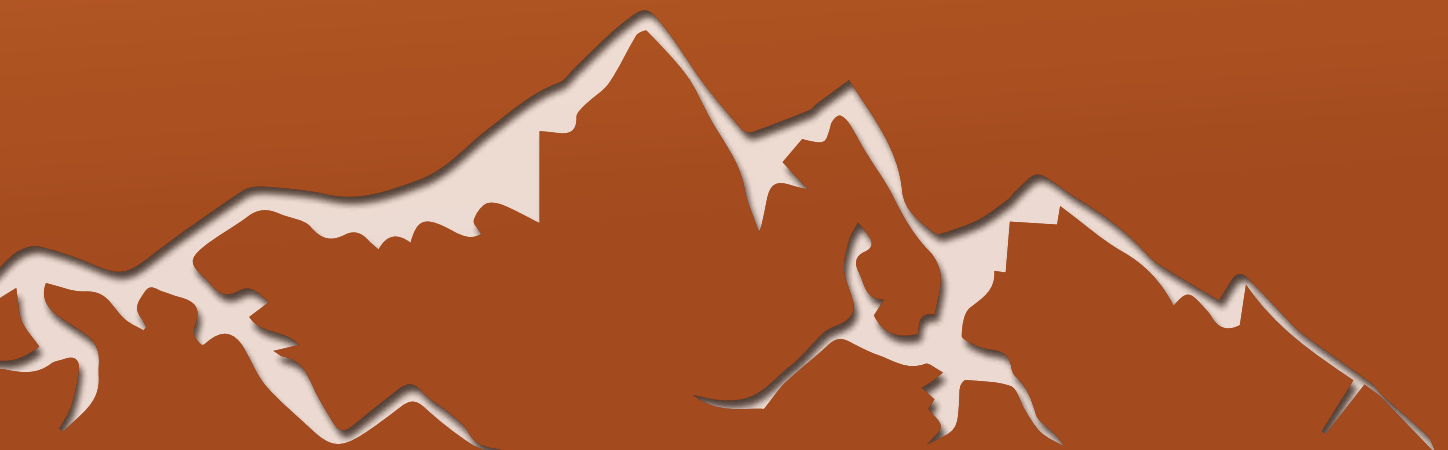




THE REPUBLIC OF UGANDA

# **District Multi-hazard, Risk and Vulnerability Profile for Rubirizi District**





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3. Mbarara District: Mr. Tumwesigye Robert Ag. District Agriculture Officer, Mr. Katungye Francis – District Probation Officer, Mr. Lubega Kazooba – Senior Health Educator.
4. Rubirizi District: Mr. Murungi Ritah – Ag. District Natural Resources Officer, Yeyambe Steven – Forest Ranger, Mr. Tinkamanyire Jonan – Physical Planner, Mr. Tumushabe Nelson – Lands Officer, Mr. Kabandize Nicholas – Student on Intern (Natural Resources Department).
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Hon. Hilary O. Onek

Minister for Relief, Disaster Preparedness and Management

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## List of Acronyms

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
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
UTM	Universal Transverse Mercator
WGS	World Geodetic System

## Definition of Key Concepts

**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).

## **EXECUTIVE SUMMARY**

The multi-hazard vulnerability profile outputs from this assessment for the five districts (Isingiro, Kamwenge, Mbarara, Rubirizi and Sheema) was a combination of spatial modeling using socio-ecological spatial layers, socio-economic, and meteorological data etc.) 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 GIS environment (ArcGIS 10.1).

### **Stakeholder engagements**

Stake holder 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, to floods, landslides, human and animal disease, pests, animal attacks, earthquakes, fires, conflicts etc. Hazard, risk and vulnerability assessment was done using a stack of methods including participatory approaches such as Participatory GIS (PGIS), Focus Group Discussions (FGDs), key informant interviews, transect drives as well as spatial and non-spatial modelling. Key informant interviews and Focus Group Discussions were guided by a checklist (Appendix 1 and 2). Key Informant Interviews for District officers included: Districts Natural Resources Officers, Environment Officers, Wetland Officers, Forest Officers, Production and Marketing Officers, Veterinary Officers, Health Inspectors. At sub-county level Key informants for this assessment included: Sub-county and parish chiefs, community Development mobilizers and health workers.

### **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**

Ground-truthing and geo-referencing was done 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 were classified using a participatory approach on a scale of "not reported/ not prone", "low", "medium" and "high", consistent with the methodology specified in Annex 3.

### **Data analysis and integration in GIS**

Data analysis and spatial modeling 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**

In collaboration with OPM, a five days regional data verification and validation workshop was organized by 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 the districts were classified as:**

- Geomorphological or Geological hazards including landslides, rock falls, soil erosion and earth quakes.
- Climatological or Meteorological hazards including floods, drought, hailstorms, strong winds and lightening
- 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 land conflicts.

