, high transport costs and water pollution among others. The invasions are high during the rainy season due to the increase in the plant water content that facilitates their high growth. The adverse effects of land based species include loss of biodiversity, loss of livestock, low income levels, poor crop yields and encroachment of public land among others. On the other hand in water, the species cause illness, loss of biodiversity, depletion of fish stocks, high transport costs and malnutrition among others. The invasion of both alien species is common in all the sub counties

3.2.7 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 (hippos, crocodiles, 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,

Plate 4: Example of Nile crocodile commonly affecting fishing and human life along lakeshores

The encounters have resulted into the loss of household income, reduction in tourism revenue, migration, illness, low crop yields and modification of local climate. The fatalities have been highly reported in Sigulu, Bukana, Mutumba, Buhemba, Banda, and Lolwe sub counties.

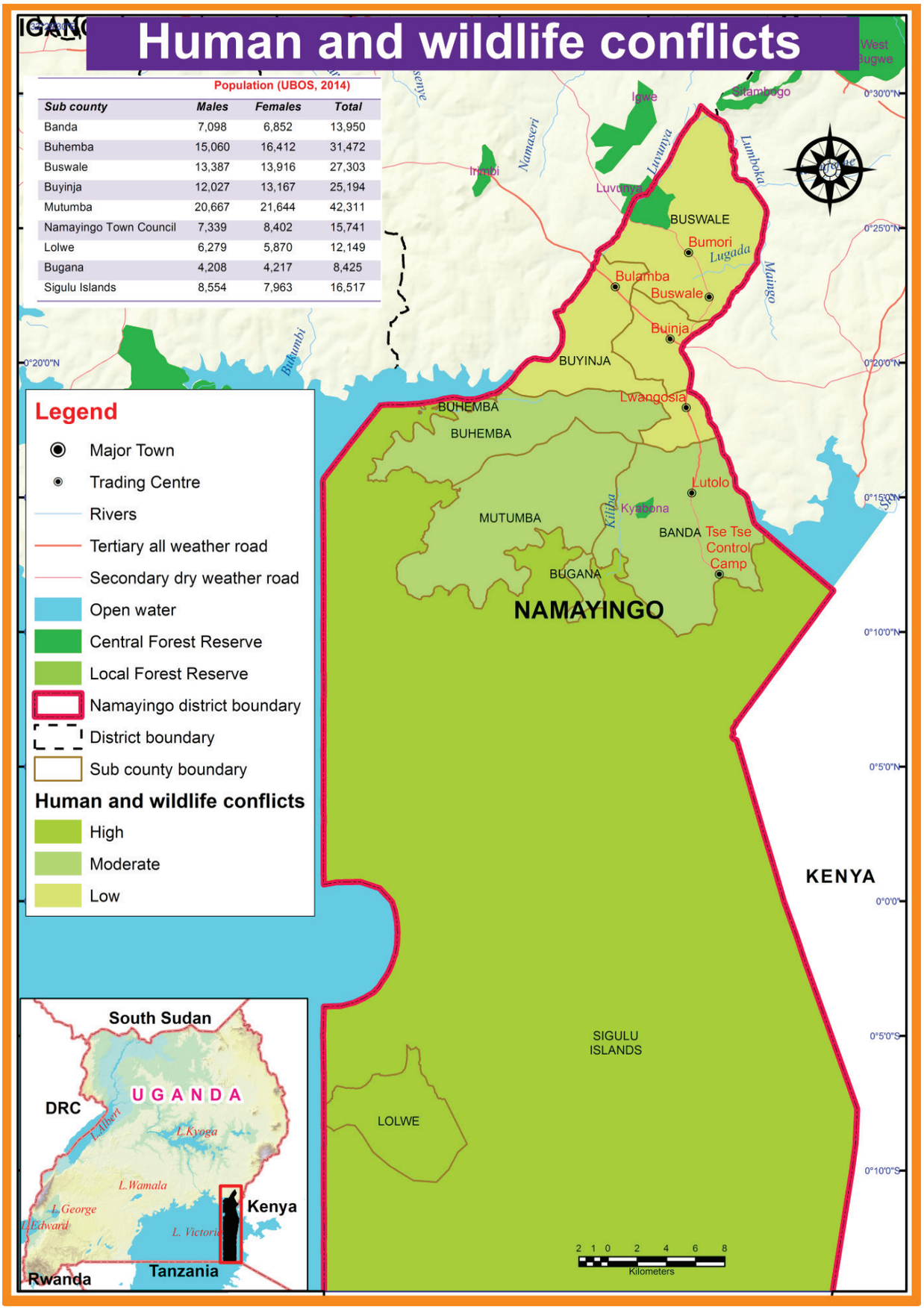


Figure 5: Levels of human wildlife conflicts

3.2.8 Soil Collapse

Artisanal gold mining is on the increase in Namayingo District. The artisanal gold mining is widespread where wetlands and upland areas have been opened into deep holes and channels to extract gold ore.(Plate 9) The opening of land without proper soil stabilization mechanisms have caused the collapse of shafts due to lose soil particles and over saturation.

