



THE REPUBLIC OF UGANDA

# Lyantonde 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.

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.

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My appreciation also goes to Lyantonde District Team;

1. Mr. Yiga Martin Paul- Assistant Chief Administrative Officer
2. Dr. Ssekawojwa Edward- Acting District Production Officer
3. Mr. Rwensheshe Herbert- District Vice Chairperson LCV

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

The multi-hazard vulnerability profile outputs from this assessment was a combination of spatial modeling using socio-ecological spatial layers (i.e. DEM, Slope, Aspect, Flow Accumulation, Land use, vegetation cover, hydrology, soil types and soil moisture content, population, socio-economic, health facilities, accessibility, and meteorological data) and information captured from District Key Informant interviews and sub-county FGDs using a participatory approach. The level of vulnerability was assessed at sub-county participatory engagements and integrated with the spatial modeling in the GIS environment. The methodology included five main procedures i.e.

### **Preliminary spatial analysis**

Hazard prone areas base maps were generated using Spatial Multi-Criteria Analysis (SMCA) was done in a GIS environment (ArcGIS 10.1).

### **Stakeholder engagements**

Stakeholder engagements were carried out in close collaboration with OPM's DRM team and the District Disaster Management focal persons with the aim of identifying the various hazards ranging from drought, floods, landslides, human, animal and crop diseases, pests, wildlife animal attacks, earthquakes, fires and conflicts among others. Stakeholder engagements were done through Focus Group Discussions (FGDs) and Key Informant Interviews guided by checklist tools (Appendix I). At District level Key Informants included: Deputy Chief Administrative Officer, District Production Officer, District Natural Resources Officer and Vice-Chairperson LC V while at Sub-county level key informants included: Sub-county and parish chiefs and Community Development Officers.

FGDs were carried out in four purposively selected sub-counties that were ranked with the highest vulnerability. FGDs comprising of an average of 12 respondents (crop farmers, local leaders and cattle keepers) were conducted at Kaliiro, Lyantonde, Mpumudde and Lyakajjula Sub-counties. Each Parish of the selected Sub-counties was represented by at least one participant and the selection of participants was engendered. FGDs were conducted with utmost consideration to the various gender categories (women, men) with respect to age groups since hazards affect both men and women though in different perspectives irrespective of age.

### **Participatory GIS**

Using Participatory GIS (PGIS), local communities were involved in identifying specific hazards prone areas on the Hazard base maps. This was done during the FGDs and participants were requested through a participatory process to develop a community hazard profile map.

### **Geo-referencing and ground-truthing**

The identified hazard hotspots in the community profile maps were ground-truthed and geo-referenced using a handheld Spectra precision Global Positioning System (GPS) unit, model: Mobile Mapper 20 set in WGS 1984 Datum. The entities captured included: hazard location, (Sub-county and parish), extent of the hazard, height above sea level, slope position, topography, neighboring land use among others. Hazard hot spots, potential and susceptible areas will be classified using a participatory approach on a scale of "not reported/ not prone", "low", "medium" and "high".

## Data analysis and integration

Data analysis and spatial modeling was done by integrating spatial layers and non-spatial attribute captured from FGDs and KIIs to generate final HRV maps at Sub-county level.

## Data verification and validation

OPM, organized a five days regional data verification and validation workshop in collaboration with UNDP in Mbarara Municipality as a central place within the region. This involved key district DDMC focal persons for the purpose of creating local/district ownership of the profiles.

Multi-hazards experienced in Lyantonde district were classified as:

- Geomorphological or Geological hazards including; landslides, rock falls, soil erosion and earthquakes.
- Climatological or Meteorological hazards including; floods, drought, hailstorms, strong winds and Lightning
- Ecological or Biological hazards including; crop pests and diseases, livestock pests and diseases, human disease outbreaks, vermin and wildlife animal attacks and invasive species.
- Human induced or Technological hazards including; bush fires, road accidents and land conflicts.

General findings from the participatory assessment indicated that Lyantonde district has over the past two decades increasingly experienced hazards including landslides, rock falls, soil erosion, floods, drought, hailstorms, strong winds, Lightning , crop pests and diseases, livestock pests and diseases, human disease outbreaks, vermin, wildlife animal attacks, invasive species, bush fires, water accidents and land conflicts putting livelihoods at increased risk. Drought and floods were identified as most serious problems in Lyantonde district with almost all sub-counties being vulnerable to the hazards. This could be due to its location in the cattle corridor which is associated with prominent dry spells and droughts, but also the area is relatively flat with slope percentage rise (0-2) which is very prone to flooding in case of heavy rains.

The limited adaptive capacity (and or/resilience) and high sensitivity of households and communities in the district increase their vulnerability to hazard exposure necessitating urgent external support. To reduce vulnerability at community, local government and national levels should be a threefold effort hinged on:

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

The following were recommended policy actions targeting vulnerability reduction:

- The government should improve enforcement of policies aimed at enhancing sustainable environmental health.
- The government through MAAIF should review the animal diseases control act because of low penalties given to defaulters.
- The government should establish systems to motivate support of political leaders towards

government initiatives and programmes aimed at disaster risk reduction.

- The government should increase awareness campaigns aimed at sensitizing farmers/ communities on disaster risk reduction initiatives and practices.
- The government should revive disaster committees at district level and ensure funding of disaster and environmental related activities.
- The government through UNRA and the District authority should fund periodic maintenance of feeder roads to reduce on traffic accidents.
- The government through MAAIF and the District Production office should promote drought and disease resistant crop seeds.
- The government through relevant ministries coordinated by OPM should increase importation of Lightning conductors and also reduce taxes on their importation.
- The government through OPM and Meteorology agency should support establishment of disaster early warning systems.
- The government through MWE should increase funding and staff to monitor wetland degradation and non-genuine agro-inputs.
- The government through OPM should improve communication between the disaster department and local communities.
- The government through MWE should promote Tree planting along road reserves.
- The government through MAAIF should fund and recruit extension workers at sub-county level and also provide staff with necessary logistics.

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## LIST OF ACRONYMS

BBW	Banana Bacterial Wilt
DDMC	District Disaster Management Committee
DEM	Digital Elevation Model
DLG	District Local Government
DRM	Disaster Risk Management
DWD	Directorate of Water Development
DWRM	Directorate of Water Resources Management
ENSO	El Niño Southern Oscillation
FGD	Focus Group Discussion
GIS	Geographical Information Systems
HRV	Hazard Risk Vulnerability
KII	Key Interview Informant
MAAIF	Ministry of Agriculture Animal Industry and Fisheries
MWE	Ministry of Water and Environment
NCCP	National Climate Change Policy
OPM	Office of the Prime Minister
PGIS	Participatory GIS
SMCA	Spatial Multi-criteria Analysis
STRM	Shuttle Radar Topography Mission
UBOS	Uganda Bureau of Statistics
UNDP	United Nations Development Program
UNRA	Uganda National Roads Authority
UTM	Universal Transverse Mercator
WGS	World Geodetic System

## DEFINITION OF KEY TERMS

**Climate change:** Climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer).

**Drought:** The phenomenon that exists when precipitation has been significantly below normal recorded levels, causing serious hydrological imbalances that adversely affect land resource production systems.

**El Niño:** El Niño, in its original sense, is warm water current that periodically flows along the coast of Ecuador and Peru, disrupting the local fishery. This oceanic event is associated with a fluctuation of the inter tropical surface pressure pattern and circulation in the Indian and Pacific Oceans, called the Southern Oscillation. This coupled atmosphere-ocean phenomenon is collectively known as El Niño Southern Oscillation, or ENSO. During an El Niño event, the prevailing trade winds weaken and the equatorial countercurrent strengthens, causing warm surface waters in the Indonesian area to flow eastward to overlies the cold waters of the Peru Current. This event has great impact on the wind, sea surface temperature, and precipitation patterns in the tropical Pacific. It has climatic effects throughout the Pacific region and in many other parts of the world. The opposite of an El Niño event is called La Niña.

**Flood:** An overflowing of a large amount of water beyond its normal confines.

**Food insecurity:** A situation that exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active and healthy life. It may be caused by the unavailability of food, insufficient purchasing power, inappropriate distribution, or inadequate use of food at the household level. Food insecurity may be chronic, seasonal, or transitory.

**Impact:** Consequences of climate change on natural and human systems.

**Risk:** The result of the interaction of physically defined hazards with the properties of the exposed systems i.e., their sensitivity or vulnerability.

**Susceptibility:** The degree to which a system is vulnerable to, or unable to cope with, adverse effects of climate change, including climate variability and extremes.

**Semi-arid:** Ecosystems that have more than 250 mm precipitation per year but are not highly productive; usually classified as rangelands.

**Vulnerability:** The degree of loss to a given element at risk or set of elements at risk resulting from the occurrence of a natural phenomenon of a given magnitude and expressed on a scale from 0 (no damage) to 1 (total damage)" (UNDRO, 1991) or it can be understood as the conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of community to the impact of hazards "(UN-ISDR 2009.)

Also Vulnerability can be referred to as the potential to suffer harm or loss, related to the capacity to anticipate a hazard, cope with it, resist it and recover from its impact. Both vulnerability and its antithesis, resilience, are determined by physical, environmental, social, economic, political, cultural and institutional factors" (J.Birkmann, 2006)

**Hazard:** A physically defined source of potential harm, or a situation with a potential for causing harm, in terms of human injury; damage to health, property, the environment, and other things of value; or some combination of these (UNISDR, 2009).

## INTRODUCTION

### 1.1 Background

Uganda has over the past years experienced frequent disasters that range from drought, to floods, landslides, human and animal diseases, pests, animal attacks, earthquakes, fires, conflicts and other hazards which in many instances resulted in deaths, property damage and losses of livelihood. With the increasing negative effects of hazards that accompany population growth, development and climate change, public awareness and pro-active 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 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 encourage mainstreaming of disaster and climate risk management in development planning and contingency planning at national and local levels.

Since 2013 Office of the Prime Minister has been developing with the support of UNDP District Hazard Risk and Vulnerability profiles in the sub-regions of Rwenzori, Karamoja, Teso, Lango, Acholi and West Nile covering 42 districts. During the above exercise, local government officials and community members have actively participated in data collection and analysis. The data collected was used to generate hazard risk and vulnerability maps and profiles. Validation workshops were held in close collaboration with Ministries, District local Government (DLG), Development Partners, agencies and academic/research institutions. The developed maps show the geographical distribution of hazards and vulnerabilities up to sub-county level of each district. The analytical approach to identify risk and vulnerability to hazards in the pilot sub-regions visited of Rwenzori and Teso was improved in subsequent sub-regions.

This final draft report details methodological approach for HRV profiling and mapping for Lyantonde district in Central Uganda.

### 1.2 Objectives of the study

The following main and specific objectives of the study were indicated:

#### 1.2.1 Main objective

The main objective of the study was to develop Multi-hazard, Risk and Vulnerability Profile for Lyantonde District, Central Uganda.

#### 1.2.3 Specific Objectives

In fulfilling the above mentioned main objective the following are specific objectives as expected:

- i. Collect and analyze field data generated using GIS in close collaboration and coordination with OPM.
- ii. Develop District specific multi-hazard risk and Vulnerability profile using a standard methodology.
- iii. Preserve the spatial data to enable use of the maps for future information.
- iv. Produce age and sex disaggregated data in the HRV maps.

### 1.3 Scope of Work

Through UNDP's Project: ***“Strengthening Capacities for Disaster Risk Management and Resilience Building”*** the scope of work entailed following:

- i. Collection of field data using GIS in close collaboration and coordination with OPM in Lyantonde district and quantify them through a participatory approach on a scale of “not reported/ not prone”, “low”, “medium” and “high”.
- ii. Analysis of field data and review the quality of each hazard map which should be accompanied by a narrative that lists relevant events of their occurrence. Implications of hazards in terms of their effects on stakeholders with the vulnerability analysis summarizing the distribution of hazards in the district and exposure to multi-hazards in sub-counties.
- iii. Compilation of the entire district multi-hazard, risk and vulnerability HRV Profiles in the time frame provided.
- iv. Generating complete HRV profiles, maps and developing a database for all the GIS data showing disaggregated hazard risk and vulnerability profiles to OPM and UNDP.

### 1.4 Justification

The government recognizes climate change as a big problem in Uganda. The draft National Climate Change Policy (NCCP) notes that the average temperature in semi-arid climates is rising and that there has been an average temperature increase of 0.28°C per decade in the country between 1960 and 2010. It also notes that rainfall patterns are changing with floods and landslides on the rise and are increasing in intensity, while droughts are increasing, and now significantly affect water resources, and agriculture (MWE, 2012). The National Policy for Disaster Preparedness and Management (Section 4.1.1) requires the Office of the Prime Minister to “Carry out vulnerability assessment, hazard and risk mapping of the whole Country and update the data annually”. UNDP's DRM project 2015 Annual Work Plan; Activity 4.1 is “Conduct national hazard, risk and vulnerability (HRV) assessment including sex and age disaggregated data and preparation of district profiles.”

### 1.5 Structure of the Report

This Report is organized into four sections: Section 1 provides Introduction on the assignment. Section 2 elaborates on the overview of Lyantonde district. Section 3 focuses on the methodology employed. Section 4 elaborates the Multi-hazard, Risks and Vulnerability profile and Coping strategies for Lyantonde district. Section 5 describes Conclusions and policy related recommendations.

## OVERVIEW OF LYANTONDE DISTRICT

### 2.1 Location

Lyantonde District is located between coordinates: 0° 25' 0" S and 31° 10' 0" E in Southern central Uganda. The District is bordered by Sembabule District to the North and Northeast, Lwengo District to the East, Rakai District to the South, and Kiruhura District to the West. Lyantonde district has 6 sub-counties and 1 town council. These include; Kaliro, Kasagama, Kinuuka, Lyantonde, Mpumudde and Lyakajjula sub-counties and Lyantonde town council. Figure 1 shows the Administrative boundaries and gazetted areas of Lyantonde District.

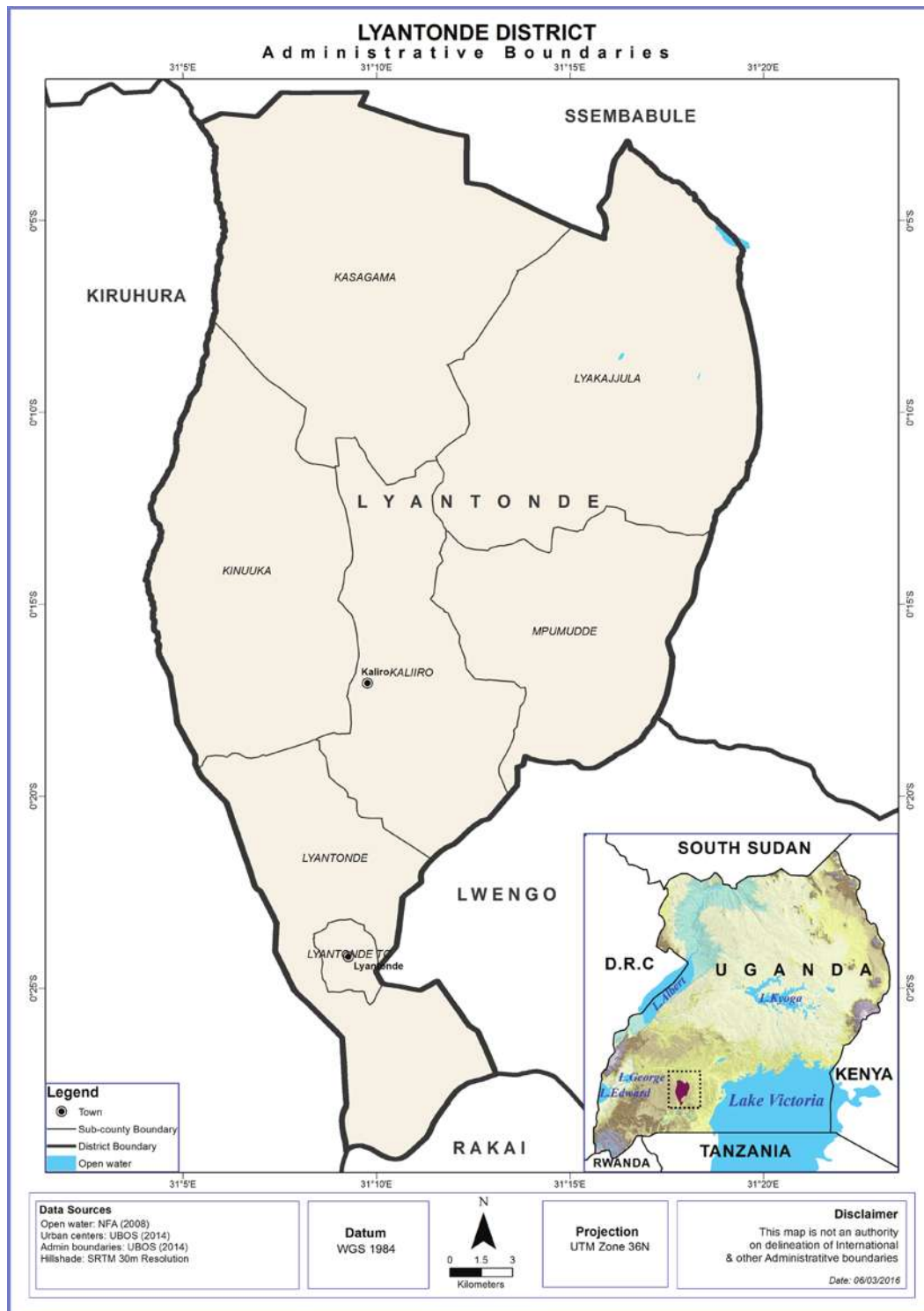


Figure 1: Administrative Boundaries, Lyantonde District

### 2.1.1 Geomorphology

The nature of land in Lyantonde District is composed of undulating landscape with some hills and flat areas. The area is characterized by bare hills and the shrubs are concentrated in the valleys and lowlands. The District has a sandy type of soil which has a low water retention capacity and this makes crops dry before their maturity stage. Figure 2 presents the geomorphology of Lyantonde district.