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

The limited adaptive capacity (and or/resilience) and high sensitivity of households and communities in the districts increase their vulnerability to hazard exposure necessitating urgent external support. To counteract 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, 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 recommended policy actions targeting vulnerability reduction include:**

- Improved enforcement of policies aimed at enhancing sustainable environmental health.
- Quickly review the animal diseases control act because of low penalties given to defaulters.

- Establishment of systems to motivate support of political leaders toward government initiatives and programmes aimed at disaster risk reduction.
- Increased awareness campaigns aimed at sensitizing farmers/communities on disaster risk reduction initiatives and practices.
- Revival of disaster committees at the district levels
- Periodic maintenance of feeder roads to reduce on traffic accidents
- Relocation of communities in the affected areas in the district by government
- Promotion of drought and disease resistant crop seeds
- Increase funding in the disaster and environmental departments
- Removal taxes on the importation of lightening conductors
- Support establishment of disaster early warning systems
- Increase funding and staff to monitor wetland degradation and non-genuine agro-inputs
- Improve the communication channel between the disaster department and local Communities
- Office of the prime minister should decentralize their activities at the district level
- Tree planting along road reserves
- Fund and equip recruited extension works
- Government should allocate funds aimed at disaster preparedness and management at district levels
- Removal of taxes on the importation of lightening conductors
- Support establishment of a disaster risk early warning systems

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background

Uganda has over the past years experienced frequent disasters that range from drought, to floods, landslides, human and animal disease, 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 proactive engagement of the whole spectrum of stakeholders in disaster risk reduction, are becoming critical.

The Government of Uganda is moving the disaster management paradigm from the traditional emergency response focus toward one of prevention and preparedness. Contributing to the evidence base for 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 encourage mainstreaming of disaster and climate risk management in development planning and contingency planning at national and local levels.

From 2013 UNDP has been supporting the Office of the Prime Minister to develop district hazard risk and vulnerability profiles in the sub-regions of Rwenzori, Karamoja, Teso, Lango, Acholi and West Nile covering 42 districts. During the exercise above, local government officials and community members actively participated in the 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 inception report details methodological approach for HRV profiling and mapping for 5 districts in Western Uganda in response to a call by UNDP to engage an Individual Consultant to facilitate the process. The districts under consideration include Isingiro, Kamwenge, Mbarara, Rubirizi and Sheema.

### 1.2 Objectives of the study

The following main and specific objectives of the study are indicted:

#### 1.2.1 Main objective

The main objective of the study is to develop District Hazard, Risk and Vulnerability Profiles for Isingiro, Kamwenge, Mbarara, Rubirizi and Sheema Districts in Western Uganda (Figure 1).

### 1.2.3 Specific Objectives

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

- i. Collect and analyse field data generated using GIS in close collaboration and coordination with OPM in Isingiro, Kamwenge, Mbarara, Rubirizi and Sheema districts.
- ii. Develop district specific multi hazard risk and Vulnerability profiles 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 and Deliverables

The consultant understands that UNDP through the Project “Strengthening Capacities for DRM and Resilience Building” will contract the following work:

- i. Collection of field data using GIS in close collaboration and coordination with OPM Isingiro, Kamwenge, Mbarara, Rubirizi and Sheema districts and quantify them through a participatory approach on a scale of “not reported”, “low”, “medium” and “high”, consistent with the methodology specified in Annex 3.
- 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 multiple 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 and maps and developing a database for all the GIS data for all the districts visited 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 semiarid 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.”