Plate 5: Loosely hanging soil at an Artisanal gold mine at Budde, in Buyinja Sub county

The increasing death rates are attributed to the high poverty rates amongst the communities, diversification of sources of income and high local and international market demands for gold. The widespread activities without control have resulted into increased numbers of death cases for people and livestock, school drop outs, food insecurity, wetland degradation, siltation of streams, and diseases related to mercury pollution. The life threatening incidences mainly occur in the wet seasons than the dry periods. Severe cases have been reported in Bukana, Sigulu, Buyinja, and Banda sub counties.

3.2.9 Flash floods

Namayingo district experiences flash floods that destroy several acres of crops and properties. The district lies in the Lake Victoria floodplain. In addition to erratic/heavy rainfall, wetland degradation, poor drainage and farming methods, siltation, unplanned settlement, deforestation and political pronouncements are the major causes of flash floods in the

district. The district experiences a bi-model type of rainfall pattern. The floods occur in the months of April-May and September-November of each year. The rainfall patterns are largely influenced by neutral conditions of sea surface temperatures in the eastern and central equatorial Pacific Ocean, and the warming of sea surface temperatures in the western sector of equatorial Indian Ocean.

Plate 6: Flash flooding in Banda Sub county

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

The characteristics of flash floods is associated with water logging of crop fields, increment in water borne diseases (malaria, typhoid, cholera etc.), submergence of roads and houses etc. However, seasonal predictions show that the district has a high chance of receiving near normal rains. The factors that contribute to the vulnerability of households include: ignorance, sub-standard agro inputs, and weak enforcement of wetland policies among others. The adverse effects of flash floods include a reduction in household income levels, low crop yields, increased prices of staple foods, illness, destruction of water sources, displacement of families, destruction of roads, loss of human life, property and livestock. The phenomenon severely affects all the sub counties in Namayingo District (figure 6).