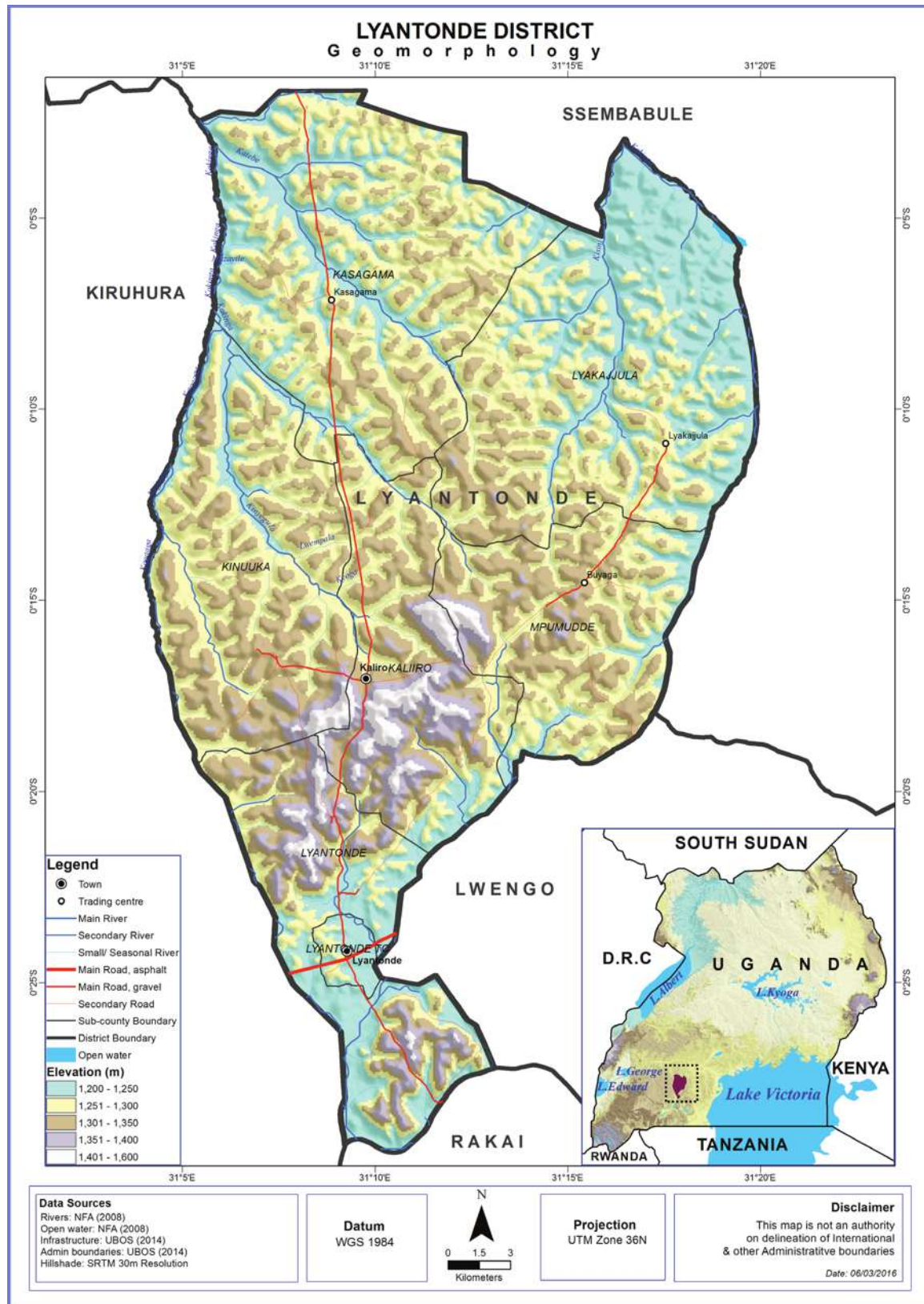


Figure 2: Geomorphology, Lyantonde District

### 2.1.2 Geology and soils

Over 75% of Lyantonde soils are ferralitic representing an almost final stage of weathering with some minerals identified such as wolfram, granite and Tin. Some heavy clay varieties have some fertility but sandy varieties are particularly poor. Other types include lithosols, alluvial and lacustrine sands and alluvial clays. Generally lithosols and humus loams are the dominant upland components while the grey sandy soils derived from hill wash or river alluvium, grey clays of the valley bottoms and lacustrine sands dominate the lowland component. Lithosols are soils without horizons and thus young and stony or bare rocks. Generally the soils of Lyantonde District can be classified into two soil catenas, four soil series and peat soils. The dominant catena is the Mawogola accounting for over 85%, and then there are the Mirambi and Nyabusozzi catenas (Figure 3). Some of these soils are loose and collapsing making pit latrine construction difficult and very expensive.

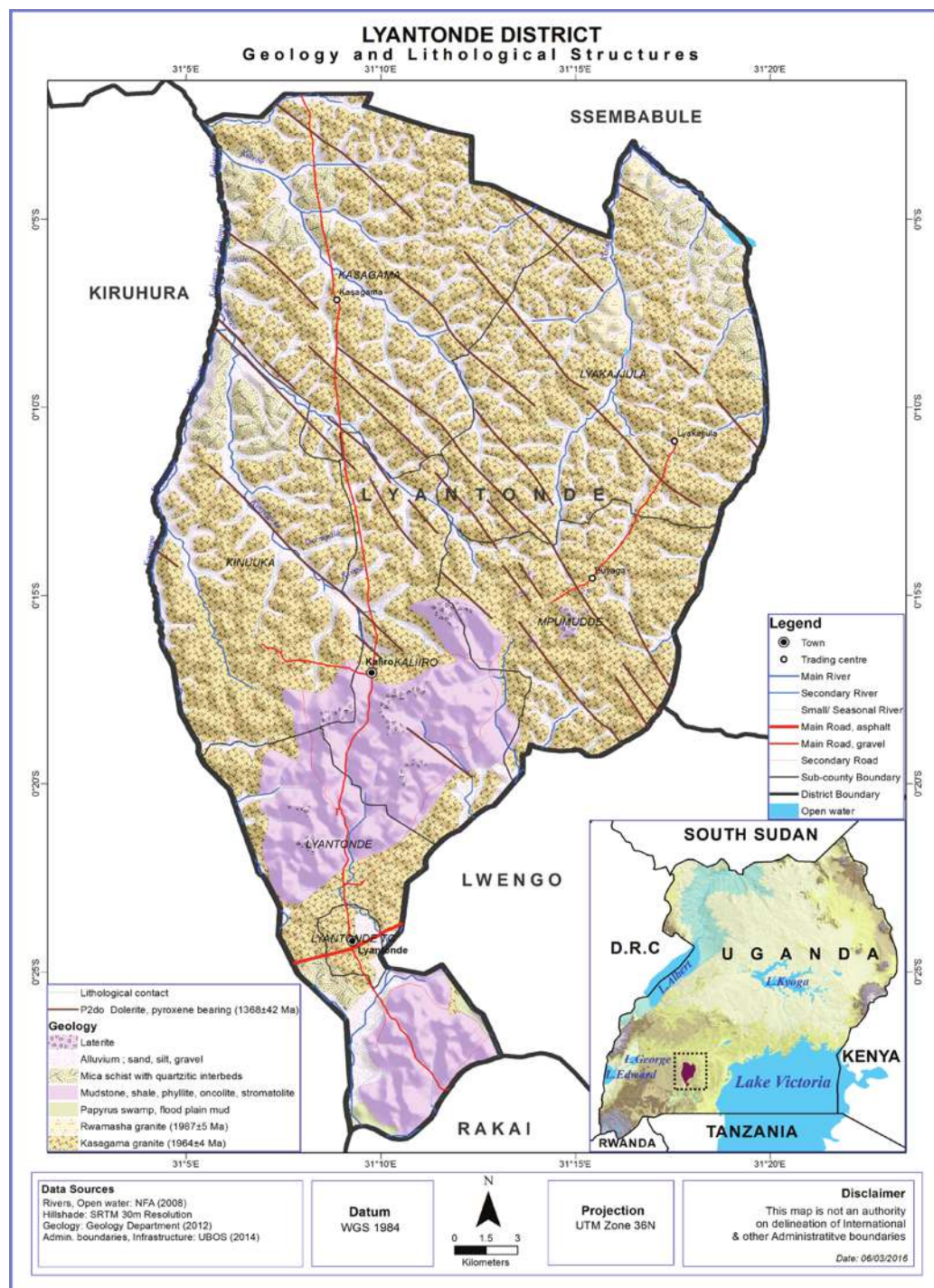


Figure 3: Geology and Lithological Structures, Lyantonde District



### 2.1.3 Vegetation and Land use Stratification

Lyantonde District has a pure savanna woodland type of vegetation characterized by short eucalyptus trees, acacia species and short grass. The District has no profound forest covers since most of them such as Kabula forest in Lyantonde sub-county and Buyaga forest in Mpumudde sub-county have been cleared for settlement and establishment of farmland. Figure 4 shows the Land use Stratification and Gazetted areas of Lyantonde District.

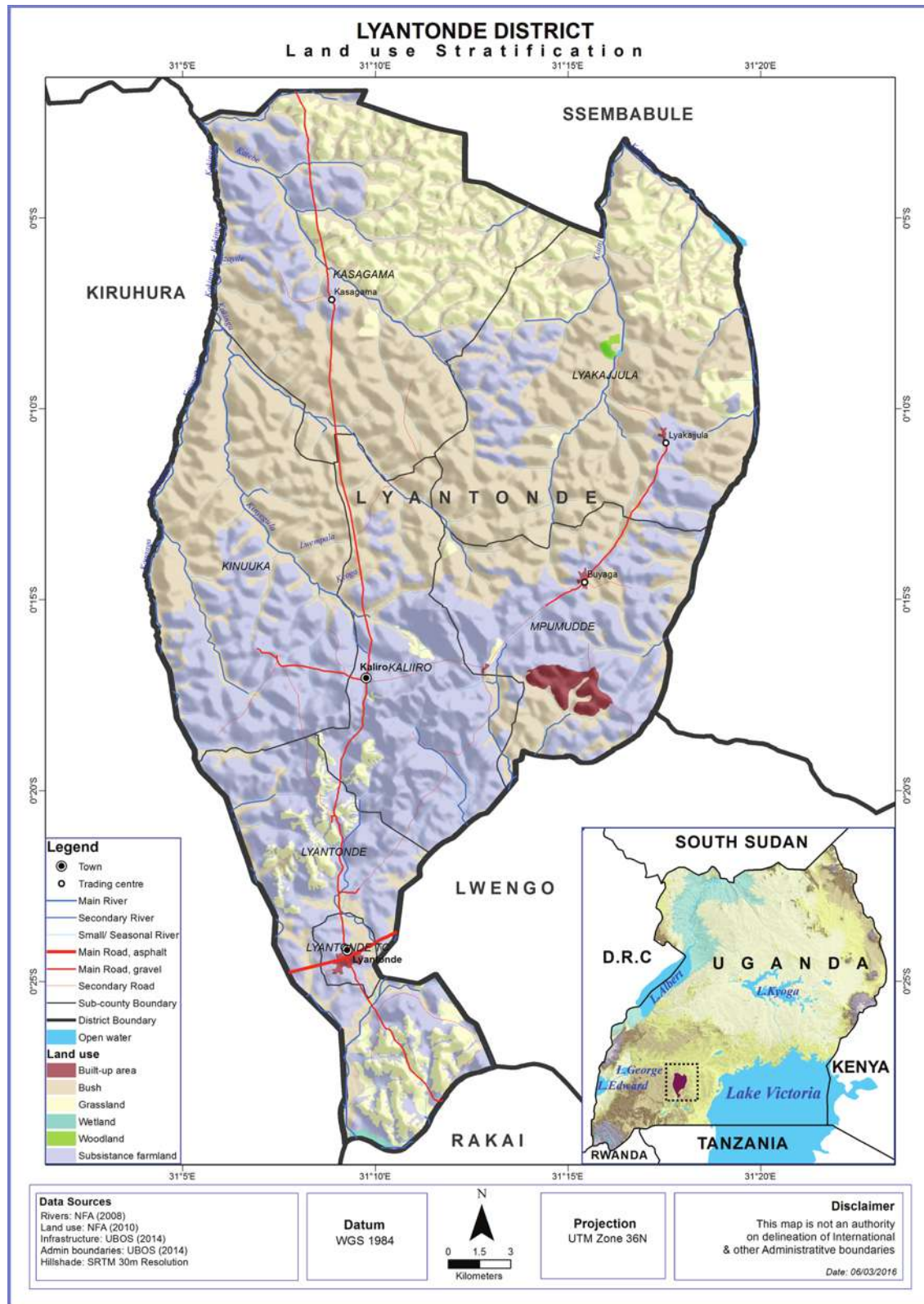


Figure 4: Land Use Stratification, Lyantonde District

#### **2.1.4 Temperature and Humidity**

The District generally records mean monthly maximum temperatures between 25°C and 29°C. This leads to prolonged perennial drought mainly from May to October. Relative humidity ranges between 80% - 90% in the morning and decreases to between 61% and 66% in the afternoons during the months of January and May.

#### **2.1.5 Wind**

The long-term wind speed records from the East African Meteorological Department (1975) indicate average annual wind speeds of 3 knots and 5 knots at 0600 hours and 1200 hours, for Lyantonde. The wind speed values indicated, therefore, represent conditions of moderate to strong or turbulent conditions. The average number of calms experienced in the area, are indicated to be experienced for 99 days at 0600 hours, and 27 days at 1200 hours, respectively, at Lyantonde. The general conclusion from these climatic figures is that for most of the year, Lyantonde district experiences moderate to strong and gusty winds, increasing in the afternoon.

#### **2.1.6 Rainfall**

Lyantonde is located in the semi-arid stretch of the Ankole - Masaka dry corridor. This belt experiences a bimodal pattern of rainfall ranging between 1000mm-1200mm per annum. However in recent period, Lyantonde District is experiencing severe drought, and the rainfall pattern has been complicated as it has received a unimodal type of rain fall as low as 750mm. Two dry seasons occur with the more pronounced ones in July-September and December-February. Figure 5 shows Total Annual Rainfall Distribution of Lyantonde District.

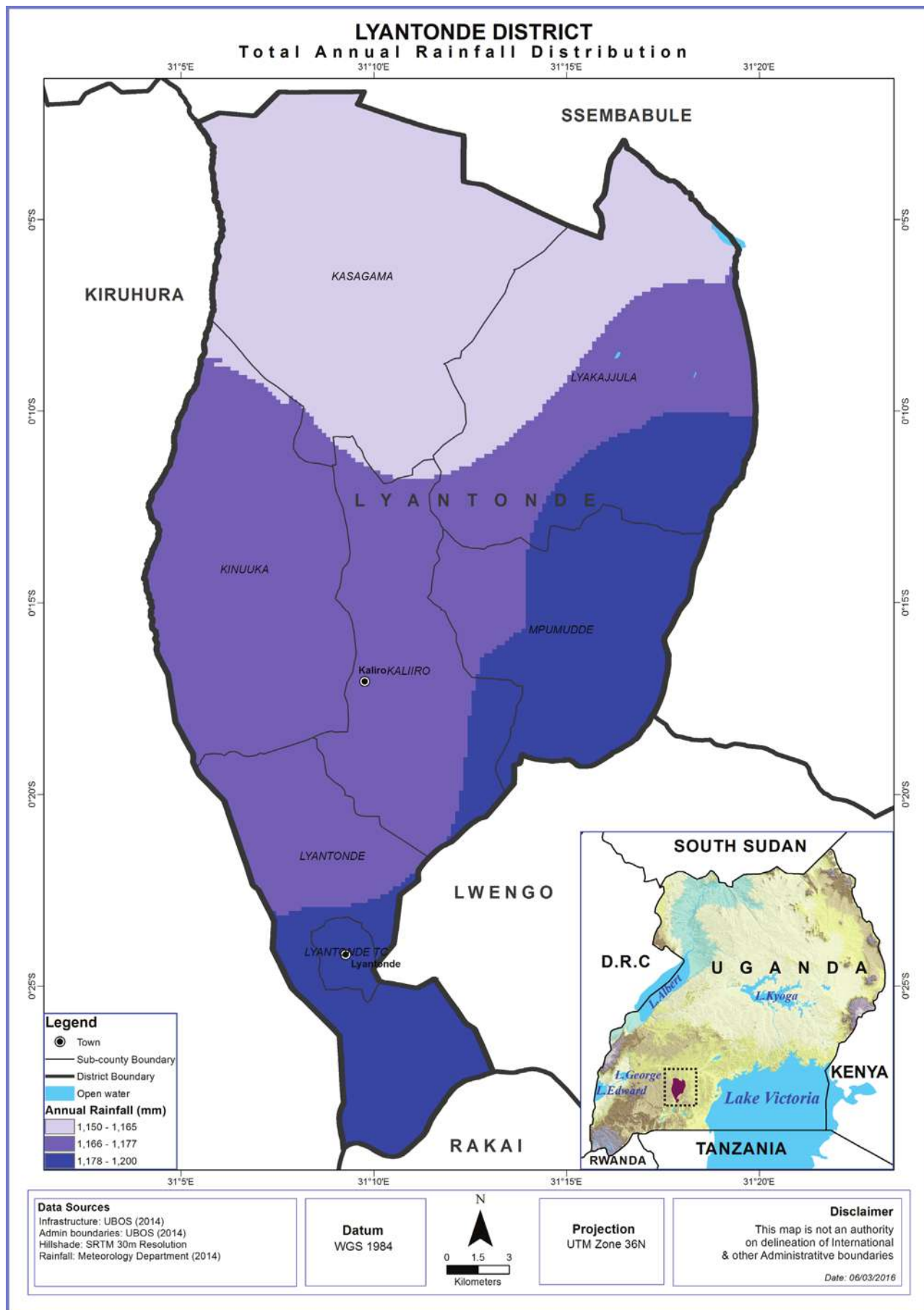


Figure 5: Total Annual Rainfall Distribution, Lyantonde District

### 2.1.7 Hydrology

Lyantonde District is generally poorly endowed in terms of surface and subsurface water sources. This partly explains the severe water shortages often experienced especially during the dry season. However in the south western, the District slightly borders with a swamp / catchment of Lake Kacheera, in Rakai district, the only fresh water source for piped water to Lyantonde town council. The lake also provides economic livelihood opportunities to surrounding communities especially in terms of fishing.