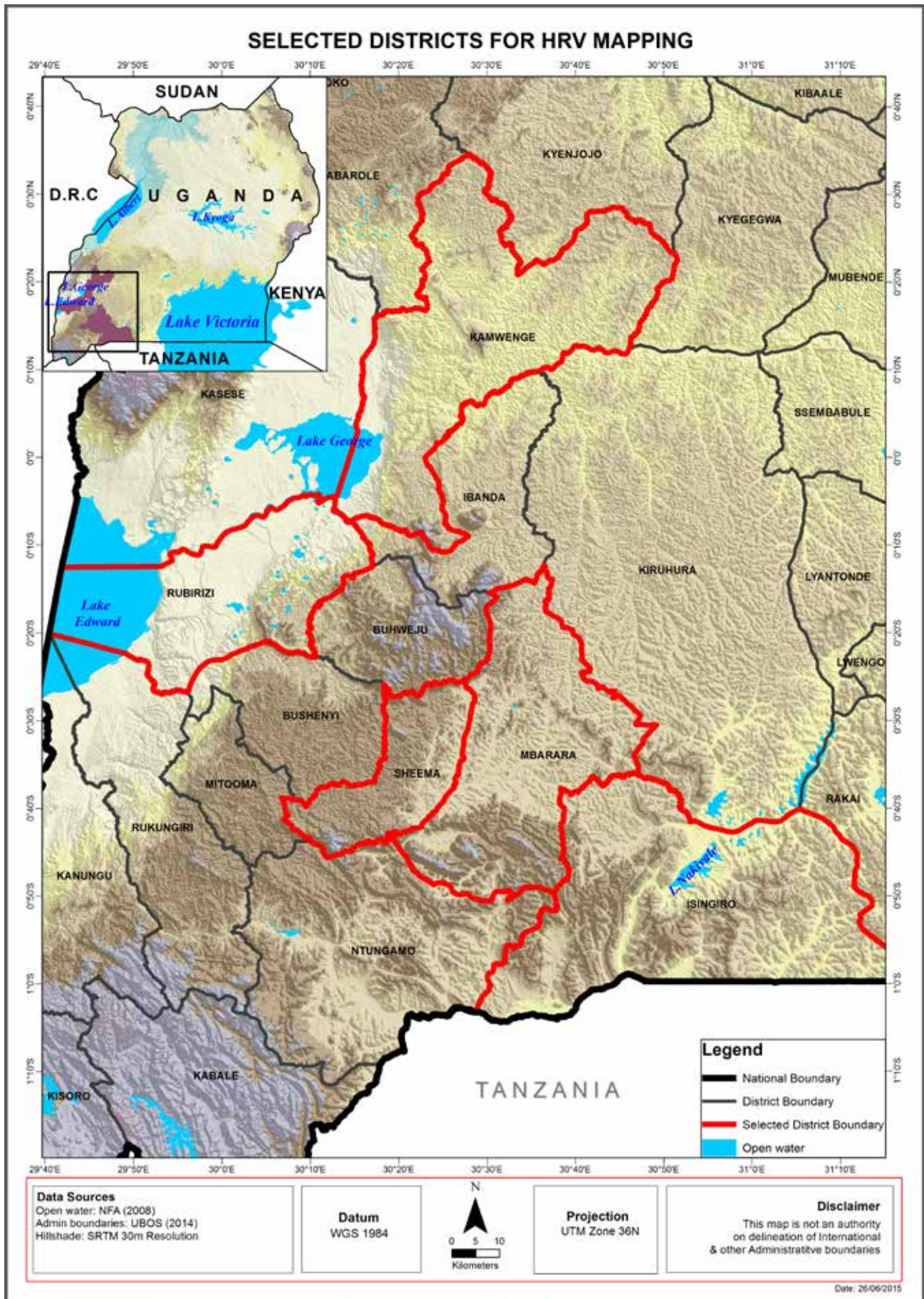


Figure 1: Location of Study Area



## **1.5 Structure of the Report**

This Report is organized into Two Chapters: Chapter 1 provides Introduction on the assignment. Chapter 2 describes the Multi-hazard, Risks and Vulnerability profiles of Rubirizi district.

# CHAPTER TWO

## RUBIRIZI DISTRICT MULTI-HAZARD, RISKS AND VULNERABILITY PROFILE

### 2.1 Overview of Rubirizi District

Rubirizi District is located (UTM 177167; 9970487) in South Western Uganda. Rubirizi District is bordered by Kasese to the north, Kamwenge to the northeast, Ibanda to the east, Buhweju to the southeast, Bushenyi to the south, Rukungiri to the southwest and the Democratic Republic of Congo to the west (Figure 2). Rubirizi District was originally Bunyaruguru County of greater Bushenyi District. It has 8 sub-counties and 2 town councils. The sub-counties include: Katunguru, Kichwamba, Ryeru, Magambo, Rutoto, Katerera, Katanda, Kyabakara and Kirugu. The town councils include: Rubirizi and Katerera.