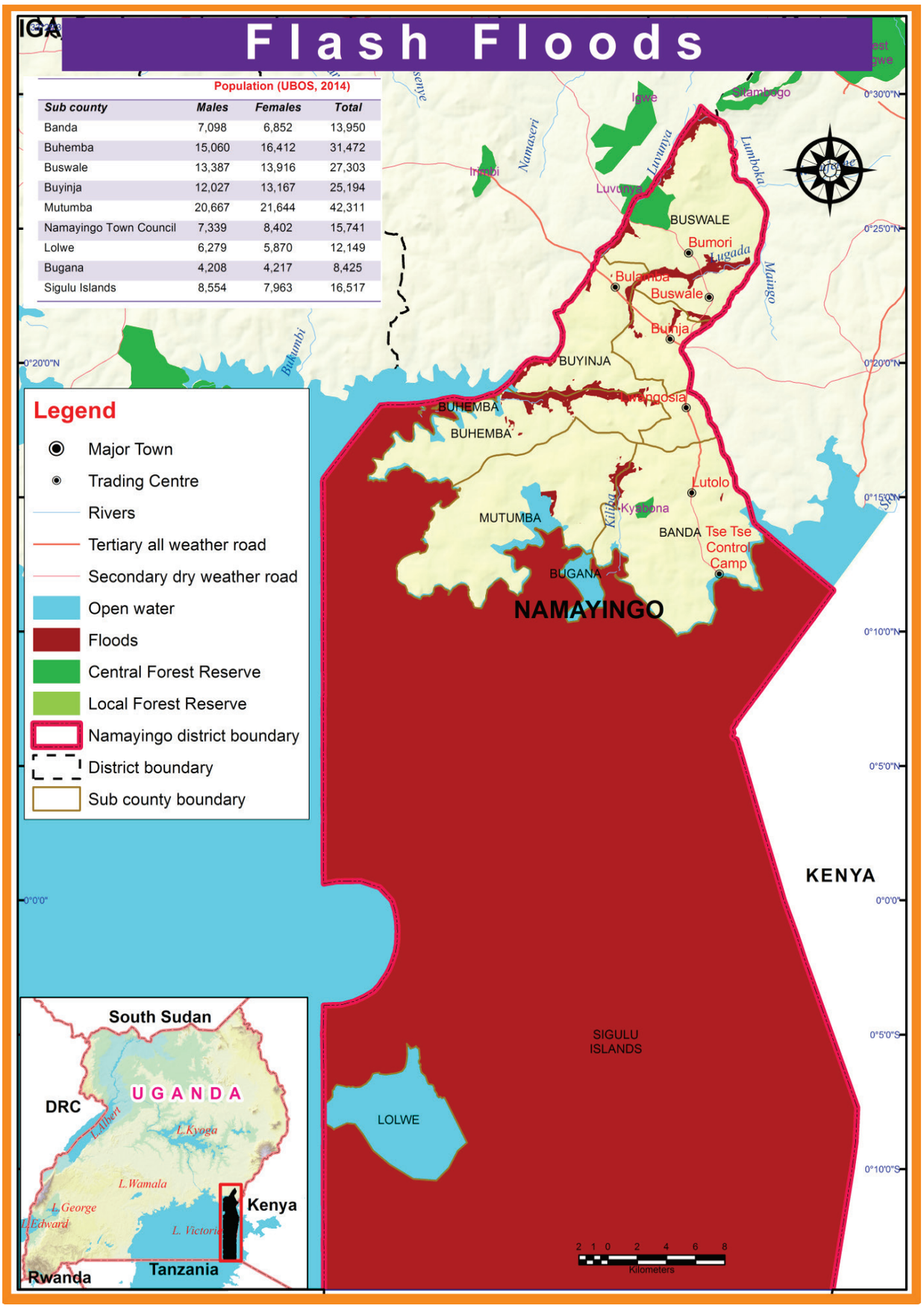


Figure 6: Flood prone/Inundation areas

3.2.10 Land conflicts

Land conflicts have now become rampant in the district for the last 10 years. Most of the land in the district is under unregistered customary ownership with an increasing number of leaseholds and freeholds. The conflicts are between the people and government, communities and cultural institutions and vice versa.

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

The conflicts have resulted into the migration of people to the neighbouring sub counties and other districts, under development, loss of human life and livestock; and loss of property and income due to court cases. Furthermore, the tenure arrangements are associated with over exploitation by several implemented land use options such as overgrazing, bush burning and land fragmentation on the allocated piece of land. (figure 7).