### 2.1.8 Population

According to the National Population and Housing Census (2014) results, Lyantonde District had a total population 94,573 people. Results also showed that most of the people in Lyantonde District reside in rural areas (80,987 (85.6%) compared to (13,586 (14.4%) who reside in urban centers. The gender distribution was reported to be males: 46,703 (49.4%) and females: 47,870 (50.6%). About 99.2% (93,846) of the population form the household population and only 0.8% (727) is Non-household. Lyantonde sub-county has the highest population of 18,846 people while Kinuuka sub-county had the least population of 8,729 people (Figure 6). Table 1 shows the population distribution per sub-county for the different gender.

**Table 1:** Population Distribution in Lyantonde District

<b>Sub-County</b>	<b>HOUSEHOLDS</b>		<b>POPULATION</b>		
	<b>Number</b>	<b>Average Size</b>	<b>Males</b>	<b>Females</b>	<b>Total</b>
Lyantonde	3889	4.8	9331	9515	18846
Kaliiro	4078	4.6	8997	9611	18608
Mpumudde	3137	5.0	7887	7744	15631
Lyantonde Town Council	4155	3.2	6332	7254	13586
Kasagama	2218	4.9	5598	5297	10895
Kinuuka	1716	5.1	4381	4348	8729
Lyakajjula	1662	5.0	4177	4101	8278

**Source:** UBOS Census 2014



## METHODOLOGY

### 3.1 Collection and analysis of field data using GIS

#### 3.1.1 Preliminary spatial analysis

Hazard prone areas base maps were generated using Spatial Multi-Criteria Analysis (SMCA) basing on numerical models and guidelines using existing environmental and socio-ecological spatial layers (i.e. DEM, Slope, Aspect, Flow Accumulation, Land use, vegetation cover, hydrology, soil types and soil moisture content, population, socio-economic, health facilities, accessibility, and meteorological data) in a GIS environment (ArcGIS 10.1).

#### 3.1.2 Stakeholder engagements

Stakeholder engagements were carried out in close collaboration with OPM's DRM team and the District Disaster Management focal persons with the aim of identifying the various hazards ranging from drought, floods, landslides, human, animal and crop diseases, pests, wildlife animal attacks, earthquakes, fires and conflicts among others. Stakeholder engagements were done through Focus Group Discussions (FGDs) and Key Informant Interviews guided by checklist tools (Appendix I). At District level, one Key Informant Interview comprising of four respondents (Deputy Chief Administrative Officer, District Production Officer, District Natural Resources Officer and Vice-Chairperson LC V) was held at Lyantonde District Headquarters (31.15183E; -0.39977S). At Sub-county level key informants included: Sub-county and parish chiefs and Community Development Officers.

FGDs were carried out in four purposively selected sub-counties that were ranked with the highest vulnerability. FGDs comprising of an average of 12 respondents (crop farmers, local leaders and cattle keepers) were conducted at Kaliiro Sub-county (31.16341E; -0.28958S), Lyantonde Sub-county (31.15236E; -0.39995S) and Lyakajjula Sub-county (31.29349E;-0.18315S). Each Parish of the selected Sub-counties was represented by at least one participant and the selection of participants was engendered. FGDs were conducted with utmost consideration to the various gender categories (women, men) with respect to age groups since hazards affect both men and women though in different perspectives irrespective of age. This allowed for comprehensive representation as well as provision of detailed and verifiable information.

Focus Group discussions and Key Informant Interviews were transcribed in the field for purposes of input into the NVIVO software for qualitative data analysis. Case stories and photographs were documented and captured respectively. In order to produce age and sex disaggregated data, results from FGDs and KIIs were integrated with the district population census data. This was also input in the multi-hazard, risk and vulnerability profile maps.

#### 3.1.3 Participatory GIS

Using Participatory GIS (PGIS), local communities were involved in identifying specific hazards prone areas on the Hazard base maps. This was done during the FGDs and participants were requested through a participatory process to develop a community hazard profile map.

#### 3.1.4 Geo-referencing and ground-truthing

The identified hazard hotspots in the community profile maps were ground-truthed and geo-

referenced using a handheld Spectra precision Global Positioning System (GPS) unit, model: Mobile Mapper 20 set in WGS 1984 Datum. The entities captured included: hazard location, (Sub-county and parish), extent of the hazard, height above sea level, slope position, topography, neighboring land use among others (Appendix I). Hazard hot spots, potential and susceptible areas will be classified using a participatory approach on a scale of “not reported/ not prone”, “low”, “medium” and “high”. This information generated through a participatory and transect approach was used to validate modelled hazard, risk and vulnerability status of the district. The spatial extent of a hazard event was established through modelling and a participatory validation undertaken.

### **3.2 Develop District Specific Multi-hazard Risk and Vulnerability Profiles**

#### ***3.2.1 Data analysis and integration***

Data analysis and spatial modeling was done by integrating spatial layers and non-spatial attribute captured from FGDs and KIIs to generate final HRV maps at Sub-county level. Spatial analysis was done using ArcGIS 10.1 to generate specific hazard, risk and vulnerability profile for the district.

#### ***3.2.2 Data verification and validation***

OPM, in collaboration with UNDP organized a five days regional data verification and validation workshop in Mbarara Municipality as a central place within the region. This involved key district DDMC focal persons for the purpose of creating local/district ownership of the profiles.

### **3.3 Preserve the Spatial data to enable future use of the maps**

HRV profile reports and maps have been verified and validated, final HRV profiles inventory and geo-database have been prepared containing all GIS data in various file formats to enable future use of the maps.

## RESULTS FROM MULTI-HAZARD RISK, VULNERABILITY MAPPING

### 4. Multi-hazards

A hazard, and the resultant disaster can have different origins: natural (geological, Hydro-meteorological and biological) or induced by human processes (environmental degradation and technological hazards). Hazards can be single, sequential or combined in their origin and effects. Each hazard is characterized by its location, intensity, frequency, probability, duration, area of extent, speed of onset, spatial dispersion and temporal spacing (Cees, 2009).

In the case of Lyantonde district, hazards were classified following main controlling factors:

- i. Geomorphological or Geological hazards including landslides, rock falls and soil erosion
- ii. Climatological or Meteorological hazards including floods, drought, hailstorms, strong winds and Lightning
- iii. Ecological or Biological hazards including crop pests and diseases, livestock pests and diseases, human epidemic diseases, vermin attacks and wildlife animal attacks,
- iv. Human induced or Technological hazards including bush fires, road accidents land conflicts.

### 4.1 Geomorphological and Geological Hazards

#### 4.1.1 Landslides, rock falls and soil erosion

Results from the participatory assessments indicated that there weren't any incidences of landslides and rock falls in Lyantonde district. However, participants reported cases of soil erosion on the bare hills due to poor agricultural practices, overgrazing, bush burning, charcoal burning and murrum extraction. Incidences of rock falls and soil erosion were reported at the Wolfram mining site in Buyaga, Mpumudde sub-county. This information was integrated with the spatial modelling using socio-ecological spatial data i.e. Soil texture (data for National Agricultural Research Laboratories – Kawanda (NARL) 2014, Rainfall (Meteorology Department 2014), Digital Elevation Model (DEM), SLOPE, ASPECT (30m resolution data from SRTM Shuttle Radar Topography Mission (SRTM) to generate Land slide, rock falls and soil erosion vulnerability map (Figure 7).



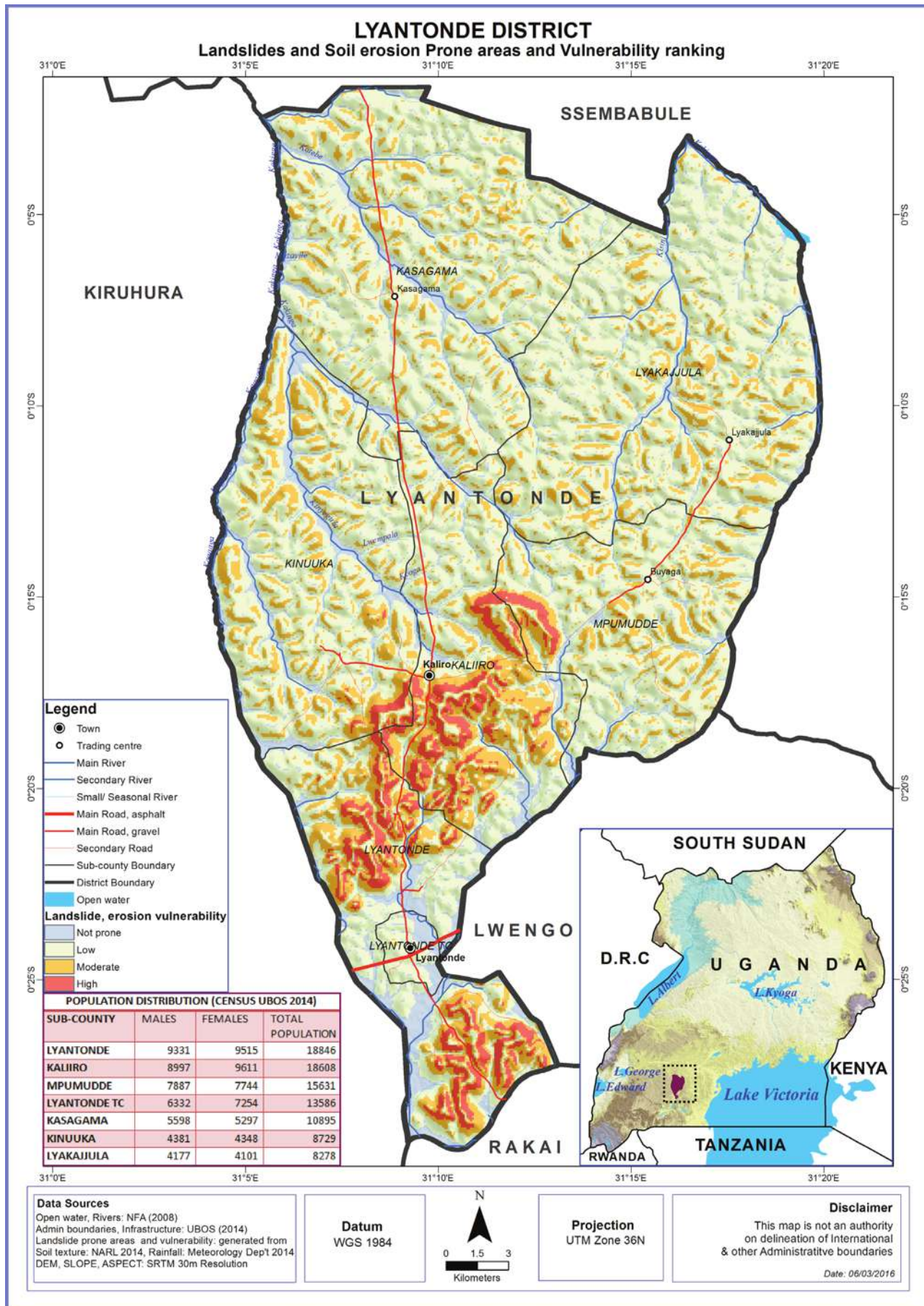


Figure 7: Landslides and Soil erosion Prone Areas and Vulnerability, Lyantonde District

### 4.1.2 Earthquakes and faults

Participants of the focus group discussion indicated that earthquakes weren't a problem in Lyantonde district. However, it was observed that the entire district only experiences minor tremors (Figure 8).

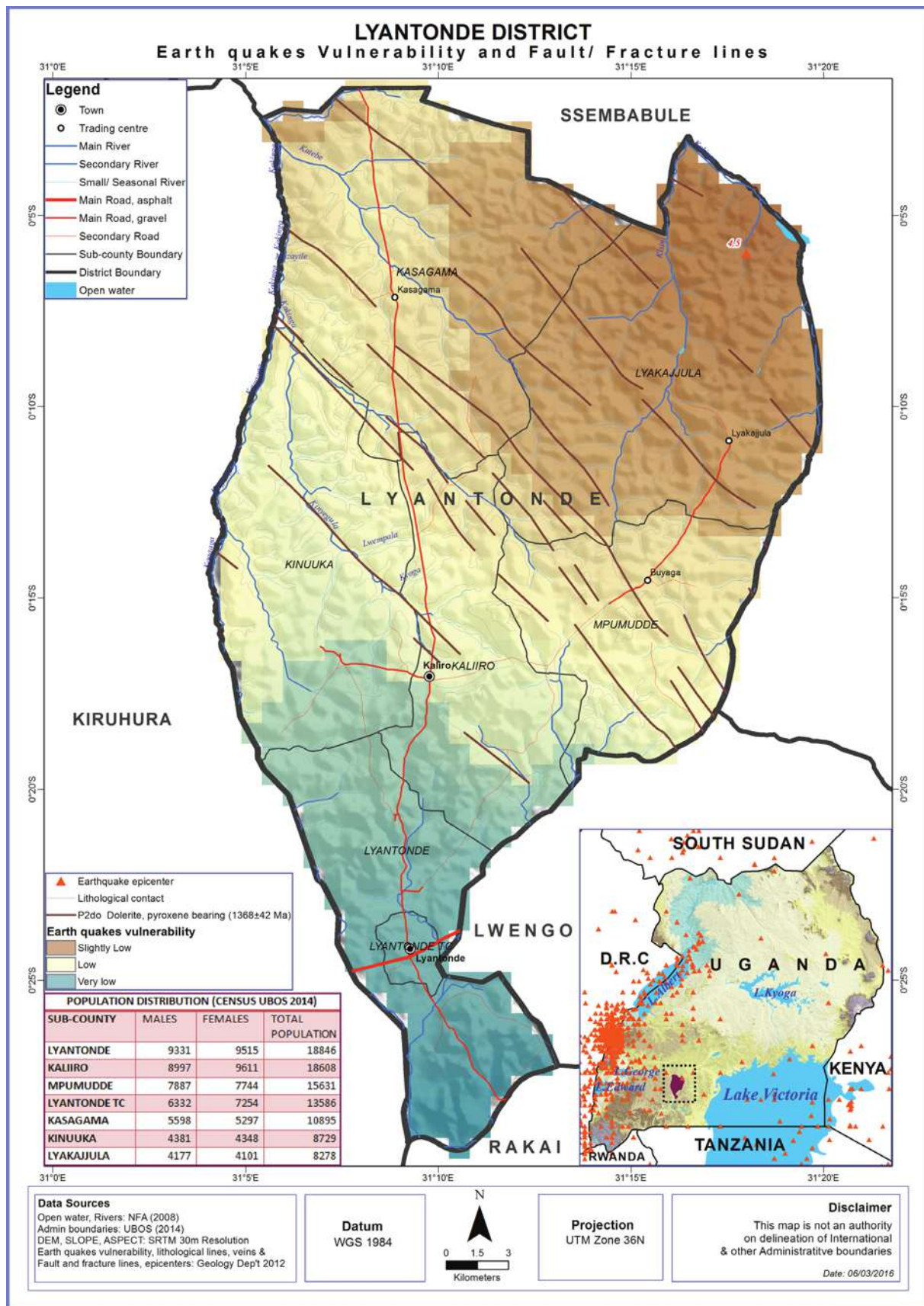


Figure 8: Earthquakes Vulnerability and Fault lines, Lyantonde District

## 4.2 Climatological and Meteorological Hazards

### 4.2.1 Floods

Results from the focus group discussions revealed that floods usually occur in the low lying areas and valleys during the rainy seasons .i.e. October to November. Participants reported that floods submerge crops such; as beans, sweet potatoes and maize thus causing food insecurity and considerable economic losses. Incidences of flooding were reported in Karunyiga wetland in Lyantonde rural sub-county, Kiyinda, Bubaare and Kabajungu wetlands in Kaliiro sub-county, Mukokoma and Kyabuza in Lyantonde Town council. This information was integrated with the spatial modelling using socio-ecological spatial data i.e. generated from Soil texture (data for National Agricultural Research Laboratories – Kawanda (NARL) 2014, Rainfall (Meteorology Department 2014), Digital Elevation Model (DEM), SLOPE, ASPECT (30m resolution data from SRTM Shuttle Radar Topography Mission (SRTM). Figure 9 shows areas susceptible to floods.