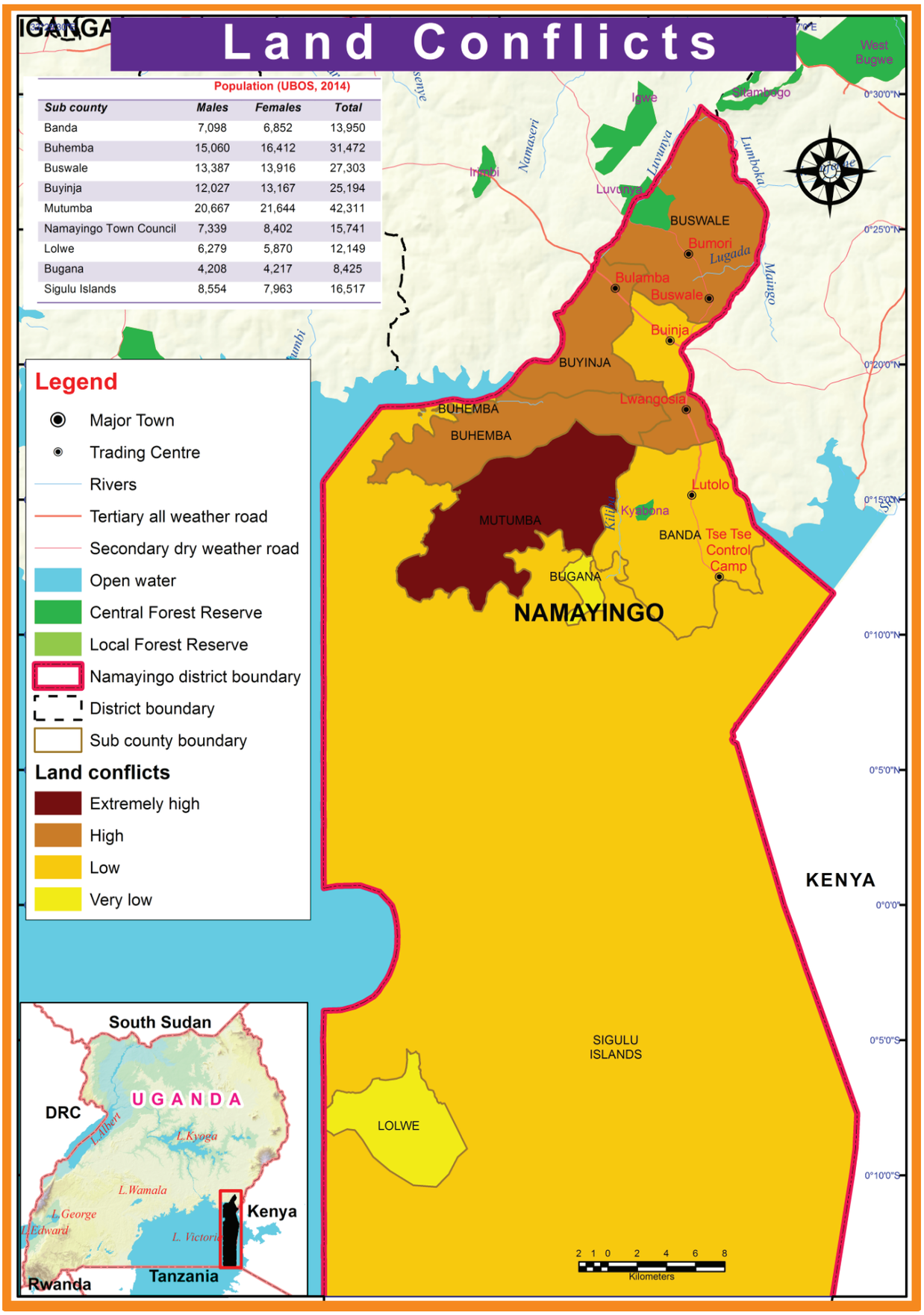


Figure 7: Severity of land conflicts

3.2.11 Road and Water accidents

Road and water accidents claim a number of lives in the district of recent than before. The prevalence of road accidents are attributed to the driving of cars in dangerous mechanical conditions, reckless driving, lack of road sign posts, bad weather, overloading, lack of driving documents, livestock grazing in the road reserves, narrow roads, incompetent drivers and over speeding. The road accidents mainly involve pedestrians, cars, bicycles, motorcycles and boats. The water accidents are largely caused by strong winds and Hippos in the water bodies.

The road and water accidents are associated with injuries, disabilities and arrests among others. The incidences are more frequent during the festive seasons such as Christmas and Easter, election days and at the start and closure of schools. The factors that contributed to the vulnerability of households to road accidents are; weak enforcement of traffic laws, poor roads and establishment of road markets among others.

The notable effects of road and water accidents include: loss of human life and livestock, illness, disabilities, loss of property and documentation, reduction in crop and livestock production and loss of income in compensations. The accident incidents are reported in all the sub counties throughout the year (figure 8).

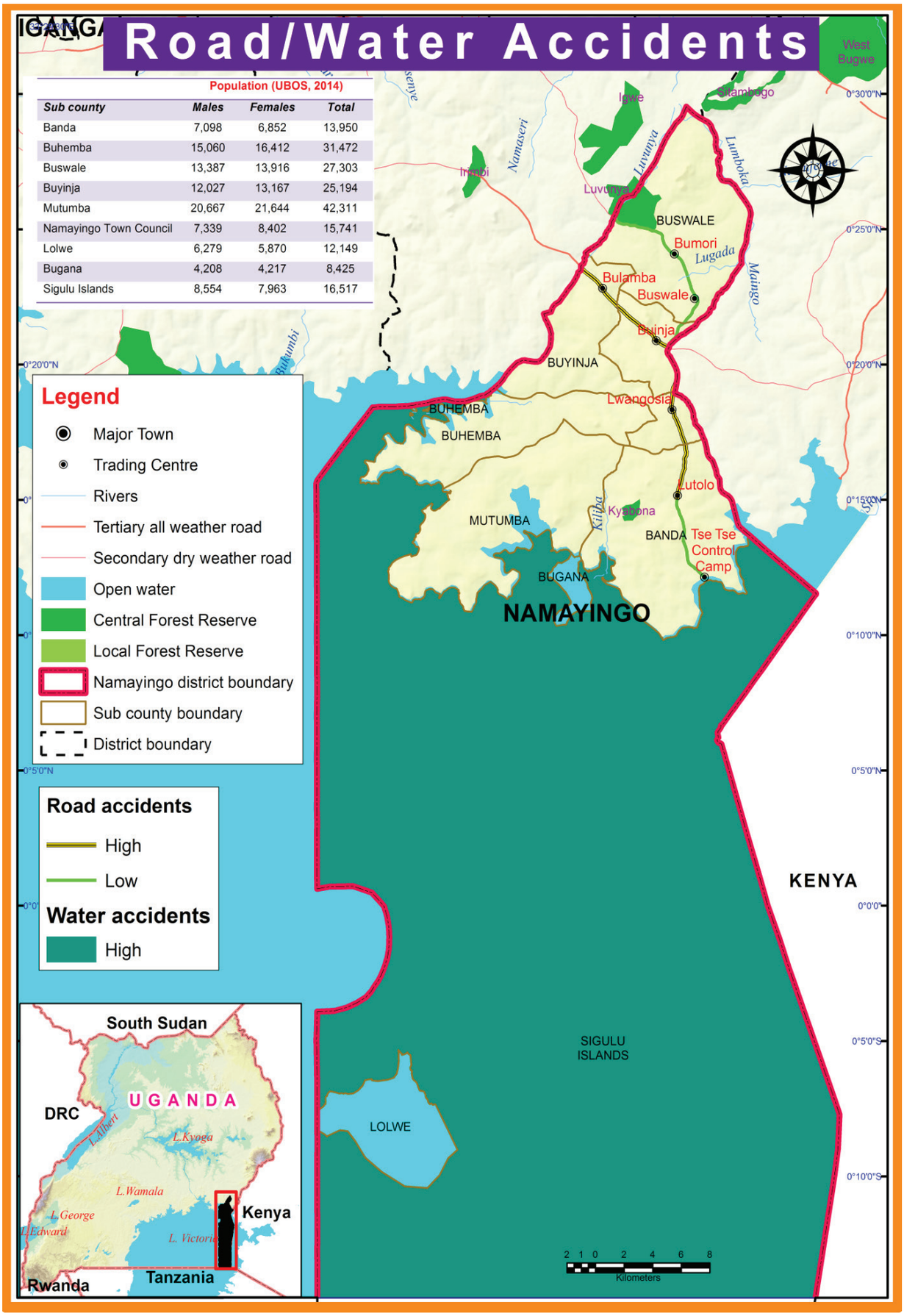


Figure 8: Road and water accidents distribution

3.2.12 Deforestation

Deforestation is perceived as the cutting of trees for wood and timber purposes.This has mainly affected Namayingo district because most of the trees have been wiped away in search for land for settlement caused by the high birthrates and migration, charcoal and timber products, farm land since the soils have lost their fertility and commercialization of agriculture, corruption and weak laws that are not adhered to or enforced to protect forest reserves and forests.

The factors that contribute to the vulnerability include weak enforcement of forestry laws, high population growth rates, drought and reduced soil fertility among others in the district.

The resultant effects have led to increases in pests, parasites and diseases, destruction of habitats and drought. In addition to the loss of biodiversity, water resource conflicts and loss of water quality have been recorded in the district. The activities are prevalent in all the sub counties; however there are more severe in Banda, Mutumba and Buhemba.

Plate 7: Previously forested area in Banda Sub county, Sityohe village

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 of vegetables • sensitization • Tree planting • Planting drought resistant crops • Diversification of livelihood • Planting quick maturing seeds • Practicing conservation agriculture • Construction of valley dams	• Provision of tree seedlings • Food relief • Construction of valley dams • Improved irrigation technologies • Diversify sources of livelihood • Construction of food storage facilities • Extraction of underground water • Provision of drought resistant species
2	Wetland degradation	• Sensitization on the dangers • Tree planting • Upland rice growing • Alternative livelihood like apiary, business	• Provision of highly yielding upland rice • Funding the natural resource department • Strict enforcement of wetland laws • Diversify sources of livelihood e.g Apiary • Improved irrigation technologies • Demarcation of wetlands
3	Soil erosion	• Digging trenches and ridges • Mixed cropping • Afforestation • Crop spacing • Plantation of cover crops • Sensitization (farmer visits) • Minimum tillage	• Sensitization of the farmers on proper farming methods • Agro-forestry • Provision of tree seedlings • Subsidize the costs of pesticides and fertilizers • Recruitment and adequate funding extension workers
4	Pests/parasites and Diseases	• Crop rotation • Spraying of vegetables • Vaccination of livestock • Use of disease resistant varieties • Distribution of nets(mosquito and tsetse flies)	• Recruitment of veterinary doctors at sub-county level • Subsidizing herbicides • Sensitization on control measures • Sufficient distribution of nets(mosquito and tsetse flies)
5	Invasive Species	• Mixed planting • Crop rotation • Uprooting • Massive cutting of lantana camaraand water hyacinth • Planting resistant crops • Sensitization	• More research on invasive species • Planting resistant improved seeds e.g in Maize Longe 7-H to control striga • Legislation on the movement of seeds • Provision of improved seedlings

6	Human wildlife conflicts	• Sensitization on peak hours • Use of scare crows • Wearing life jackets • Gazetting water collection points • Conservation law enforcement • Involving Wildlife authority	• Uganda Wildlife Authority should be vigilant • Equip vermin control staff • Conduct massive awareness campaigns • Sensitization of the community on the peak hours
7	Mining	• Sensitization • Law enforcement	• Early intervention to restore • Gazetting and demarcation of wetlands and mines • Diversify sources of livelihood e.g Apiary
8	Floods	• Digging of trenches • Shifting to safe places • Sale of livestock and migration • Installation of road culverts	• Tree planting (Eucalyptus, Pine, Gravelia, Musizi, Melia and Bathedavea). • Sensitization on wetland degradation • Wetland demarcation • Enforce buffer zone • Mechanical farming to drain water reservoirs • Improve weather forecasts • Provision of tree seedlings • Funding the community outreach department
9	Land Conflicts	• Law courts like Clan, LC's, magistrate courts • Demarcation of land • Acquisition of land titles • Sensitization	• Subsidize land registration • Sensitization of the community on land ownership • Popularize the land policy • Quick judgments of land cases • Gazetting and buffering the lake • Demarcation of wetlands
10	Road and water accidents	• Law enforcement • Installation of road signs • Installation of humps • Wearing Life jackets • Using large and safe boats • Proper road and water use	• Enforcement of traffic laws • Frequent maintenance of roads • Sensitization • Provision of ferries • Provision of life jackets
11	Deforestation	• Sensitization • Afforestation and re-afforestation • Introduction of energy saving technologies	• Provision of tree seedlings • Enforcement of laws • Funding the community outreach department