**Plate 1:** Flooding hotspot along the road in Kaliiro Sub-county

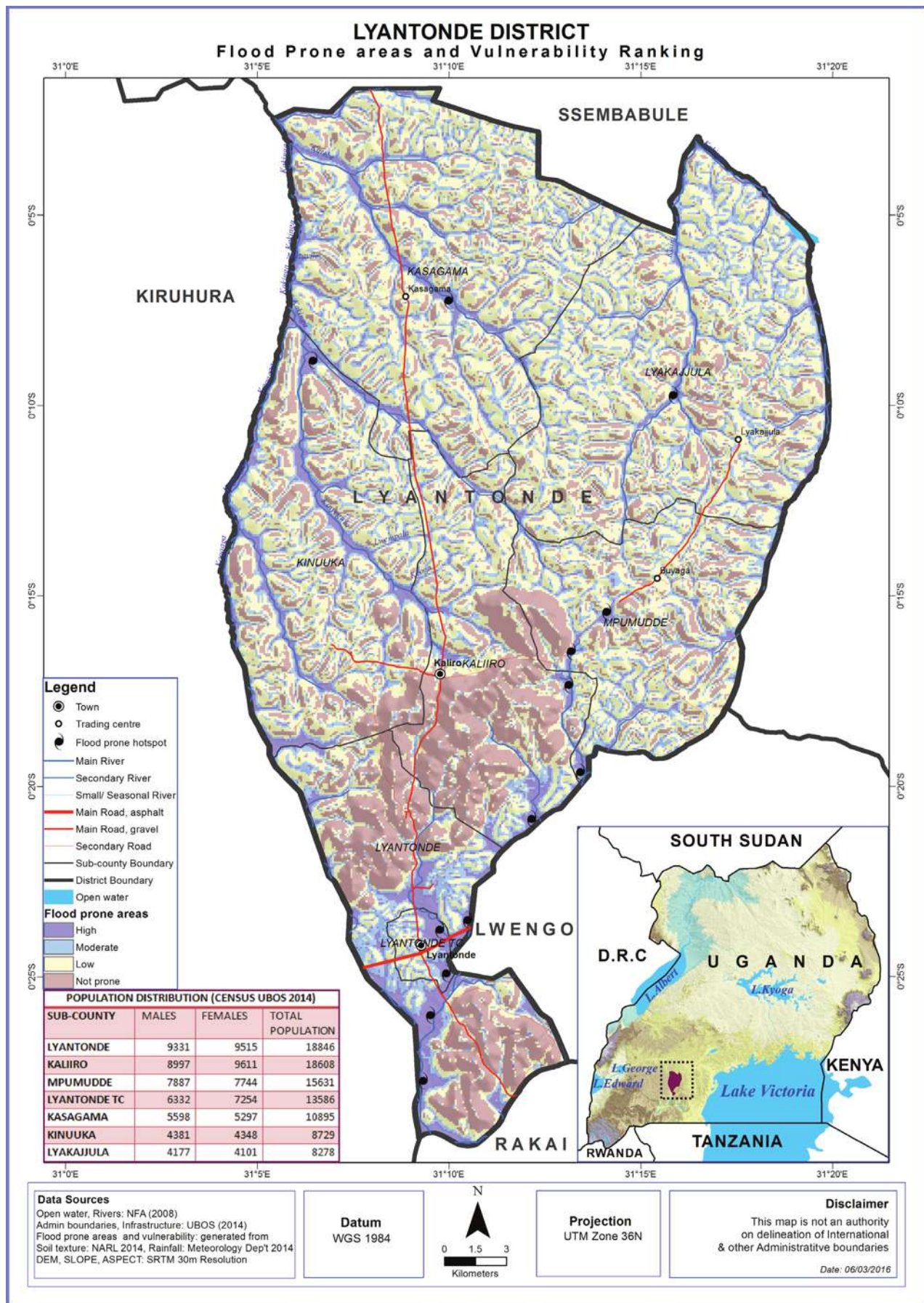


Figure 9: Flood Prone Areas and Vulnerability Ranking, Lyantonde District

#### 4.2.2 Drought

Participatory assessments through focus group discussions indicated that Lyantonde district experiences severe drought in form of prolonged dry spells in months beginning June to September. It was observed that drought was the most prominent hazard in this district. Participants reported that the entire district experiences this phenomenon because it lies in the Ankole - Masaka dry cattle corridor of Uganda. Participants indicated that drought had detrimental impacts on their livelihoods and wellbeing. Some of these impacts include; drying up of water sources, lack of pastures for livestock, food insecurity, rampant outbreaks of crop and livestock diseases and bush burning. Reports indicated most water reservoirs including Makukulu dam in Kaliiro sub-county dry up very fast during the dry season as a result of reduced capacity to retain water due to siltation and leaks. This information was integrated with the spatial modeling using socio-ecological spatial data i.e. generated from Rainfall and Temperature (Uganda National Meteorological Authority, 2014) using the Standardized Precipitation Index. Figure 10 shows areas that are affected by drought and their ranking.



**Plate 2:** Makukulu valley dam in Kaliiro Sub-county

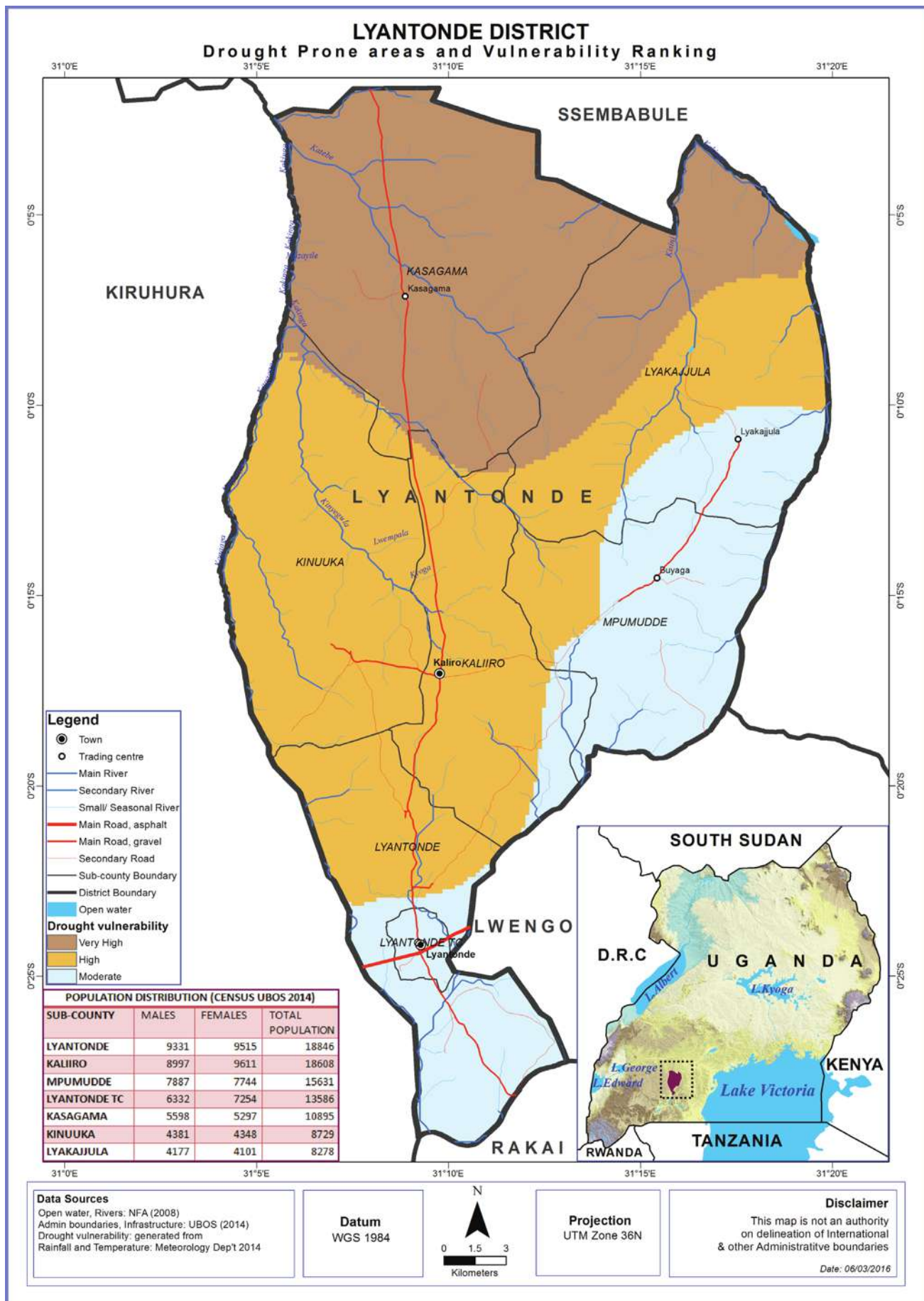


Figure 10: Drought Prone Areas and Vulnerability Ranking, Lyantonde District

### **4.2.3 Hailstorms**

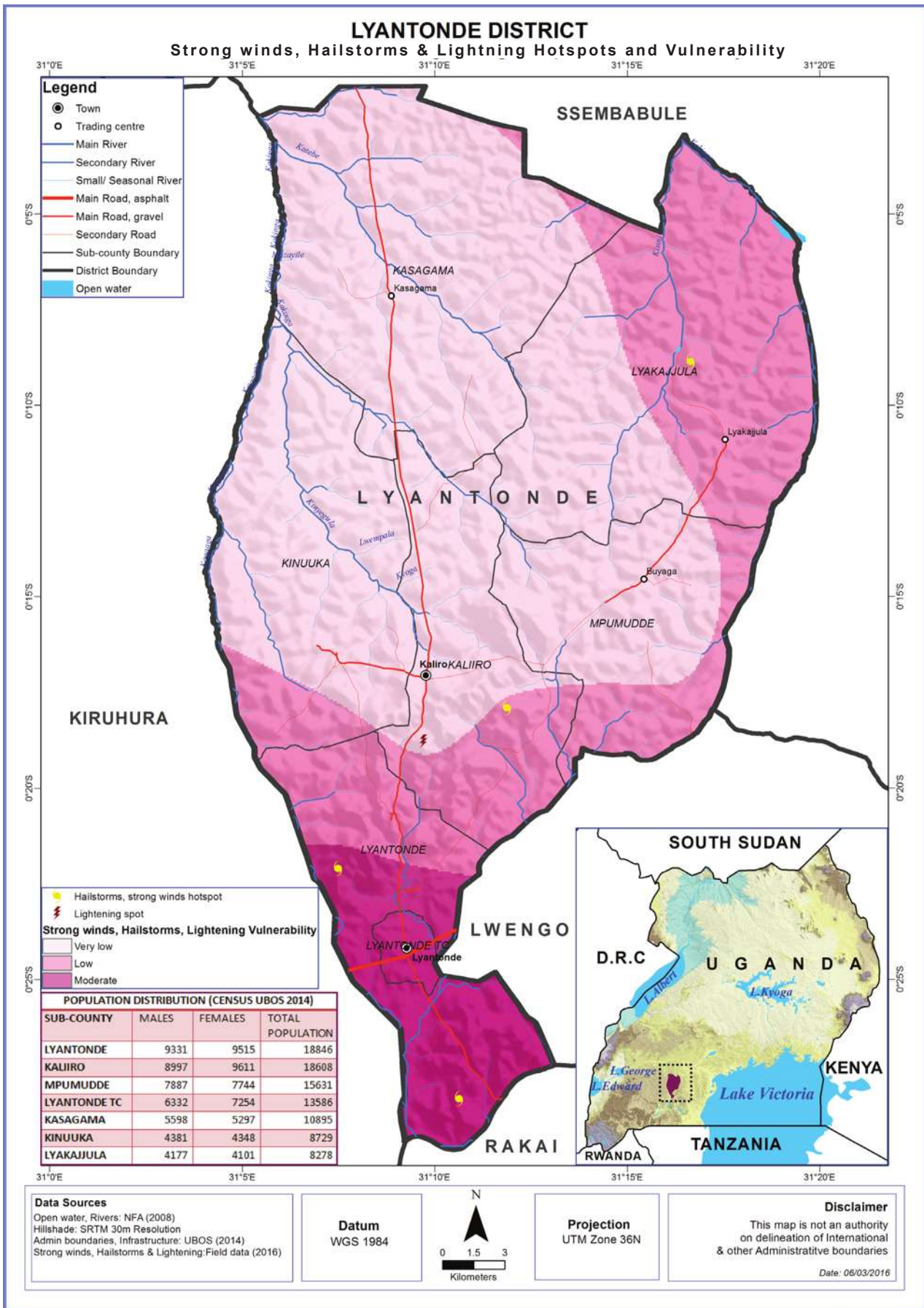
Results from the participatory assessments showed that Lyantonde district experiences hailstorms at the beginning of the rainy seasons. Participants reported that hailstorms cause serious damage to crops such as beans, coffee, maize and banana plantations leading to food insecurity and considerable economic losses to farmers. In 2014, several gardens in Buyanja village in Biworobo parish, Lyantonde sub-county were devastated by hailstorms. The most affected sub-counties are; Kinuuka, Kaliiro, and Lyantonde rural (Figure 11).

### **4.2.4 Strong winds**

The participants of the focus group discussions reported that strong winds are experienced during the rainy seasons. It was observed that strong winds blow off roof tops of houses, churches and schools, destroy banana plantations and cause tree falls. The most affected sub-counties are; Kinuuka, Kaliiro, and Lyantonde rural (Figure 11).

### **4.2.5 Lightning**

Lightning is a sudden high-voltage discharge of electricity that occurs within a cloud, between clouds, or between a cloud and the ground. The distribution of Lightning on Earth is far from uniform. The ideal conditions for producing Lightning and associated thunderstorms occur where warm, moist air rises and mixes with cold air above. Results from participatory assessments indicated that Lightning was not a common phenomenon in Lyantonde district. However, incidences of Lightning had increased between 2012 and 2013 in the entire district (Figure 11).



**Figure 11:** Strong winds, Hailstorms and Lightning Hotspots and Vulnerability, Lyantonde District



### 4.3 Ecological and Biological Hazards

#### 4.3.1 Crop Pests and Diseases

Participatory assessments through focus group discussions indicated that Lyantonde district was vulnerable to crop pests and diseases. The main crop disease causing agents include; plant viruses, bacteria, fungi and damage by arthropod pests. All crops grown in the district are affected leading to reduction of yield and quality of produce. The most common crop pests in the district are; coffee twig borer and army worms. While the most common crop diseases include; Coffee wilt disease and banana bacterial wilt. Participants noted that Biwolobo, Kalagala and Katovu parishes in Lyantonde were most affected by banana bacterial wilt. Most affected sub-counties include Kasagama, Kaliiro and Lyantonde (Figure 12).



**Plate 3:** A banana plantation affected by banana bacterial wilt in Kaliiro Sub-county

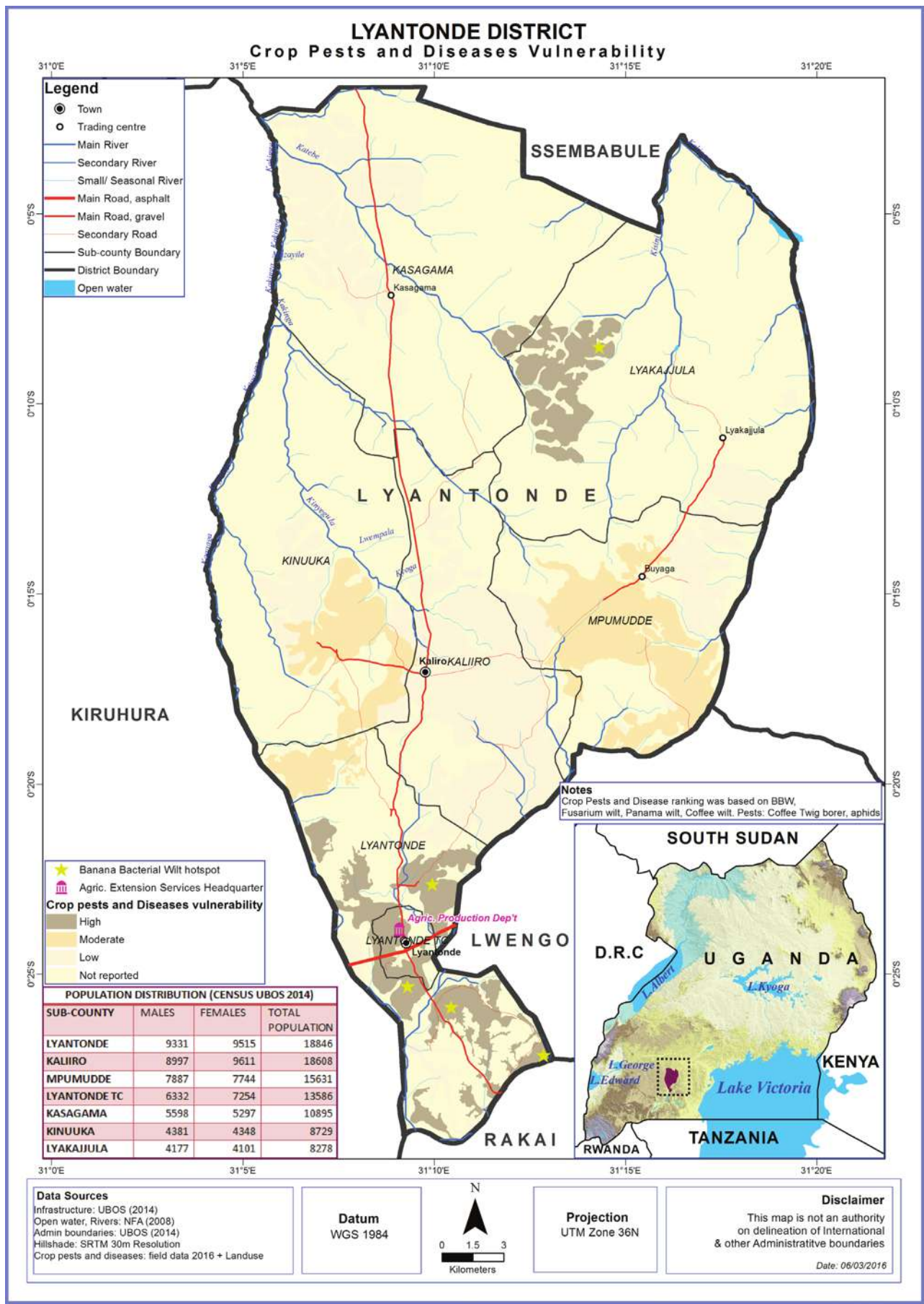


Figure 12: Crop Pests and Diseases Vulnerability, Lyantonde District

### 4.3.2 Livestock Pests and Diseases

Results from the focus group discussions indicated that livestock pests and diseases were a serious problem in Lyantonde district. This was attributed to the district's location in the cattle corridor. The most common livestock diseases in the district are; east coast fever, anaplasmosis, heart water, brucellosis, trichomoniasis, and lumpy skin disease. Ticks were the most common pests. Reports indicated that the sub-counties of Kasagama, Lyakajjula, Mpumudde, Kinuuka, Kaliiro and Lyantonde were the most affected (Figure 13).