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 Namayingo 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	3	9	Banda, Lolwe, Sigulu Islands/Bukana is, Mutumba and Buhemba
Droughts	5	5	25	Banda, Buhemba, Mutumba, Lolwe, Sigulu Islands, Bukana
Hail storms				
Pests, parasites and diseases	5	4	20	Banda, Buhemba, Buswale, Buyinja, Mutumba, Namayingo Town Council, Lolwe, Bukana, Sigulu Islands
Soil erosion	5	5	25	Lolwe, Bukana, Sigulu Islands
Strong winds	5	5	20	Lolwe, Bukana, Sigulu Islands
Land conflicts	3	4	25	Banda, Buhemba, Mutumba
Wetland degradation	5	5	25	Banda, Buhemba, Buswale,Mutumba
water accidents	4	3	12	Banda, Buhemba, Mutumba, Bukana, Sigulu Islands,Lolwe
Human wildlife conflicts	4	4	16	Mutumba, Lolwe, Bukana, Sigulu Islands
Lightning				
Invasive species	5	4	20	Banda, Buhemba, Buswale, Buyinja, Mutumba, Namayingo Town Council, Lolwe, Bukana, Sigulu Islands
Mining	3	3	9	Buyinja, Banda, Bukana, Sigulu Islands
Deforestation	3	2	6	Banda, Sigulu Islands, Buhemba, Mutumba

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

	Disasters	Number of Events (last 30 years)	Years in record	Recurrence Interval per year	Hazard Frequency (%) Chance/year
1	Pests, parasites and diseases	1986 2016	30	2	6.67
2	Droughts	2000 2016	16	2	12
3	Invasive species	1986 2016	30	2	6.67
4	Human wildlife conflicts	1986 2016	30	12	40
5	Wetland degradation	1986 2016	30	12	40
6	Soil erosion	1986 2016	30	2	6.67
7	Land conflicts	2000 2016	16	12	75
8	Floods	1986 2016	30	2	6.67
9	Water,Road accidents	1986 2016	30	12	40
10	Deforestation	1990 2016	25	12	48
11	Mining	2005 2016	11	12	109

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 Namayingo 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 The multi-hazards that are experienced in Namayingo District can be classified as: geomorphological and geological hazards including soil erosion and soil collapse; climatological or hydro-meteorological including flash floods, and drought; ecological or biological hazards including human and wildlife conflicts, pests, parasites and diseases, and invasive species; technological hazards including water accidents; environmental hazards including wetland degradation, deforestation and land conflicts Pre-dispose the community to high vulnerability state in the Namayingo district (table 8).

Table 8: Components of vulnerability in Namayingo District

Vulnerability Components **Social Components**	Exposure			Susceptibility		Resilience	
	Hazards	**Elements at risk**	**Geographical Scale**	**Potential impacts**	**Geographical Scale**	**Coping strategies**	**Geographical Scale**
	• Invasive species	• Crops	District	• Low crop yields • Low crop production • Harbours tsetse flies • Low fish productivity	District	• Planting "*Kayongo go*" maize varieties • Mixed cropping • Crop rotation • Uprooting and slashing	District
	• Strong winds						
	• Pests, parasites and diseases	• Human and livestock populations • Crops	District	• Loss of livestock and human life • Reduced livestock and crop productivity • Complete crop failure • Stunted growth of crops	District	• Vaccination • Spraying • Planting disease resistant crops • Crop rotation	District
	• Hailstorms						
	• Deforestation	• Human and livestock populations • Crops	Sub county	• Climatic change • Drought	Sub county	• Reforestation and afforestation • Sensitisation • LVEMP involvement	District

Vulnerability Components **Social Components**	• Land conflicts	• Human and livestock populations	Sub county	• Loss of human lives • Imprisonment • Family break down • Migration • Social insecurity in the area	Sub county	• Court • Encouraging people to get land titles • Sensitize people • Court	District
	• Human and wild life conflicts	• Crops • Human population	Sub county	• Death and injury • Crop destruction • Food insecurity	Sub county	• Hunting • Trapping • Report to UWA • Gazette water collection points	District
	• Soil erosion	• Crops • Human population	Sub county	• Loss of soil fertility • Low production of crops	Sub county	• Sensitization • Digging of trenches • Tree planting • Proper farming methods like mulching	District
	• Road, water accidents	• Human population	District	• Death and injuries • Destruction of properties like cars, boats	District	• Community policing • Deployment of traffic officers • Enforcement of traffic laws • Repairing damaged roads • Life jackets and helmets • Sensitization	District

	• Wetland degradation	• Crops • Human and livestock population	Sub county	• Water scarcity • Disease • Water logging • Global warming • Loss of grazing land for animals • Pollution of water through mining	Sub county	• Demarcation • Sensitize on wise use of wetland • Alternative livelihood • Small scale irrigation	District
Vulnerability Components **Social Components**	• Drought	• Human and livestock populations • Crops	Sub county	• Famine • Low yields • Crime • Malnutrition • Water scarcity	Sub county	• Tree planting • Sensitization • Planting drought resistant crop	District
	• Mining	• Human and livestock populations • Crops	Sub county	• Destruction of roads • Water pollution • High school drop outs • Accidents	Sub county		District
	• • Water logging	• Human and livestock populations • Crops	Sub county	• Diseases • Poor quality of water for domestic use • Displacement of families • Famine • Low crop production	Sub county	• Sensitization • water treatment • Construction of boreholes	District

Economic component	• 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 • Crop rotation	District
	• Hailstorms						
	• • Water logging	• Human and livestock populations • Crops	Sub county	• Loss of income • Loss of government revenue	Sub county	• Sensitization • water treatment • Construction of boreholes	District
Economic component	• Land conflicts	• Human and livestock population	Sub county	• High costs incurred in settling land cases	Sub county	• Court • Encouraging people to get land titles • Sensitize people • Court	District
	• Human and wild life conflicts	• Crops • Human population	Sub county	• Loss of income	Sub county	• Hunting • Trapping • Report to UWA • Gazette water collection points	District
	• Soil erosion	• Crops	Sub county	• Loss of income	Sub county	• Sensitization • Digging of trenches • Tree planting • Proper farming methods like mulching	District

	• Road accidents	• Human population	District	• Expensive in terms of compensation • Loss of incomes	District	• Community policing • Deployment of traffic officers • Enforcement of traffic laws • Repairing damaged roads • Life jackets and helmets • Sensitisation	District
	• Wetland degradation	• Crops • Human and livestock population	Sub county	• Expensive in terms of compensation • Loss of incomes	Sub county	• Demarcation • Sensitize on wise use of wetland • Alternative livelihood • Small scale irrigation	District
Economic component	• Mining	• Human and livestock populations • Crops	Sub county	• Expensive in terms of compensation • Loss of incomes	Sub county		District
	• Drought	• Human and livestock populations • Crops	Sub county	• Loss of income • Loss of government revenue	Sub county	• Tree planting • Sensitization • Planting drought resistant crops	District
	• Invasive species	• Crops	District	• Loss of income • Loss of government revenue	District	• Planting "*Kayongo go*" maize varieties • Mixed cropping • Crop rotation • Uprooting and slashing	District

	• Deforestation	• Human and livestock populations • Crops	Sub county	• Loss of income • Loss of government revenue	Sub county	• Reforestation and afforestation • Sensitisation • LVEMP involvement	District
	• • Water logging	• • Human and livestock populations • Crops • Natural vegetation • Infrastructure including roads	Sub county	• Loss of income • Loss of government revenue	Sub county	• Digging trenches • Sensitization on wise use of wetlands • Water treatment • Borehole construction	Sub county
Environmental component	• Pests, parasites and diseases	• Human and livestock populations • Crops	District	• Loss of crops	District	• Vaccination • Spraying • Planting disease resistant crops • Crop rotation	District
Environmental component	• Hailstorms	• Human and livestock populations • Crops	Sub county	• Loss of vegetation cover including trees	Sub county		Sub county
	• Deforestation	• Human and livestock populations • Crops	Sub county	• Climatic change • Drought	Sub county	• Reforestation and afforestation • Sensitisation • LVEMP involvement	District
	• • Water logging	• Human and livestock populations • Crops	Sub county	• Poor quality of water for domestic use • Low crop production	Sub county	• Sensitisation • water treatment • Construction of boreholes	District

	• Land conflicts	• Human and livestock populations	Sub county	• Loss of property like crops	Sub county	• Court • Encouraging people to get land titles • Sensitize people • Court	District
	• Human and wild life conflicts	• Crops • Human population	Sub county	• Destruction of crops	Sub county	• Hunting • Trapping • Report to UWA • Gazette water collection points	District
	• Road accidents	• Human and livestock populations	District		District	• Community policing • Deployment of traffic officers • Enforcement of traffic laws • Repairing damaged roads • Life jackets and helmets • Sensitisation	District
	• Drought	• Human and livestock populations • Crops	Sub county	• Stunted growth of crops	Sub county	• Tree planting • Sensitization • Planting drought resistant crops	District