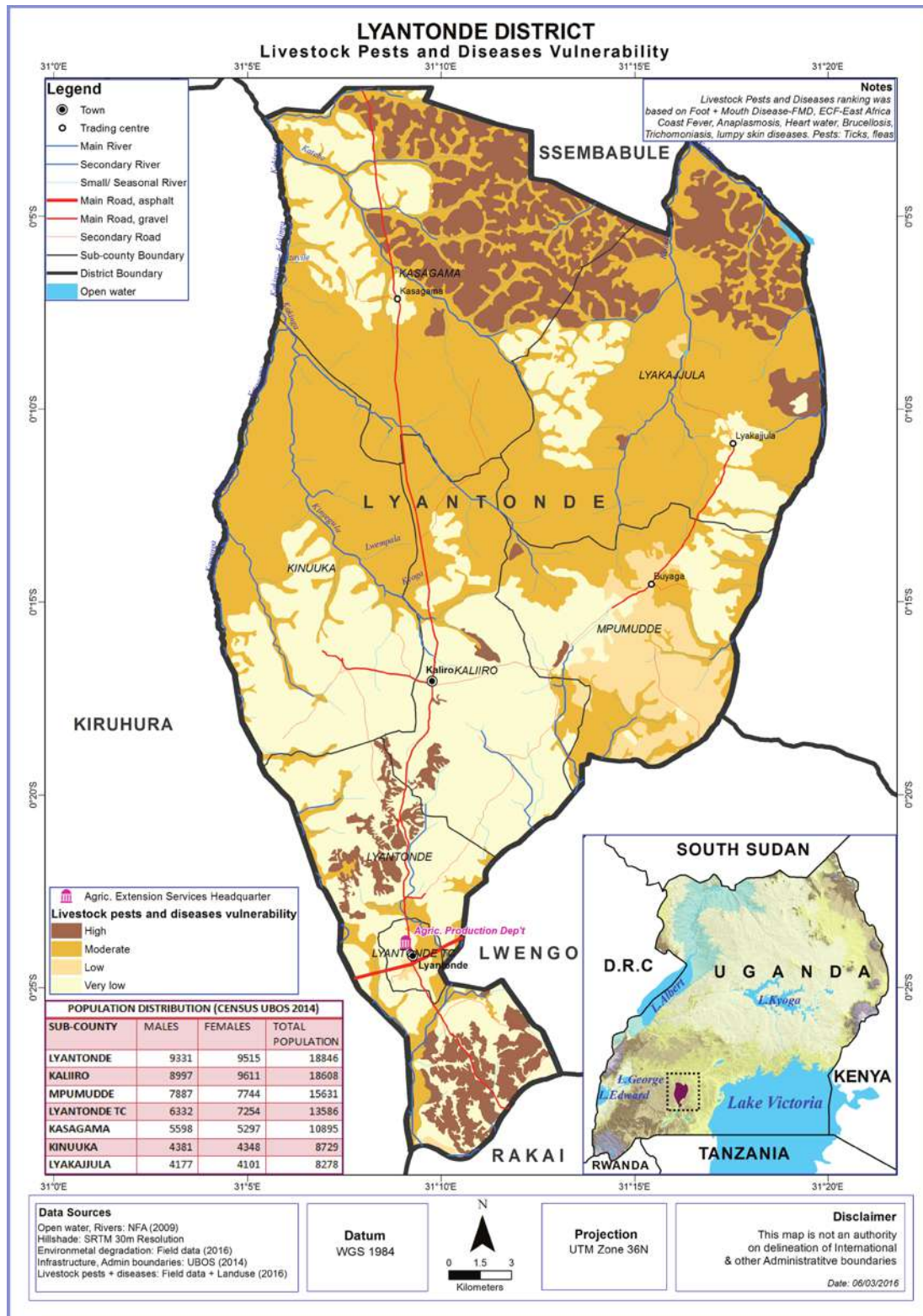


Figure 13: Livestock Pests and Diseases Vulnerability, Lyantonde District

### 4.3.3 Human Diseases

Participants in the series of focus group discussions held indicated that the most common human diseases in Lyantonde district were; malaria, brucellosis, HIV/AIDS and Hepatitis B. Reports showed that HIV/AIDS prevalence rates were very high (12%) in Lyantonde town council. Incidences of malaria and brucellosis were high in the entire district. It was also reported that Hepatitis B had caused many deaths in the sub-counties of Kasagama, Kinuuka and Lyakajjula (Figure 14).

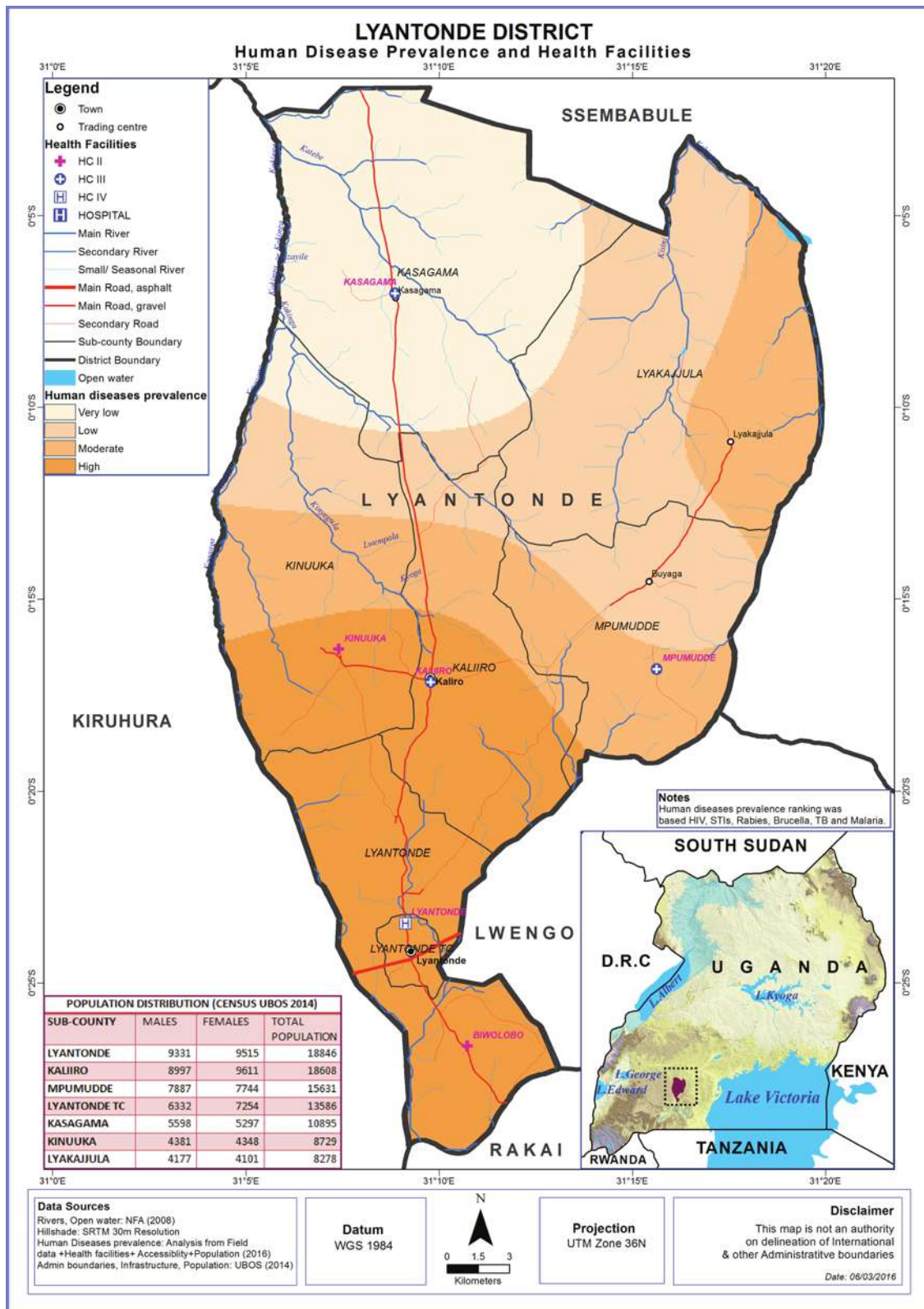


Figure 14: Human Diseases Prevalence and Health Facilities, Lyantonde District

### 4.3.4 Vermin and Wild-life Animal Attacks

Participatory assessments through focus group discussions revealed that there were increased vermin attacks in Lyantonde district. Reports indicated that monkeys, wild pigs, hippos and kobs from Lake Mburo National Park destroy crop gardens in Buyanja, Biwololo and Kabetemere villages in Lyantonde sub-county (Figure 15).

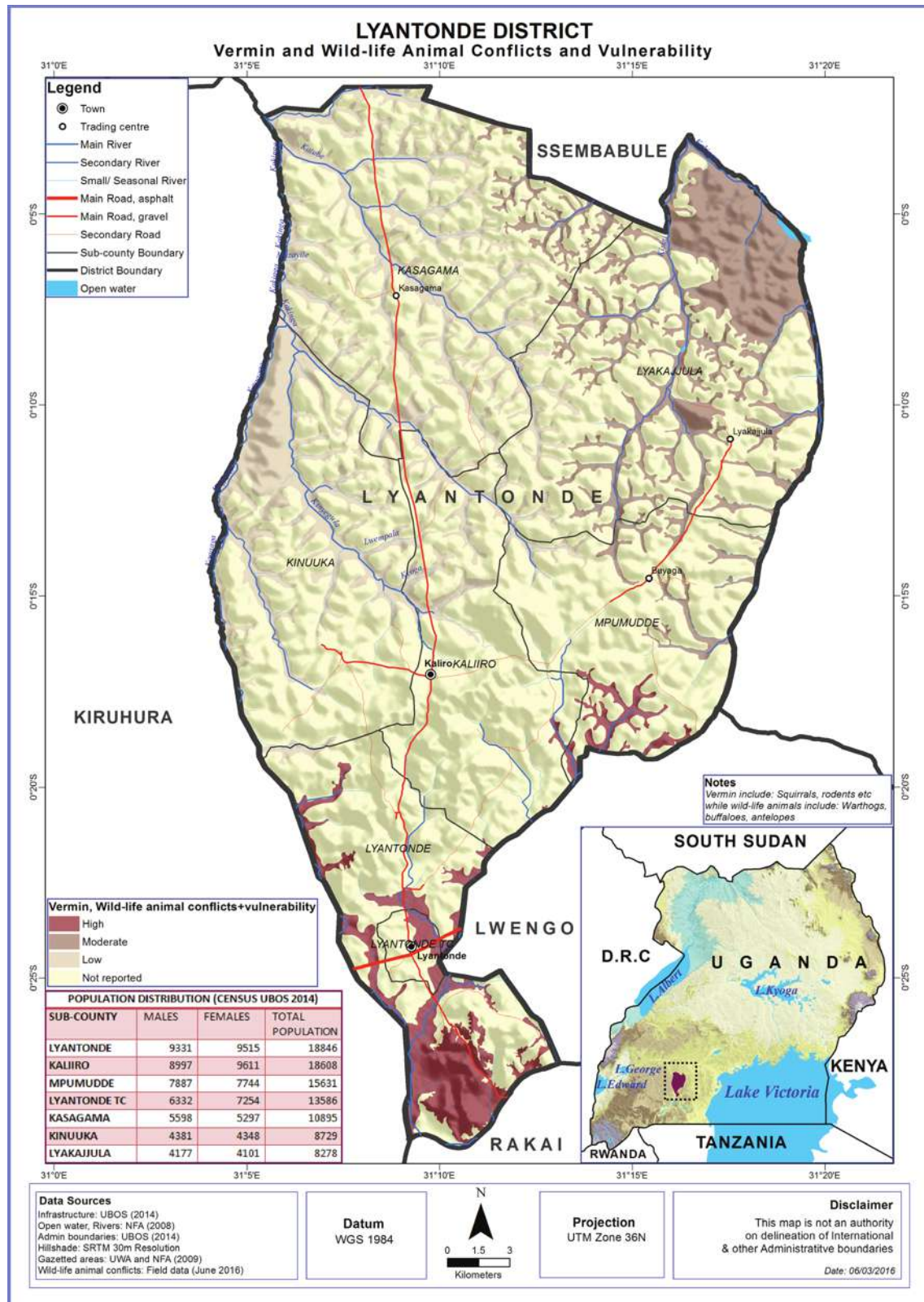


Figure 15: Vermin and Wildlife Animal Conflicts and Vulnerability, Lyantonde District

#### 4.3.5 Invasive species

The most common invasive species in Lyantonde district were; *Lantana camara*, thorny shrub with hooks locally called “Kilobo”, *Solanum nigrum* and *Cymbopogon spp.* Participants reported that these invasive species had destroyed grazing land despite efforts of clearing and burning them. Reports indicated that the thorny shrub with hooks locally called “Kilobo” were dominant in Mpumudde, Kasagama and Kinuuka sub-counties. Figure 16 indicates areas where invasive species exist and their ranking.



**Plate 4:** Solanum nigrum at Makukulu in Kaliiro Sub-county

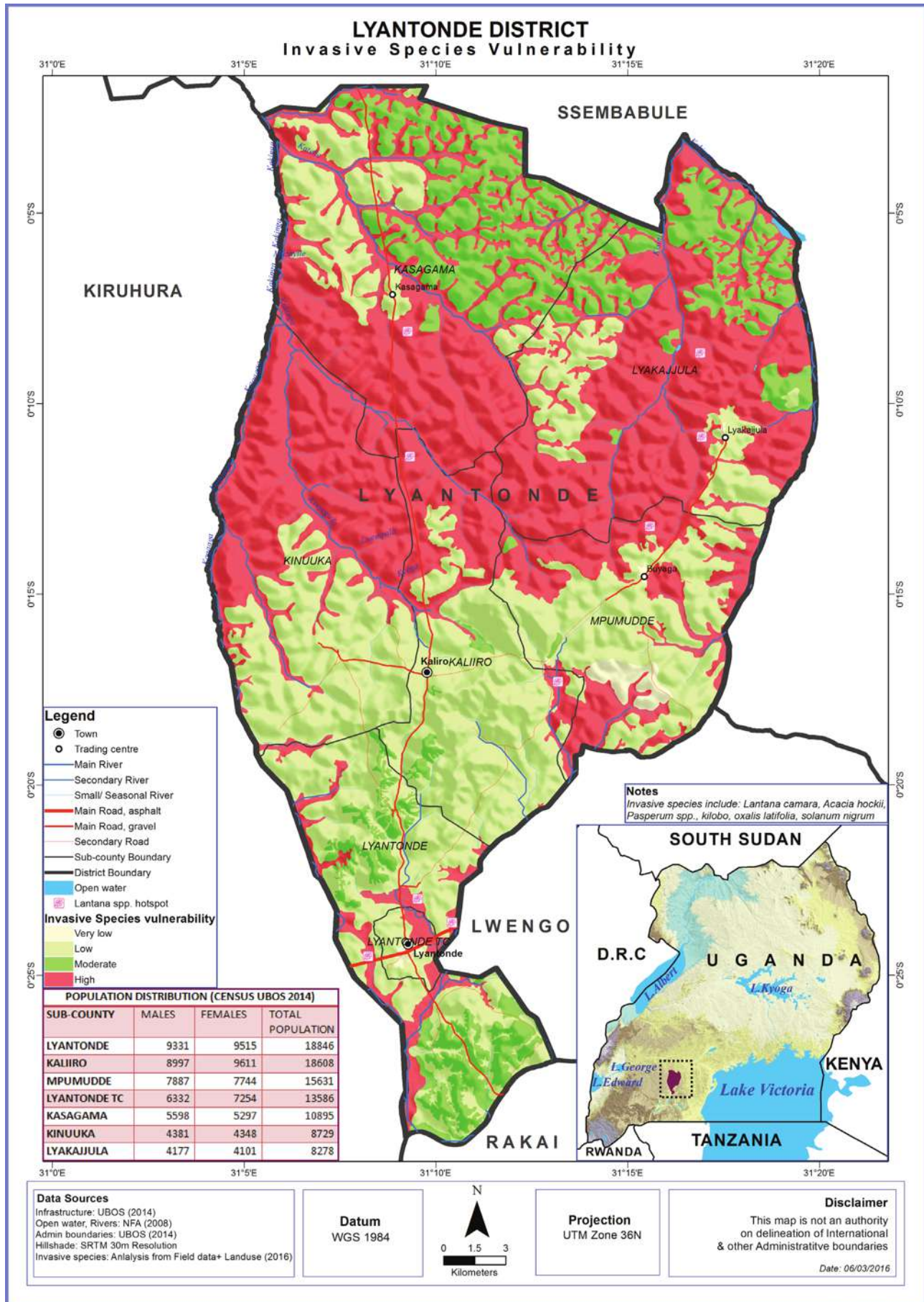


Figure 16: Invasive Species Vulnerability, Lyantonde District

## 4.4 Human Induced and Technological Hazards

### 4.4.1 Bush fires

Results from participatory assessments indicated that uncontrolled bush burning was a very serious problem in Lyantonde district. Reports indicated that cattle keepers have a practice of burning old grass for regeneration of fresh pastures at the onset of the rainy season. The most affected sub-counties are; Kaliiro, Kasagama, Mpumudde, Lyakajjula, Kinuuka and Lyantonde (Figure 17). It was reported that these fires destroy planted forests such as pine and eucalyptus plantations.

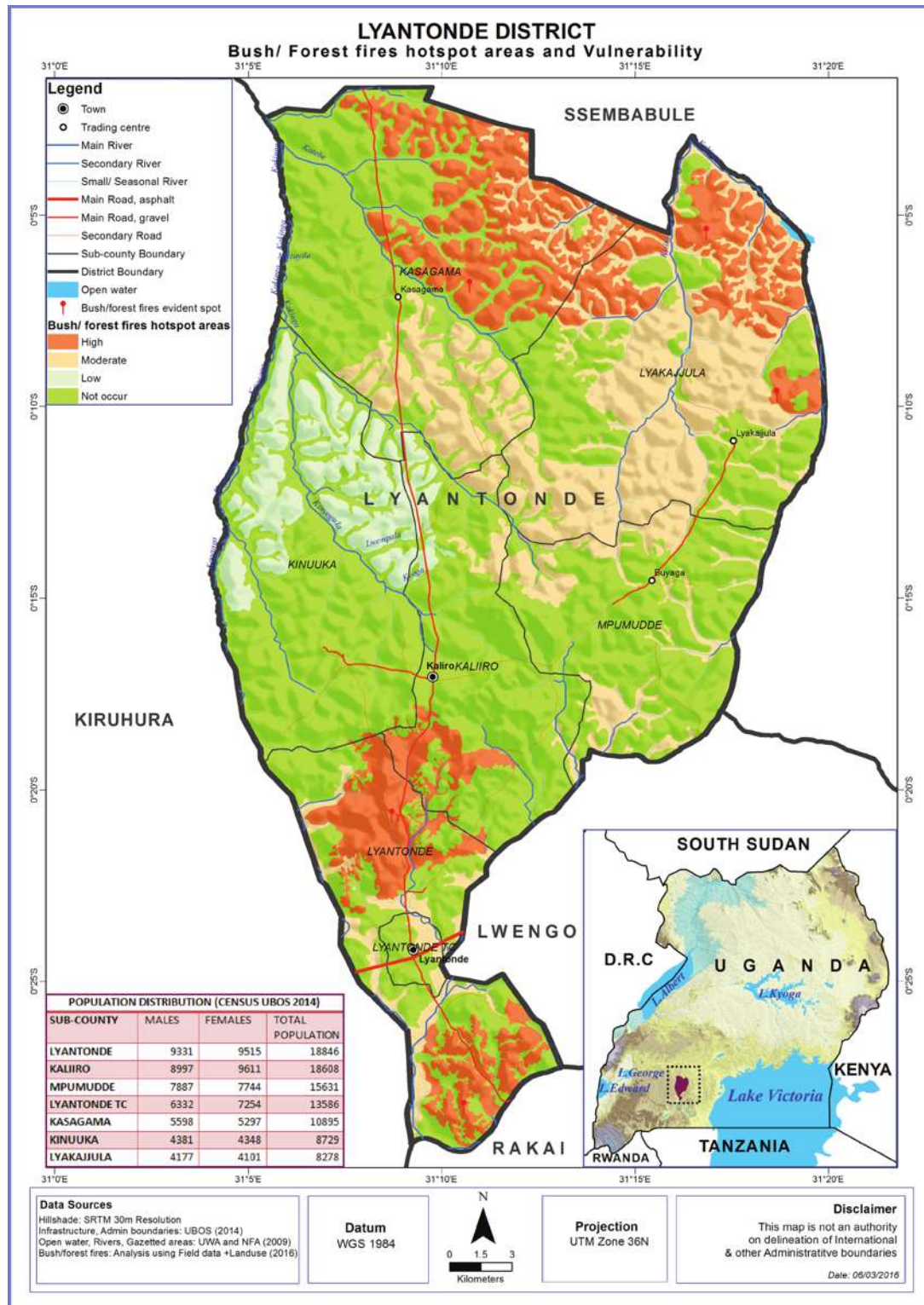


Figure 17: Bush/Forest fires Hotspot Areas and Vulnerability, Lyantonde District



#### 4.4.2 Land conflicts

Participants indicated that land conflicts were very common in Lyantonde district. Reports indicated that most of the registered land conflicts were between bibanja holders and land lords. It was also reported that the district was in conflict with other individuals over the land on which the headquarters is located (Figure 18). Matters of land disputes in the district are mostly settled by the Area land committee, RDCs office and Magistrate's court.

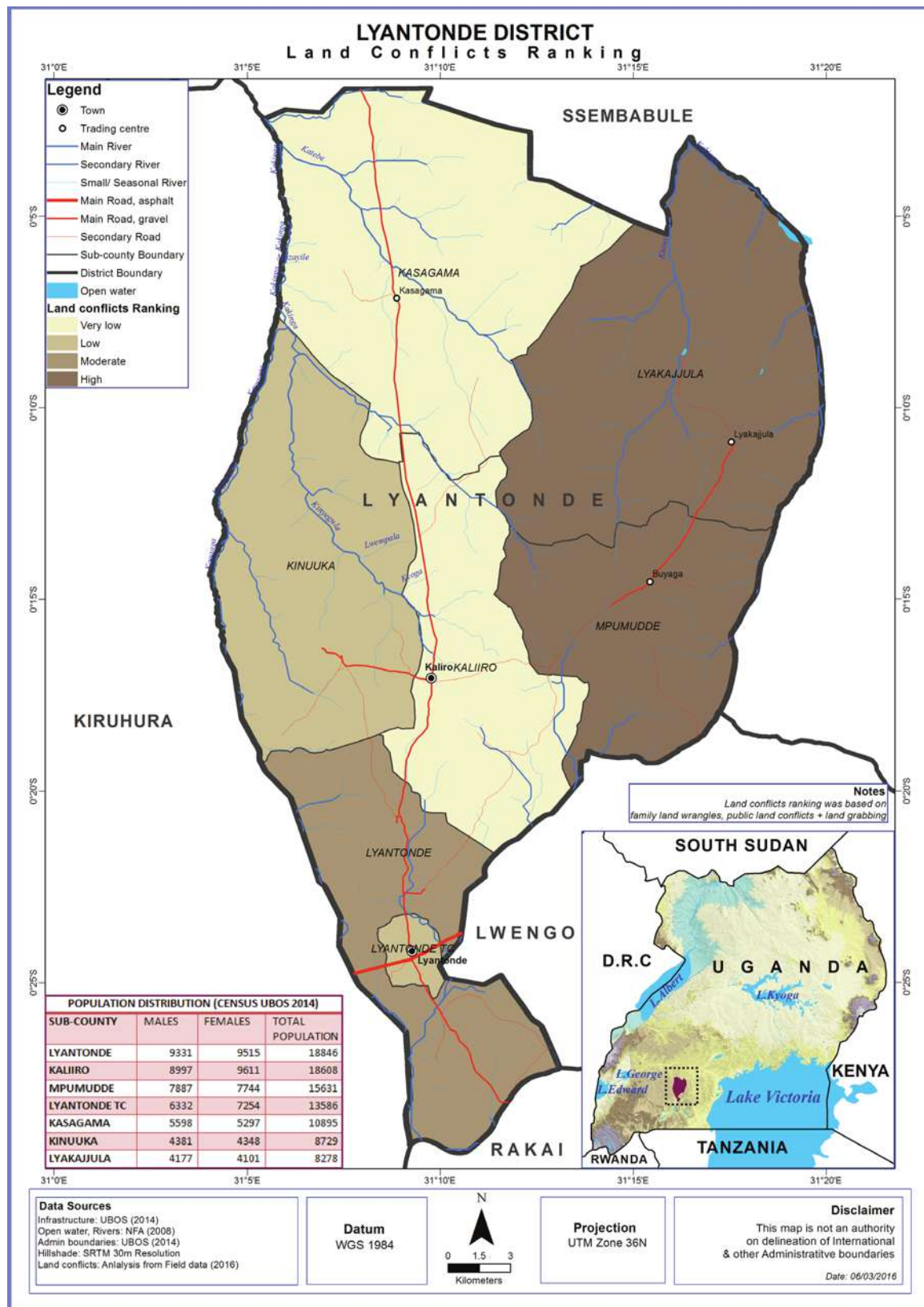


Figure 18: Land Conflicts Ranking, Lyantonde District

### 4.4.3 Environmental Degradation

The most reported forms of environmental degradation in Lyantonde district include; conversion of parts of Karunyiga wetland in Lyantonde sub-county into agricultural land, uncontrolled logging in Buyaga forest reserve, stone quarrying in Kibisi, Rusozi and Kinyarwanda villages in Kaliiro sub-county, sand mining in Kirowoza village and stone quarrying in Kalagala village all in Lyantonde sub-county and indiscriminate dumping of solid waste in Lyantonde town council. Charcoal burning and overgrazing in Lyakajjula, Mpumudde, Kinuuka sub-counties. Figure 19 indicates areas where environmental degradation has occurred and ranking.

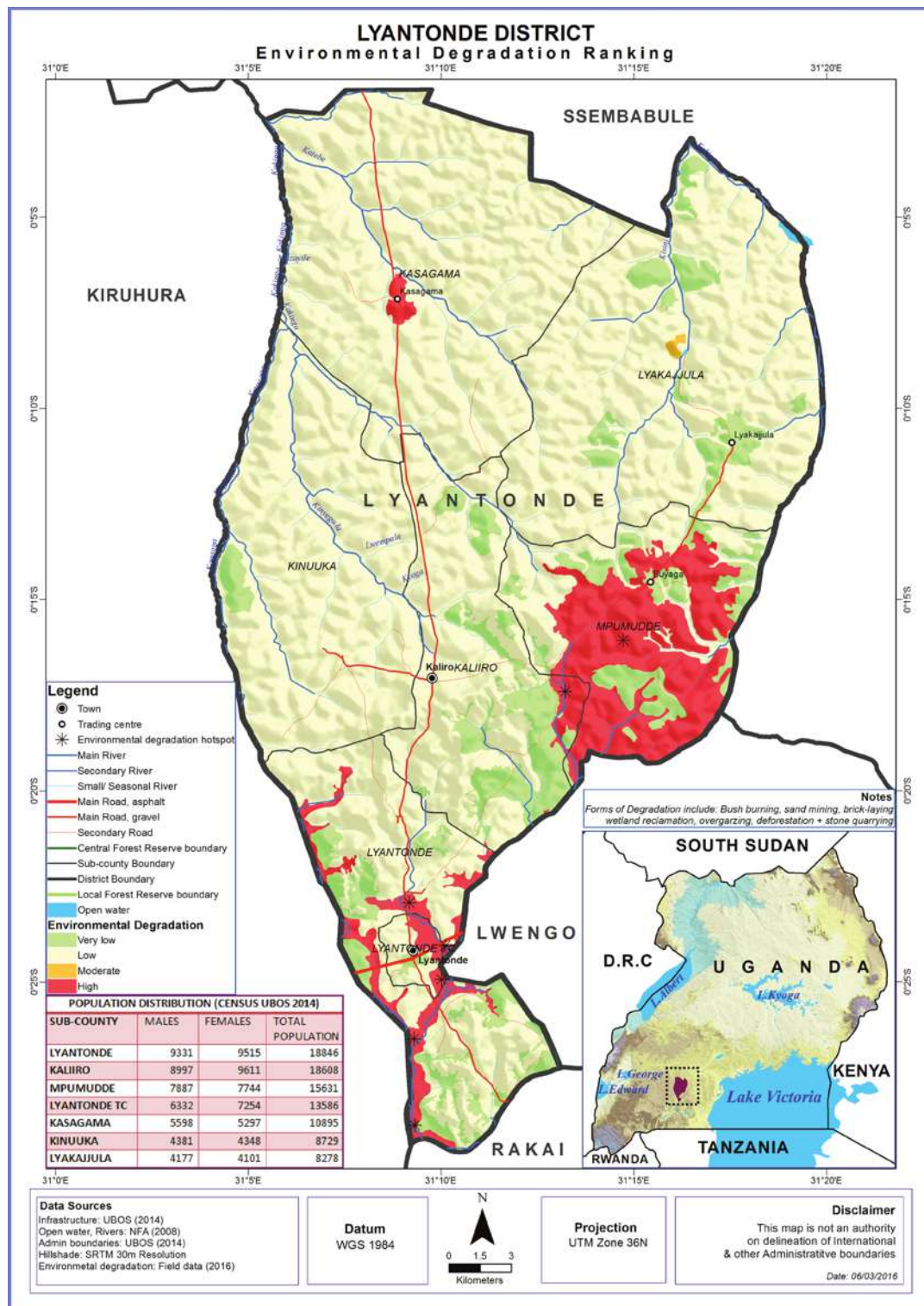


Figure 19: Environmental Degradation Ranking, Lyantonde District

#### 4.4.4 Road Accidents

It was reported that road accidents such as head on collisions and vehicles overturning were common along the Masaka - Mbarara highway and Rakai-Lyantonde road (Figure 20). Participants indicated that the rampant motor accidents along Masaka-Mbarara highway have put pressure on the Lyantonde hospital mortuary services as many bodies are unclaimed.

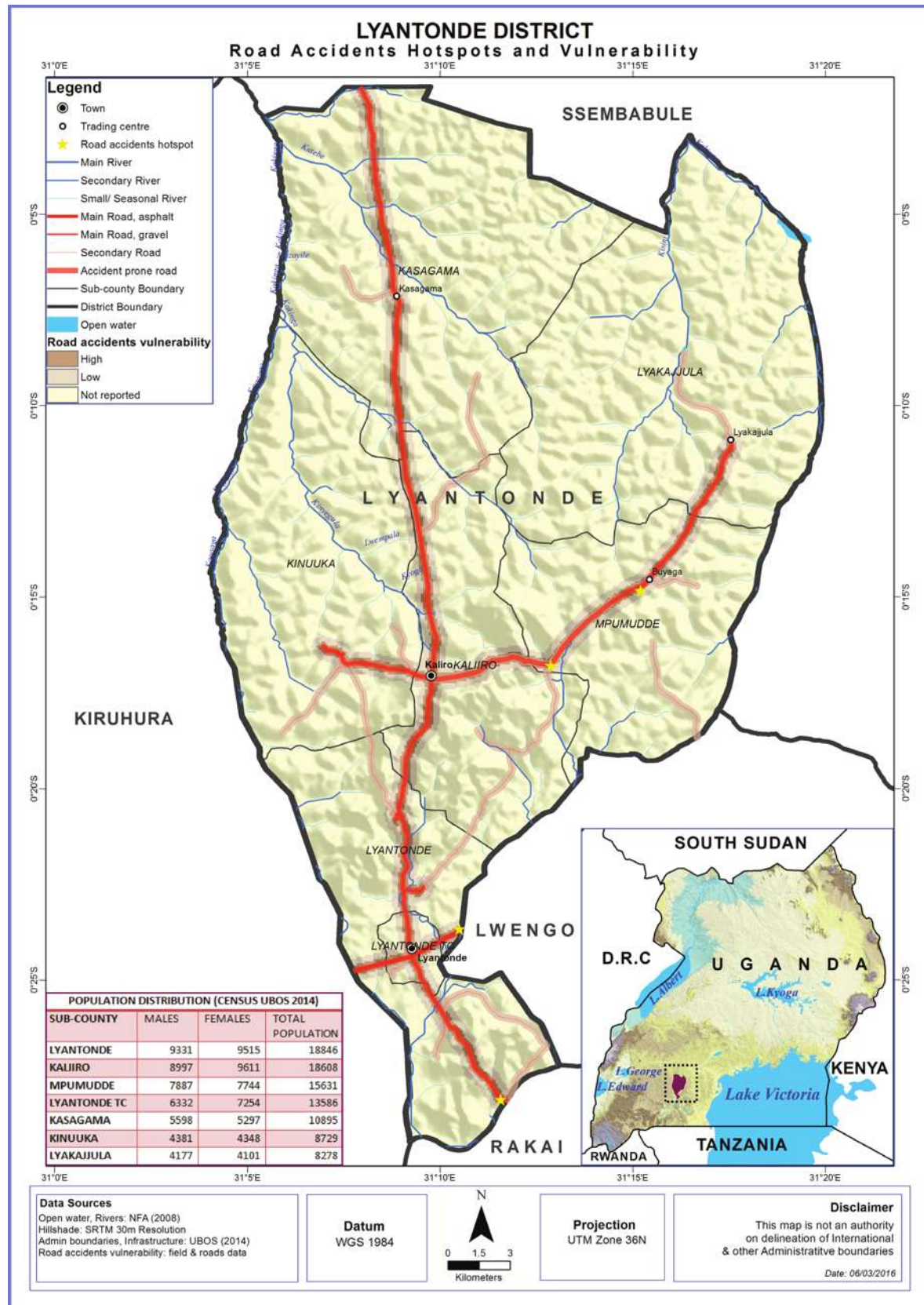


Figure 20: Road Accidents Hotspots and Vulnerability, Lyantonde District

## 4.5 VULNERABILITY PROFILE

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 of Lyantonde district were assessed based on exposure, susceptibility and adaptive capacity at community (village), parish, sub-county and district levels highlighting their sensitivity to a certain risk or phenomena. 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. Differences in socio-economic vulnerability can often be linked to differences in socio-economic status, where a low status generally means that you are more vulnerable.

Vulnerability was assessed basing on two broad criteria i.e. socio-economic and environmental components of vulnerability. Participatory approach was employed to assess these vulnerability components by characterizing the exposure agents, including hazards, elements at risk and their spatial dimension. Participants also characterized the susceptibility of the district including identification of the potential impacts, the spatial disposition and the coping mechanisms. Participants also identified the resilience dimension at different spatial scales (Table 2).

Table 3 (Vulnerability Profile) shows the relation between hazard intensity (probability) and degree of damage (magnitude of impacts) depicted in the form of hazard intensity classes, and for each class the corresponding degree of damage (severity of impact) is given. It reveals that climatological and meteorological hazards in form of drought and hailstorms predispose the community to high vulnerability state. The occurrence of pests and diseases and Lightning , also create a moderate vulnerability profile in the community (Table 3). Table 4 shows Hazard assessment for Lyantonde District.

**Table 2: Components of Vulnerability in Lyantonde District**

Vulnerability	Exposure			Susceptibility			Resilience		
	Hazards	Elements at Risk	Geographical Scale	Susceptibility	Geographical Scale	Coping strategies	Geographical Scale		
Landslides, Rock falls and Soil erosion	<ul style="list-style-type: none"> <li>- Human and livestock adjacent to hill slopes</li> <li>- Crops on hill slopes</li> <li>- Infrastructure e.g. houses, schools, roads adjacent to hill slopes</li> </ul>	Parish	<ul style="list-style-type: none"> <li>- Loss of lives</li> <li>- Complete crop failure</li> <li>- Destruction of infrastructure e.g. homes, and schools</li> </ul>	Parish	<ul style="list-style-type: none"> <li>- Migration</li> <li>- Sensitization by both government and non-governmental agencies</li> </ul>	Parish			
Earth quakes	<ul style="list-style-type: none"> <li>- Infrastructure e.g. houses, schools</li> </ul>	District	<ul style="list-style-type: none"> <li>- Loss of lives</li> <li>- Destruction of infrastructure e.g. houses, schools</li> </ul>	District	<ul style="list-style-type: none"> <li>- No much measure so far</li> </ul>	District			
Floods	<ul style="list-style-type: none"> <li>- Livestock adjacent to flood plain</li> <li>- Crops on flood plain</li> <li>- Infrastructure e.g. houses, schools, roads adjacent to flood plain</li> </ul>	Parish	<ul style="list-style-type: none"> <li>- Livestock loss</li> <li>- Destruction of crops</li> <li>- Destruction of infrastructure e.g. houses, schools, roads adjacent to flood plain</li> </ul>	Parish	<ul style="list-style-type: none"> <li>- Migration</li> <li>- Sensitization on wetland conservation</li> <li>- Dig trenches</li> </ul>	Parish			
Drought	<ul style="list-style-type: none"> <li>- Livestock</li> <li>- Crops</li> <li>- Human population</li> </ul>	Village	<ul style="list-style-type: none"> <li>- Hunger &amp; poverty</li> <li>- Livestock loss</li> <li>- Crop failure</li> <li>- Shortage of pasture</li> <li>- Shortage of water</li> </ul>	Village	<ul style="list-style-type: none"> <li>- Migration</li> <li>- Sensitization on tree planting</li> <li>- Buy food from elsewhere</li> </ul>	Village			
Hailstorms, strong winds and Lightning	<ul style="list-style-type: none"> <li>- Human and livestock populations</li> <li>- Crops</li> <li>- Infrastructure e.g. houses, schools, health centres</li> </ul>	Parish	<ul style="list-style-type: none"> <li>- Loss of lives</li> <li>- Destruction of crops</li> <li>- Destruction of infrastructure e.g. houses, schools, roads adjacent to flood plain</li> </ul>	Parish		Parish			
Crop Pests and Diseases	<ul style="list-style-type: none"> <li>-Crops</li> </ul>	District	<ul style="list-style-type: none"> <li>- Complete crop failure</li> </ul>	District	<ul style="list-style-type: none"> <li>- Spraying</li> <li>- Cut and bury affected crops</li> <li>-Sensitization on crop disease management</li> </ul>	District			
Livestock Pests and Diseases	<ul style="list-style-type: none"> <li>-Livestock (cattle, goats etc.)</li> </ul>	District	<ul style="list-style-type: none"> <li>- Loss of livestock</li> <li>- Reduced livestock productivity</li> </ul>	District	<ul style="list-style-type: none"> <li>- Vaccination</li> <li>- Bury and burn animals that have died from infection</li> <li>- Quarantine</li> </ul>	District			