Environmental component	• Invasive species	• Crops	District	• Low crop production	District	• Planting "*Kayongo go*" maize varieties • Mixed cropping • Crop rotation • Uprooting and slashing	District
	• Mining	• Human and livestock populations • Crops	Sub county	• Wetland degradation • Siltation of the lake • Water pollution	Sub county		District
	• Soil erosion	• Human and livestock populations • crops	Sub county	• Siltation of wetlands • Reduced soil and crop productivity	Sub county	• Sensitization • Digging of trenches • Tree planting • Proper farming methods like mulching	District
	• Wetland degradation	• Crops • Human and livestock population	Sub county	• Water scarcity • Water logging • Global warming • Loss of fauna and flora • Siltation of the lake • Loss of habitants • Pollution of water through mining	Sub county	• Demarcation • Sensitize on wise use of wetland • Alternative livelihood • Small scale irrigation	District
	• Strong winds						

	• 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 • Spraying • Planting disease resistant crops • Crop rotation	District
Physical components	• Strong winds						
Physical components	• Hailstorms	• Human and livestock populations • Crops	Sub county	• Loss of livestock • Complete crop failure • Stunted growth of crops	Sub county		Sub county
	• Deforestation						
	• • Water logging	• Human and livestock populations • Crops	Sub county	• Displacement of families	Sub county	• Sensitization • water treatment • Construction of boreholes	District
	• Land conflicts	• Human and livestock populations	Sub county	• Loss of human lives • Permanent hatred • Migration	Sub county	• Court • Encouraging people to get land titles • Sensitize people • Negotiation with government • Court	District

	• Human and wild life conflicts	• Crops • Human population	Sub county	• Death and injury • Crop destruction	Sub county	• Hunting • Trapping • Report to UWA • Gazette water collection points	District
	• Soil erosion	• Crops	Sub county	• Loss of soil fertility • Low production of crops	Sub county	• Sensitization • Digging of trenches • Tree planting • Proper farming methods like mulching	District
	• Road accidents	• Human population	District	• Death and injuries • Hatred • Loss of properties like boats	District	• Community policing • Deployment of traffic officers • Enforcement of traffic laws • Repairing damaged roads • Life jackets and helmets	District
Physical components	• Invasive species	• Crops	District	• Low crop yields • Death of aquatic life	District	• Planting "*Kayongo go*" maize varieties • Mixed cropping • Crop rotation • Uprooting and slashing	District
	• Drought	• Human and livestock populations • Crops	Sub county	• Stunted growth of crops • Water scarcity	Sub county	• Tree planting • Sensitization • Planting drought resistant crops	District

	• Deforestation	• Human and livestock populations • Crops	Sub county	• Destruction of herbal trees • Migration of wildlife	Sub county	• Reforestation and afforestation • Sensitisation • LVEMP involvement	District
	• Mining	• Human and livestock populations • Crops	Sub county	• Wetland degradation • Destruction of roads • Siltation of the lake • Accidents	Sub county		District
	• Wetland degradation	• Crops • Human and livestock population	Sub county	• Water scarcity • Loss of fauna and flora • Loss of grazing land for animals • Siltation of the lake • Loss of habitants • Pollution of water through mining	Sub county	• Demarcation • Sensitize on wise use of wetland • Alternative livelihood • Small scale irrigation	District

CONCLUSION AND RECOMMENDATION

It was established that Namayingo district has over the last 20 years increasingly experienced multi-hazards including floods, drought, invasive species, pests, parasites and diseases for crops and livestock, soil erosion, land conflicts, deforestation, human and wildlife conflicts, wetland degradation, soil collapse, and water accidents putting livelihoods at increased risk. The limited adaptive capacity (and or/resilience) and high sensitivity of households and communities in Namayingo district increase their vulnerability to multi-hazard exposure necessitating urgent external support.

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

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

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

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

Recommended policy actions that should target vulnerability reduction include:

i. Improved enforcement of policies aimed at enhancing sustainable environmental health;
ii. Increased awareness campaigns aimed at sensitizing farmers/communities on disaster risk reduction initiatives and practices.
iii. Revival of disaster risk committees at the district levels
iv. Support extensive research on the occurrence and frequency of disasters prior to disaster management
v. Improve the communication channel between the disaster department and local communities
vi. Office of the prime minister should decentralize their activities at the district level
vii. OPM should strengthen the district disaster committees by developing guidelines and trainings
viii. Establishment of disaster fund at the district levels
ix. Fund and equip recruited extension works
x. Establish a fund aimed at disaster preparedness and management at district levels

xi. Support establishment of a disaster risk early warning systems
xii. Provide support in form of free seedlings to promote afforestation and reforestation
xiii. Increase funding and staff to monitor wetland degradation and non-genuine agro inputs
xiv. Promote observation of the principle of rangeland carrying capacity among livestock keepers

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Namayingo District Local Government District Development Plan 2015-2020

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