Socio-economic component		Human Disease outbreaks	Human Population	District	- Loss of lives - Reduced labour productivity	District	- Mass Immunization - Use of mosquito nets	District
	Invasive species	-indigenous species -Animals	District	- Outcompete the indigenous spp., suppress growth of indigenous spp. - Loss of indigenous spp. - Complete crop Failure - suppress growth of pasture	District	- Cut and burn -Sensitization on Invasive species management	District	
	Bush fires	- Livestock - Crops - Infrastructure e.g. houses, schools	Sub-county	- Loss of livestock - Shortage of pasture - Destruction of crops - Destruction of infrastructure e.g. houses, schools	Sub-county	-Sensitization -bye laws -enforcements	Sub-county	
	Road accidents	- Human population - Infrastructure adjacent to accident black spots e.g. houses, schools etc.	Sub-county	- Loss of lives - Destruction of vehicles - Destruction of infrastructure adjacent to accident black spots e.g. houses, schools etc.	Sub-county	-Humps on roads -Signage on speed limits -Sensitization on traffic rules	Sub-county	
	Land conflicts	- Human population	Village	-Loss of lives -Family violence and break outs	Village	- Community dialogue - District court in charge of land issues	Village	
	Vermin and Wildlife animal attacks	- Human population - Livestock - Crops	Parish	-Loss of lives -Livestock loss -Crop destruction	Parish	- Report to UWA - Guard gardens -Poison -Hunt and kill -Fence water collection points with Wildlife animals	Village	
	Environmental degradation	- Human and livestock populations - Crops - Natural vegetation	Sub-county	-Crop failure -Shortage of pasture -Shortage of water -Decline of water quality	Sub-county	-Sensitization on wetland conservation -Sensitization on tree planting -Setting bi-laws	Sub-county	
	Landslides, Rock falls and Soil erosion	- Human and livestock adjacent to hill slopes - Crops on hill slopes - Infrastructure e.g. houses, schools, roads adjacent to hill slopes	Parish	- Loss of lives - Complete crop failure - Destruction of infrastructure e.g. homes, and schools	Parish	-Migration -Sensitization by both government and non-governmental agencies		



Environmental component	Earth quakes	- Infrastructure e.g. houses, schools	District	- Loss of lives - Destruction of infrastructure e.g. houses, schools	District	-No much measure so far
	Floods	- Livestock adjacent to flood plain - Crops on flood plain - Infrastructure e.g. houses, schools, roads adjacent to flood plain	Parish	- Livestock loss - Destruction of crops e.g. houses, schools, roads adjacent to flood plain	Parish	-Migration -Sensitization on wetland conservation -Dig trenches
	Drought	- Livestock - Crops - Human population	Village	- Hunger & poverty - Livestock loss - Crop failure - Shortage of pasture - Shortage of water	Village	-Migration -Sensitization on tree planting -Buy food from elsewhere
	Hailstorms, strong winds and Lightning	- Human and livestock populations - Crops - Infrastructure e.g. houses, schools, health centres	Parish	- Loss of lives - Destruction of crops e.g. houses, schools, roads adjacent to flood plain	Parish	
	Crop Pests and Diseases	-Crops	District	- Complete crop failure	District	- Spraying - Cut and burry affected crops -Sensitization on crop disease management
	Livestock Pests and Diseases	-Livestock (cattle, goats etc.)	District	- Loss of livestock - Reduced livestock productivity	District	- Vaccination - Burry and burn animals that have died from infection - Quarantine
	Human Disease outbreaks	- Human Population	District	- Loss of lives	District	- Mass Immunization - Use of mosquito nets
	Invasive species	-indigenous species -Animals	District	- Outcompete the indigenous spp., suppress growth of indigenous spp - Loss of indigenous spp. - Complete crop Failure - suppress growth of pasture	District	- Cut and burn -Sensitization on Invasive species management

Bush fires	<ul style="list-style-type: none"> <li>- Livestock</li> <li>- Crops</li> <li>- Infrastructure e.g. houses, schools</li> </ul>	Sub-county	<ul style="list-style-type: none"> <li>- Loss of livestock</li> <li>- Shortage of pasture</li> <li>- Destruction of crops</li> <li>- Destruction of infrastructure e.g. houses, schools</li> </ul>	Sub-county	-Sensitization				
Road accidents	<ul style="list-style-type: none"> <li>- Human population</li> <li>- Infrastructure adjacent to accident black spots e.g. houses, schools etc.</li> </ul>	Sub-county	<ul style="list-style-type: none"> <li>- Loss of lives</li> <li>- Destruction of vehicles</li> <li>- Destruction of Infrastructure adjacent to accident black spots e.g. houses, schools etc.</li> </ul>	Sub-county	<ul style="list-style-type: none"> <li>-Humps on roads</li> <li>-Signage on speed limits</li> <li>-Sensitization on traffic rules</li> </ul>				
Land conflicts	<ul style="list-style-type: none"> <li>- Human population</li> </ul>	Village	<ul style="list-style-type: none"> <li>-Loss of lives</li> <li>-Family violence and break outs</li> </ul>	Village	<ul style="list-style-type: none"> <li>- Community dialogue</li> <li>- District court in charge of land issues</li> </ul>				
Vermin and Wildlife animal attacks	<ul style="list-style-type: none"> <li>- Human population</li> <li>- Livestock</li> <li>- Crops</li> </ul>	Parish	<ul style="list-style-type: none"> <li>-Loss of lives</li> <li>-Livestock loss</li> <li>-Crop destruction</li> </ul>	Parish	<ul style="list-style-type: none"> <li>- Report to UWA</li> <li>- Guard gardens</li> <li>-Poison</li> <li>-Hunt and kill</li> <li>-Fence water collection points with Wildlife animals</li> </ul>				
Environmental degradation	<ul style="list-style-type: none"> <li>- Human and livestock populations</li> <li>- Crops</li> <li>- Natural vegetation</li> </ul>	Sub-county	<ul style="list-style-type: none"> <li>-Crop failure</li> <li>-Shortage of pasture</li> <li>-Shortage of water</li> <li>-Decline of water quality</li> </ul>	Sub-county	<ul style="list-style-type: none"> <li>-Sensitization on wetland conservation</li> <li>-Sensitization on tree planting</li> <li>-Setting bi-laws</li> </ul>				







**Table 4:** Hazard Risk Assessment

Hazard	Lyantonde	Kaliro	Mpumudde	Lyantonde T.C	Kasagama	Kinuuka	Lyakajjula
Floods	H	H	H	M	M	M	H
Drought	H	H	H	M	VH	VH	VH
Landslides, Rock falls and Erosion	L	L	M	L	L	L	L
Strong winds, Hailstorms and Lightning	H	H	M	M	M	H	M
Crop pests and Diseases	H	M	M	L	M	M	M
Livestock pests and Diseases	H	H	H	L	H	H	H
Human disease outbreaks	M	M	M	H	H	H	H
Vermin and Wildlife animal attacks	H	L	M	L	M	M	M
Land conflicts	H	M	M	H	H	M	M
Bush fires	H	H	H	L	H	M	H
Environmental degradation	H	H	M	H	M	M	M
Earthquakes and faults	L	L	L	L	L	L	L
Road accidents	H			M			
Invasive species	H	H	M	L	H	H	H

**Key**

VH	Very High
H	High
M	Medium
L	Low
	Not reported/ Not prone

#### 4.5.1 Gender and Age groups mostly affected by Hazards

**Table 5:** Gender and age groups mostly affected by hazards

Hazard	Gender and Age mostly affected
Drought	Affects mostly women and children since most water wells dry up increasing distance for fetching water
Erosion	All age groups and gender are affected
Hailstorms Lightning	All gender and age groups Children in schools are mostly affected
Crop pests and Diseases	All gender and age groups
Livestock pests and Diseases	African swine fever affects mostly women as most pigs belong to women but overall all groups are equally affected
Human disease outbreaks	Malaria mostly women and children HIV especially prominent in girl child Diarrhea and pneumonia in children
Vermin and Wildlife animal attacks	All gender and age groups
Land conflicts	All gender and age groups
Bush fires	All gender and age groups
Environmental degradation	All gender and age groups
Road accidents	All gender and age groups

### 4.5.2 Coping Strategies

In response to the various hazards, participants identified a range of coping strategies that the community employs to adjust to, and build resilience towards the challenges. The range of coping strategies are broad and interactive often tackling more than one hazard at a time and the focus of the communities leans towards adaptation actions and processes including social and economic frameworks within which livelihood and mitigation strategies take place; ensuring extremes are buffered irrespective of the direction of climate change and better positioning themselves to better face the adverse impacts and associated effects of climate induced and technological hazards (Table 7).

**Table 6:** Coping strategies to the Multi-hazards in Lyantonde District

No	Multi-Hazards	Coping strategies
1	Geomorphological or Geological	Landslides, Rock falls and Erosion <ul style="list-style-type: none"> <li>• Migration to safe areas</li> <li>• Terracing/ contour farming</li> <li>• Plant trees to control water movement on hill slopes</li> <li>• Mulching in banana plantations</li> <li>• Plant grass in banana plantations on hill slopes</li> <li>• Removal of stones from banana farmlands</li> </ul>
2		Earthquakes and faults <ul style="list-style-type: none"> <li>• No action, communities think the tremors are minor</li> <li>• Designs of houses (pillars)</li> <li>• Early warning system</li> <li>• Vigilance</li> <li>• Sensitization</li> <li>• Emergency response mechanisms</li> </ul>
3	Climatological or Meteorological	Floods <ul style="list-style-type: none"> <li>• Digging up of trenches in the flood plains</li> <li>• Planting trees to control water movement to flood plains</li> <li>• Migration to other areas</li> <li>• Seek for government food aid</li> </ul>
4		Drought <ul style="list-style-type: none"> <li>• Leave wetlands as water catchments</li> <li>• Plant trees as climate modifiers</li> <li>• Buy food elsewhere in case of shortage</li> <li>• Buy water from the nearby areas</li> <li>• Food Storage especially dry grains</li> </ul>
5		Strong winds, Hailstorms and Lightning <ul style="list-style-type: none"> <li>• Plant trees as wind breakers</li> <li>• Use of stakes against wind in banana plantations</li> <li>• Use of ropes to tie banana against wind</li> <li>• Installation of Lightning conductors</li> <li>• Stay indoors during rains</li> <li>• Changing building designs and roof types</li> <li>• Removal of destroyed crops</li> <li>• Request for aid from the Office of the Prime Minister</li> <li>• Installation of Lightning conductors on newly constructed schools</li> </ul>
6	Ecological or Biological	Crop pests and Diseases <ul style="list-style-type: none"> <li>• Spraying pests</li> <li>• Cutting and burying BBW affected crops</li> <li>• Burning of affected crops</li> <li>• Vigilance</li> </ul>
7		Livestock pests and Diseases <ul style="list-style-type: none"> <li>• Spraying pests</li> <li>• Vaccinations</li> <li>• Burying animals that have died from infection</li> <li>• Quarantine</li> </ul>

8	Ecological or Biological	Human epidemic Diseases	<ul style="list-style-type: none"> <li>• Mass immunisation</li> <li>• Visiting health centres</li> <li>• Use of mosquito nets</li> </ul>
9		Vermin and Wild-life animal attacks	<ul style="list-style-type: none"> <li>• Guarding the gardens</li> <li>• Poisoning</li> <li>• Hunt and kill</li> <li>• Report to UWA</li> <li>• Mauritius thorns</li> <li>• Dig trenches</li> <li>• Chain link</li> <li>• Plant red pepper as buffer</li> <li>• Recommend vermin guards</li> </ul>
10		Invasive species	<ul style="list-style-type: none"> <li>• Uproot</li> <li>• Spray with herbicides (e.g 2-4-D)</li> <li>• Biological control (e.g beetles)</li> <li>• Cut and burn</li> <li>• Sensitization on Invasive species management</li> <li>• Blacklisting exotic species</li> </ul>
11	Human induced or technological	Land conflicts	<ul style="list-style-type: none"> <li>• Community dialogues</li> <li>• Report to court</li> <li>• Migration</li> <li>• Resettlement</li> <li>• Surveying and titling</li> <li>• Strengthen Land management structures</li> <li>• Sensitization on land ownership</li> <li>• Proper demarcation (live fencing)</li> </ul>
12		Bush fires	<ul style="list-style-type: none"> <li>• Stop the fires in case of fire outbreak</li> <li>• Fire lines (may be constructed, cleared grass)</li> <li>• Fire breaks planted along gardens e.g. euphorbia spp.</li> <li>• Vigilance especially in dry seasons where most burning is done</li> <li>• Bye-laws</li> <li>• Sensitization on dangers of fires</li> </ul>
13		Road accidents	<ul style="list-style-type: none"> <li>• Construction of humps</li> <li>• Road Signage including speed limits</li> <li>• Separate lanes on sharp corners</li> <li>• Sensitisation</li> <li>• Widen narrow roads</li> <li>• Plant trees on road reserve, as road guards</li> <li>• Deployment of Traffic officers</li> </ul>
14		Environmental degradation	<ul style="list-style-type: none"> <li>• Leave wetlands as water catchments</li> <li>• Plant appropriate tree species as climate modifiers</li> <li>• Sensitization</li> <li>• Bye-laws</li> <li>• Enforcement</li> <li>• Gazette and demarcate wetlands</li> <li>• Restore wetlands and other fragile ecosystems</li> <li>• EIA for new developments</li> <li>• No land titles for wetland areas</li> <li>• Cancellation of existing wetland land titles</li> <li>• Developing land use plans and enforce them</li> </ul>

## GENERAL CONCLUSIONS AND RECOMMENDATIONS

### 5.1 Conclusions

The multi-hazard vulnerability profile output from this assessment was a combination of spatial modeling using socio-ecological spatial layers (i.e. DEM, Slope, Aspect, Flow Accumulation, Land use, vegetation cover, hydrology, soil types and soil moisture content, population, socio-economic, health facilities, accessibility, and meteorological data) and information captured from District Key Informant interviews and sub-county FGDs using a participatory approach. The level of vulnerability was assessed at sub-county participatory engagements and integrated with the spatial modeling in the GIS environment.

Results from the participatory assessment indicated that Lyantonde district has over the past two decades increasingly experienced hazards including rock falls, soil erosion, floods, drought, hailstorms, strong winds, Lightning , crop pests and diseases, livestock pests and diseases, human disease outbreaks, vermin, wildlife animal attacks, invasive species, bush fires and land conflicts putting livelihoods at increased risk. Generally drought and flooding were identified as most serious problem in Lyantonde district with almost all sub-counties being vulnerable to the hazards. The limited adaptive capacity (and or/resilience) and high sensitivity of households and communities in Lyantonde district increase their vulnerability to hazard exposure necessitating urgent external support.

Hazards experienced in Lyantonde district can be classified as:

- i. Geomorphological or Geological hazards including; landslides, rock falls, soil erosion and earth quakes.
- ii. Climatological or Meteorological hazards including; floods, drought, hailstorms, strong winds and Lightning .
- iii. Ecological or Biological hazards including; crop pests and diseases, livestock pests and diseases, human disease outbreaks, vermin and wildlife animal attacks and invasive species.
- iv. Human induced or Technological hazards including bush fires, road accidents 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.

### 5.2 Policy-related Recommendations

The following recommended policy actions targeting vulnerability reduction include:

- i. The government should improve enforcement of policies aimed at enhancing sustainable environmental health.
- ii. The government through MAAIF should review the animal diseases control act because of low

penalties given to defaulters.

- iii. The government should establish systems to motivate support of political leaders toward government initiatives and programmes aimed at disaster risk reduction.
- iv. The government should increase awareness campaigns aimed at sensitizing farmers/communities on disaster risk reduction initiatives and practices.
- v. The government should revive disaster committees at district level and ensure funding of disaster and environmental related activities.
- vi. The government through UNRA and the District authority should fund periodic maintenance of feeder roads to reduce on traffic accidents.
- vii. The government through MAAIF and the District Production Office should promote drought and disease resistant crop seeds.
- viii. The government through OPM and Meteorology Authority should increase importation of Lightning conductors and also reduce taxes on their importation.
- ix. The government through OPM and Meteorology Authority should support establishment of disaster early warning systems.
- x. The government through MWE increase funding and staff to monitor wetland degradation and non-genuine agro-inputs.
- xi. The government through OPM should improve communication between the disaster department and local communities.
- xii. The government through MWE should promote Tree planting along road reserves.
- xiii. The government through MAAIF should fund and recruit extension works at sub-county level.

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## APPENDIX I: DATA COLLECTION TOOLS



*Key informant interview at Lyantonde District Headquarters*

## FOCUS GROUP DISCUSSION GUIDE FOR DISTRICT DISASTER RISK MANAGEMENT FOCAL PERSONS

Interviewer Team Name(s)	District:	GPS Coordinates	
	Sub- county:	X:	
	Parish:	Y:	
	Village:	Altitude	

No.	Name of Participants	Designation	Contact	Signature

### Introduction

- i. You have all been requested to this session because we are interested in learning from you. We appreciate your rich experiences and hope to use them to strengthen service delivery across the district and the country as whole in a bid to improve access to information on Hazards and early warning.
- ii. There is no “right” or “wrong” answers to any of the questions. As a Focus Group Discussion leader, I will try to ask all people here today to take turns speaking. If you have already spoken several times, I may call upon someone who has not said as much. I will also ask people to share their remarks with the group and not just with the person beside them, as we anxious to hear what you have to say.
- iii. This session will be tape recorded so we can keep track of what is said, write it up later for our report. We are not attaching names to what you have to what is said, so whatever you say here will be anonymous and we will not quote you by name.
- iv. I would not like to keep you here long; at most we should be here for 30 minutes- 1 hour.

### Section A: Geomorphological or Geological Hazards (Landslides, rock falls, soil erosion and earth quakes)

1. Which crops are majorly grown in your area of jurisdiction?
2. Which domestic animals are dominant in your area of jurisdiction?
3. What challenges are faced by farmers in your area of jurisdiction?
4. Have you experienced landslides and rock falls in the past 10 years in your area of jurisdiction?
5. Which villages, parishes or sub-counties have been most affected by landslide and rock falls?

6. As a way of ranking from Low, Medium, High and Very high, rank the villages, parishes or sub-counties that have been most affected?
7. Which crops are majorly affected by landslides and rock falls in your area of jurisdiction?
8. In which way are the crops affected by landslides and rock falls?
9. Which domestic animals are majorly affected by landslides and rock falls in your area of jurisdiction?
10. In which way are the domestic animals affected by landslides and rock falls?
11. Which agricultural practices are being adopted by farmers in a bid to mitigate the above challenges?
12. What are the relevant government's interventions focusing at helping farmers mitigate the challenges mentioned?
13. Do you have any earth faults or earth cracks as lines of weakness in your area of jurisdiction?
14. Have you experienced any earth quakes in the past 10 years in your area of jurisdiction?
15. Which particular villages, parishes or sub-counties have been majorly affected by earth quakes in your area of jurisdiction?
16. As a way of ranking from Low, Medium, High and Very high, rank the villages, parishes or sub-counties that have been most affected?
17. What impacts have been caused by earth quakes?
18. To what extent have the earth quakes affected livelihoods of the local communities in your area of jurisdiction?
19. Which mitigation measures have been adopted local communities in a bid to mitigate the above challenges?
20. What are the relevant government's interventions focusing at helping local communities mitigate the challenges mentioned?

**Section B:** Meteorological or climatological hazards (Floods, Droughts, Lightning , strong winds, hailstorms)

21. Have you experienced floods in the past 10 years in your area of jurisdiction?
22. Which villages, parishes or sub-counties have been most affected by floods?
23. As a way of ranking from Low, Medium, High and Very high, rank the villages, parishes or sub-counties that have been most affected?

24. Which crops are majorly affected by floods in your area of jurisdiction?
25. In which way are the crops affected by floods?
26. Which domestic animals are majorly affected by floods in your area of jurisdiction?
27. In which way are the domestic animals affected by floods?
28. Which agricultural practices are being adopted by farmers in a bid to mitigate the above challenges?
29. What are the relevant government's interventions focusing at helping farmers mitigate the challenges mentioned?
30. Have you experienced drought in the past 10 years in your area of jurisdiction?
31. Which villages, parishes or sub-counties have been most affected by drought?
32. As a way of ranking from Low, Medium, High and Very high, rank the villages, parishes or sub-counties that have been most affected?
33. Which crops are majorly affected by drought in your area of jurisdiction?
34. In which way are crops affected by drought?
35. Which domestic animals are majorly affected by drought in your area of jurisdiction?
36. In which way are the domestic animals affected by drought?
37. Which agricultural practices are being adopted by farmers in a bid to mitigate the above challenges?
38. What are the relevant government's interventions focusing at helping farmers mitigate the challenges mentioned?
39. Have you experienced hailstorms or Lightning in the past 10 years in your area of jurisdiction?
40. Which villages, parishes or sub-counties have been most affected by hailstorms or Lightning ?
41. As a way of ranking from Low, Medium, High and Very high, rank the villages, parishes or sub-counties that have been most affected?
42. What impacts have been caused by hailstorms or Lightning ?
43. To what extent have the hailstorms or Lightning affected livelihoods of the local communities in your area of jurisdiction?
44. Which mitigation measures have been adopted local communities in a bid to mitigate the above challenges?

45. What are the relevant government's interventions focusing at helping local communities mitigate the challenges mentioned?

**Section C:** Biological hazards (Crop pests and diseases, Livestock pests and Diseases, Invasive species, vermin and wild-life animal attacks)

46. Have you experienced any epidemic animal disease outbreaks in the past 10 years in your area of jurisdiction?

47. Which villages, parishes or sub-counties have been most affected by epidemic animal disease outbreaks?

48. As a way of ranking from Low, Medium, High and Very high, rank the villages, parishes or sub-counties that have been most affected?

49. Specify the epidemic animal disease outbreaks that have majorly affected animals in your area of jurisdiction?

50. Which domestic animals are majorly affected by epidemic animal disease outbreaks in your area of jurisdiction?

51. In which way are the domestic animals affected by epidemic animal disease outbreaks?

52. Which mitigation practices are being adopted by farmers in a bid to mitigate the above epidemic animal disease outbreaks?

53. What are the relevant government's interventions focusing at helping farmers mitigate the epidemic animal disease outbreaks mentioned?

54. Have you experienced any crop pests and disease outbreaks in the past 10 years in your area of jurisdiction?

55. Which villages, parishes or sub-counties have been most affected by epidemic animal disease outbreaks?

56. As a way of ranking from Low, Medium, High and Very high, rank the villages, parishes or sub-counties that have been most affected?

57. Specify the crop pests and disease outbreaks that have majorly affected animals in your area of jurisdiction?

58. Which crops are majorly affected by crop pests and disease outbreaks in your area of jurisdiction?

59. In which way are the crops affected by crop pests and disease outbreaks?

60. Which mitigation practices are being adopted by farmers in a bid to mitigate the above crop pests and disease outbreaks?

61. What are the relevant government's interventions focusing at helping farmers mitigate the crop pests and disease outbreaks mentioned?

62. Have you experienced any epidemic human disease outbreaks in the past 10 years in your area of jurisdiction?
63. Specify the epidemic human disease outbreaks that have majorly affected animals in your area of jurisdiction?
64. In which way are the humans affected by epidemic human disease outbreaks?
65. Which mitigation measures have been adopted by local communities in a bid to mitigate the above epidemic human disease outbreaks?
66. What are the relevant government's interventions focusing at helping local communities mitigate the epidemic human disease outbreaks mentioned?
67. Do you have any national park or wildlife reserve in your area of jurisdiction?
68. Have you experienced wildlife attacks in the past 10 years in your area of jurisdiction?
69. Which particular villages, parishes or sub-counties have been majorly affected by wildlife attacks in your area of jurisdiction?
70. As a way of ranking from Low, Medium, High and Very high, rank the villages, parishes or sub-counties that have been most affected?
71. What impacts have been caused by wildlife attacks?
72. To what extent have the wildlife attacks affected livelihoods of the local communities in your area of jurisdiction?
73. Which mitigation measures have been adopted local communities in a bid to mitigate the above challenges?
74. What are the relevant government's interventions focusing at helping local communities mitigate the challenges mentioned?
75. Are there invasive species in your area of jurisdiction?
76. Specify the invasive species in your area of jurisdiction?
77. Which villages, parishes or sub-counties have been most affected by invasive species in your area of jurisdiction?
78. As a way of ranking from Low, Medium, High and Very high, rank the villages, parishes or sub-counties that have been most affected?
79. Which crops or animals are majorly affected by invasive species in your area of jurisdiction?
80. In which way are the crops or animals affected by invasive species?

81. Which mitigation practices are being adopted by farmers in a bid to mitigate the above invasive species?

82. What are the relevant government's interventions focusing at helping farmers mitigate the invasive species mentioned?

**Section D:** Human induced or Technological hazards (Land conflicts, bush and forest fires, road accidents, water accidents and environmental degradation)

83. Have you experienced environmental degradation in your area of jurisdiction?

84. What forms of environmental degradation have been experienced in your area of jurisdiction?

85. Which villages, parishes or sub-counties have been most affected by environmental degradation?

86. As a way of ranking from Low, Medium, High and Very high, rank the villages, parishes or sub-counties that have been most affected?

87. What impacts have been caused by environmental degradation?

88. Which measures have been adopted by local communities in a bid to mitigate the above challenges?

89. What are the relevant government's interventions focusing at helping local communities mitigate the challenges mentioned?

90. Have you experienced land conflicts in the past 10 years in your area of jurisdiction?

91. Which particular villages, parishes or sub-counties have been majorly affected by land conflicts in your area of jurisdiction?

92. As a way of ranking from Low, Medium, High and Very high, rank the villages, parishes or sub-counties that have been most affected?

93. What impacts have been caused by land conflicts?

94. To what extent have the land conflicts affected livelihoods of the local communities in your area of jurisdiction?

95. Which conflict resolution measures have been adopted local communities in a bid to mitigate the above challenges?

96. What are the relevant government's interventions focusing at helping local communities mitigate the challenges mentioned?

97. Have you experienced Road accidents in the past 20 years in your area of jurisdiction?

98. Which roads have experienced Road accidents?

- 99.** What impacts have been caused by Road accidents?
- 100.** To what extent have the Road accidents affected livelihoods of the local communities in your area of jurisdiction?
- 101.** Which conflict resolution measures have been adopted local communities in a bid to mitigate the above challenges?
- 102.** What are the relevant government's interventions focusing at helping local communities mitigate the challenges mentioned?
- 103.** Have you experienced any serious bush and or forest fires in the past 10 years in your area of jurisdiction?
- 104.** Which particular villages, parishes or sub-counties have been majorly affected by bush and or forest fires in your area of jurisdiction?
- 105.** As a way of ranking from Low, Medium, High and Very high, rank the villages, parishes or sub-counties that have been most affected?
- 106.** What impacts have been caused by serious bush and or forest fires?
- 107.** To what extent have the serious bush and or forest fires affected livelihoods of the local communities in your area of jurisdiction?
- 108.** Which mitigation measures have been adopted local communities in a bid to mitigate the above challenges?
- 109.** What are the relevant government's interventions focusing at helping local communities mitigate the challenges mentioned?



## FOCUS GROUP DISCUSSION GUIDE FOR LOCAL COMMUNITIES

Interviewer Team Name(s)	District:	GPS Coordinates	
	Sub- county:	X:	
	Parish:	Y:	
	Village:	Altitude	

No.	Name of Participants	Village/ Parish	Contact	Signature

### Introduction

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- viii. I would not like to keep you here long; at most we should be here for 30 minutes- 1 hour.

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1. Which crops are majorly grown in your community?
2. Which domestic animals are dominant in your community?
3. What challenges are faced by farmers in your community?
4. Have you experienced landslides and rock falls in the past 10 years in your community?
5. Which villages and parishes have been most affected by landslide and rock falls?
6. As a way of ranking from Low, Medium, High and Very high, rank the villages and parishes that have been most affected?

7. Which crops are majorly affected by landslides and rock falls in your community?
8. In which way are the crops affected by landslides and rock falls?
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10. In which way are the domestic animals affected by landslides and rock falls?
11. Which agricultural practices are being adopted by farmers in a bid to mitigate the above challenges?
12. What are the relevant government's interventions focusing at helping farmers mitigate the challenges mentioned?
13. Do you have any earth faults or earth cracks as lines of weakness in your community?
14. Have you experienced any earth quakes in the past 10 years in your community?
15. Which particular villages, parishes or sub-counties have been majorly affected by earth quakes in your community?
16. As a way of ranking from Low, Medium, High and Very high, rank the villages, parishes that have been most affected?
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18. To what extent have the earth quakes affected livelihoods of the local communities in your community?
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23. As a way of ranking from Low, Medium, High and Very high, rank the villages and parishes that have been most affected?
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38. What are the relevant government's interventions focusing at helping farmers mitigate the challenges mentioned?
39. Have you experienced hailstorms or Lightning in the past 10 years in your community?
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42. What impacts have been caused by hailstorms or Lightning ?
43. To what extent have the hailstorms or Lightning affected livelihoods of the local communities in your community?
44. Which mitigation measures have been adopted local communities in a bid to mitigate the above challenges?
45. What are the relevant government's interventions focusing at helping local communities mitigate the challenges mentioned?

**Section C:** Biological hazards (Crop pests and diseases, Livestock pests and Diseases, Invasive species, vermin and wild-life animal attacks)

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50. Which domestic animals are majorly affected by epidemic animal disease outbreaks in your community?
51. In which way are the domestic animals affected by epidemic animal disease outbreaks?
52. Which mitigation practices are being adopted by farmers in a bid to mitigate the above epidemic animal disease outbreaks?
53. What are the relevant government's interventions focusing at helping farmers mitigate the epidemic animal disease outbreaks mentioned?
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61. What are the relevant government's interventions focusing at helping farmers mitigate the crop pests and disease outbreaks mentioned?
62. Have you experienced any epidemic human disease outbreaks in the past 10 years in your community?
63. Specify the epidemic human disease outbreaks that have majorly affected animals in your community?

64. In which way are the humans affected by epidemic human disease outbreaks?
65. Which mitigation measures have been adopted by local communities in a bid to mitigate the above epidemic human disease outbreaks?
66. What are the relevant government's interventions focusing at helping local communities mitigate the epidemic human disease outbreaks mentioned?
67. Do you have any national park or wildlife reserve in your area of jurisdiction?
68. Have you experienced wildlife attacks in the past 10 years in your community?
69. Which particular villages and parishes have been majorly affected by wildlife attacks in your community?
70. As a way of ranking from Low, Medium, High and Very high, rank the villages and parishes that have been most affected?
71. What impacts have been caused by wildlife attacks?
72. To what extent have the wildlife attacks affected livelihoods of the local communities in your community?
73. Which mitigation measures have been adopted local communities in a bid to mitigate the above challenges?
74. What are the relevant government's interventions focusing at helping local communities mitigate the challenges mentioned?
75. Are there invasive species in your community?
76. Specify the invasive species in your community?
77. Which villages and parishes have been most affected by invasive species in your community?
78. As a way of ranking from Low, Medium, High and Very high, rank the villages and parishes that have been most affected?
79. Which crops or animals are majorly affected by invasive species in your community?
80. In which way are the crops or animals affected by invasive species?
81. Which mitigation practices are being adopted by farmers in a bid to mitigate the above invasive species?
82. What are the relevant government's interventions focusing at helping farmers mitigate the invasive species mentioned?

**Section D:** Human induced or Technological hazards (Land conflicts, bush and forest fires, road accidents, water accidents and environmental degradation)

83. Have you experienced environmental degradation in your community?
84. What forms of environmental degradation have been experienced in your community?
85. Which villages and parishes have been most affected by environmental degradation?
86. As a way of ranking from Low, Medium, High and Very high, rank the villages and parishes that have been most affected?
87. What impacts have been caused by environmental degradation?
88. Which measures have been adopted by local communities in a bid to mitigate the above challenges?
89. What are the relevant government's interventions focusing at helping local communities mitigate the challenges mentioned?
90. Have you experienced land conflicts in the past 10 years in your community?
91. Which particular villages and parishes have been majorly affected by land conflicts in your community?
92. As a way of ranking from Low, Medium, High and Very high, rank the villages and parishes that have been most affected?
93. What impacts have been caused by land conflicts?
94. To what extent have the land conflicts affected livelihoods of the local communities in your community?
95. Which conflict resolution measures have been adopted local communities in a bid to mitigate the above challenges?
96. What are the relevant government's interventions focusing at helping local communities mitigate the challenges mentioned?
97. Have you experienced Road accidents in the past 20 years in your community?
98. Which roads have experienced Road accidents?
99. What impacts have been caused by Road accidents?
100. To what extent have the Road accidents affected livelihoods of the local communities in your community?
101. Which conflict resolution measures have been adopted local communities in a bid to mitigate the above challenges?

- 102.** What are the relevant government's interventions focusing at helping local communities mitigate the challenges mentioned?
- 103.** Have you experienced any serious bush and or forest fires in the past 10 years in your community?
- 104.** As a way of ranking from Low, Medium, High and Very high, rank the villages, parishes or sub-counties that have been most affected?
- 105.** What impacts have been caused by serious bush and or forest fires?
- 106.** To what extent have the serious bush and or forest fires affected livelihoods of the local communities in your community?
- 107.** Which mitigation measures have been adopted local communities in a bid to mitigate the above challenges?
- 108.** What are the relevant government's interventions focusing at helping local communities mitigate the challenges mentioned?

## FOCUS GROUP ATTENDANCE LIST FOR DISTRICT DISASTER RISK MANAGEMENT FOCAL PERSONS

<b>Name of Participant</b>	<b>Designation</b>	<b>Contact</b>
1. Yiga Martin Paul	Assistant Chief Administrative Officer	0772463777
2. Kanya Simon	Acting Natural Resources Officer	0782845087
3. Sekawojwa Edward	Acting District Production Officer	0772617124
4. Rwensheshe Herbert	Vice Chairperson LC V	0772555793

## FOCUS GROUP DISCUSSION ATTENDANCE LIST FOR LOCAL COMMUNITIES

<b>Name of Participant</b>	<b>Village/Parish</b>	<b>Contact</b>
1. Nikurungi Molly	Kaliiro	0782700529
2. Asiimwe Sulait	Kyakuterekera	0772894848
3. Ssekamatte John Mary	Lyantonde rural	0776810179
4. Lumala Alex	Lyakajjula	0704915332
5. Kayinda Sylvia	Lyakajjula	0753674469



## SPATIAL DATA COLLECTION SHEET FOR HAZARD VULNERABILITY AND RISK MAPPING

Observer Name:  Date:	District:	Coordinates				
	Sub- county:	X:				
	Parish:	Y:				
	Village:	Altitude				
<b>Slope characterization</b>		<b>Bio-physical characterization</b>		<b>Vegetation characterization</b>		<b>Land use type (tick)</b> Bush Grassland Wetland Tree plantation Natural forest Cropland Built-up area Grazing land Others
Slope degree (e.g 10, 20, ...)		Soil Texture		Veg. cover (%)		
Slope length (m) (e.g 5, 10, ...)		Soil Moisture		Tree cover (%)		
Aspect (e.g N, NE...)		Rainfall		Shrubs cover (%)		
Elevation (e.g high, low...)		Drainage		Grass / Herbs cover (%)		
Slope curvature (e.g concave, covex...)		Temperature		Bare land cover		
<b>Area Description (Susceptibility ranking: landslide, mudslide, erosion, flooding, drought, hailstorms, Lightning , cattle disease outbreaks, human disease outbreaks, land conflicts, wildlife conflicts, bush fires, earthquakes, faults/ cracks, pictures, any other sensitive features)</b>						



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