#### 2.1.1 Geomorphology

Rubirizi District lies between altitude of 900m-1860 m.a.s.l. Areas south east of the district around Rutoto, Ryeru and Katanda sub-counties have the highest altitudes between 1555m – 1860m towards the district border with Bushenyi and also with Buhweju districts. High areas towards the western direction of the district form the great East African rift valley escarpment in Kichwamba and Kirugu sub-counties and some part of Katerera sub-county. The low altitudes are along the great East African rift valley which forms the western part of the district in Katunguru sub-counties bordering with Kazinga channel and Lake Edward, the lowest spot located in Lake Edward (Figure 2)

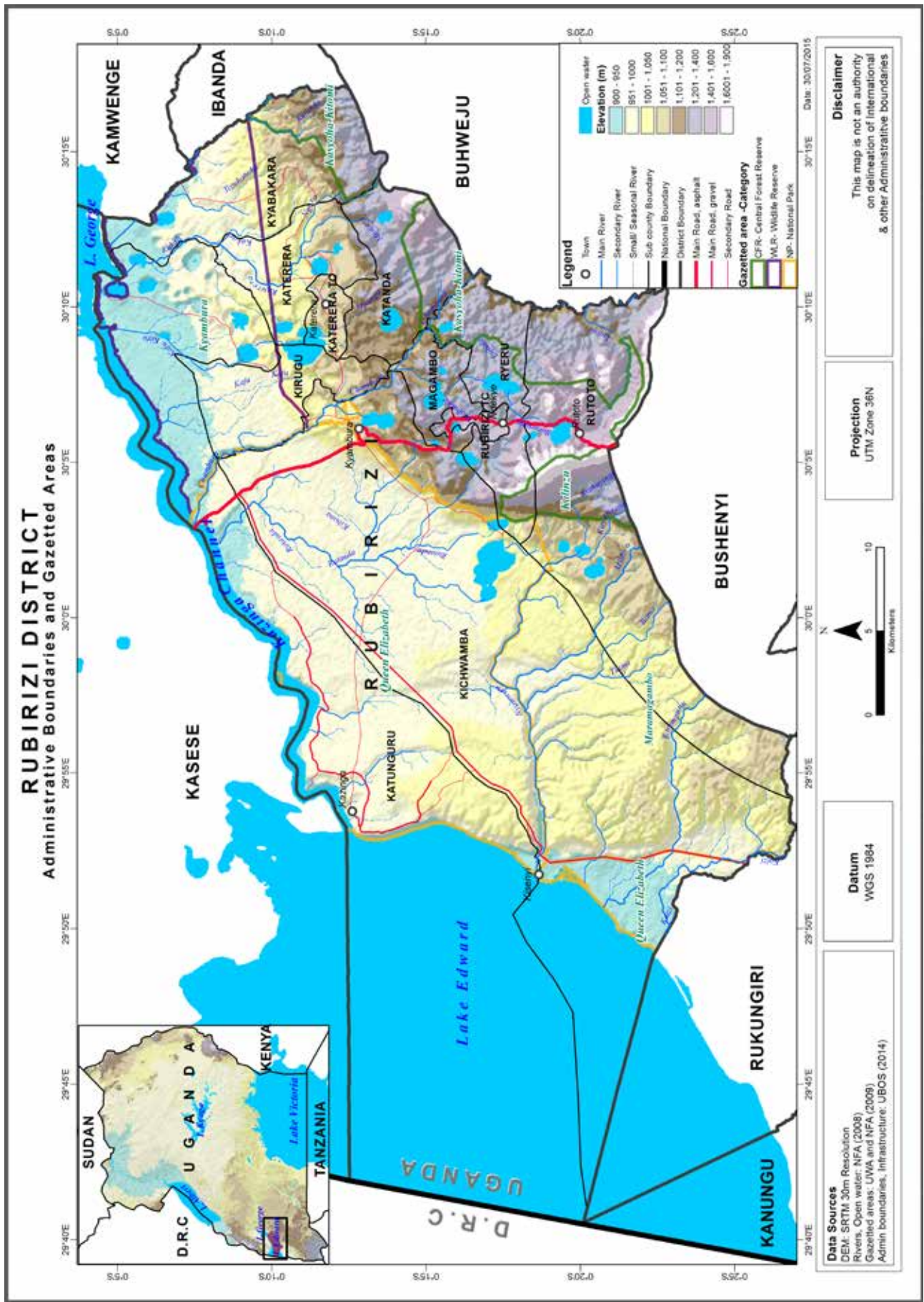


Figure 2: Administrative Units and Geomorphology, Rubirizi District

### **2.1.2 Geology**

From the geological mapping undertaken by the Geological Surveys and mines (2012), indicate that biggest area of the district is predominantly High-K volcanics with carbonatite lava associated with volcanic activities that could have occurred in the region. The great East African rift valley has the biggest High-K volcanics with carbonatite lava in the sub-counties Katunguru, Katerera, Kirugu, Katanda, Magambo, Rubirizi Town council, Ryeru and Kyabakara. The eastern part of the district is dominated by patches of pelites with minor quartzite beds especially in the sub-counties of Kyabakara, Katanda and Ryeru. The southern part of the district is predominantly rift alluvium especially in Kichwamba and Rutoto sub-counties (Figure 3).

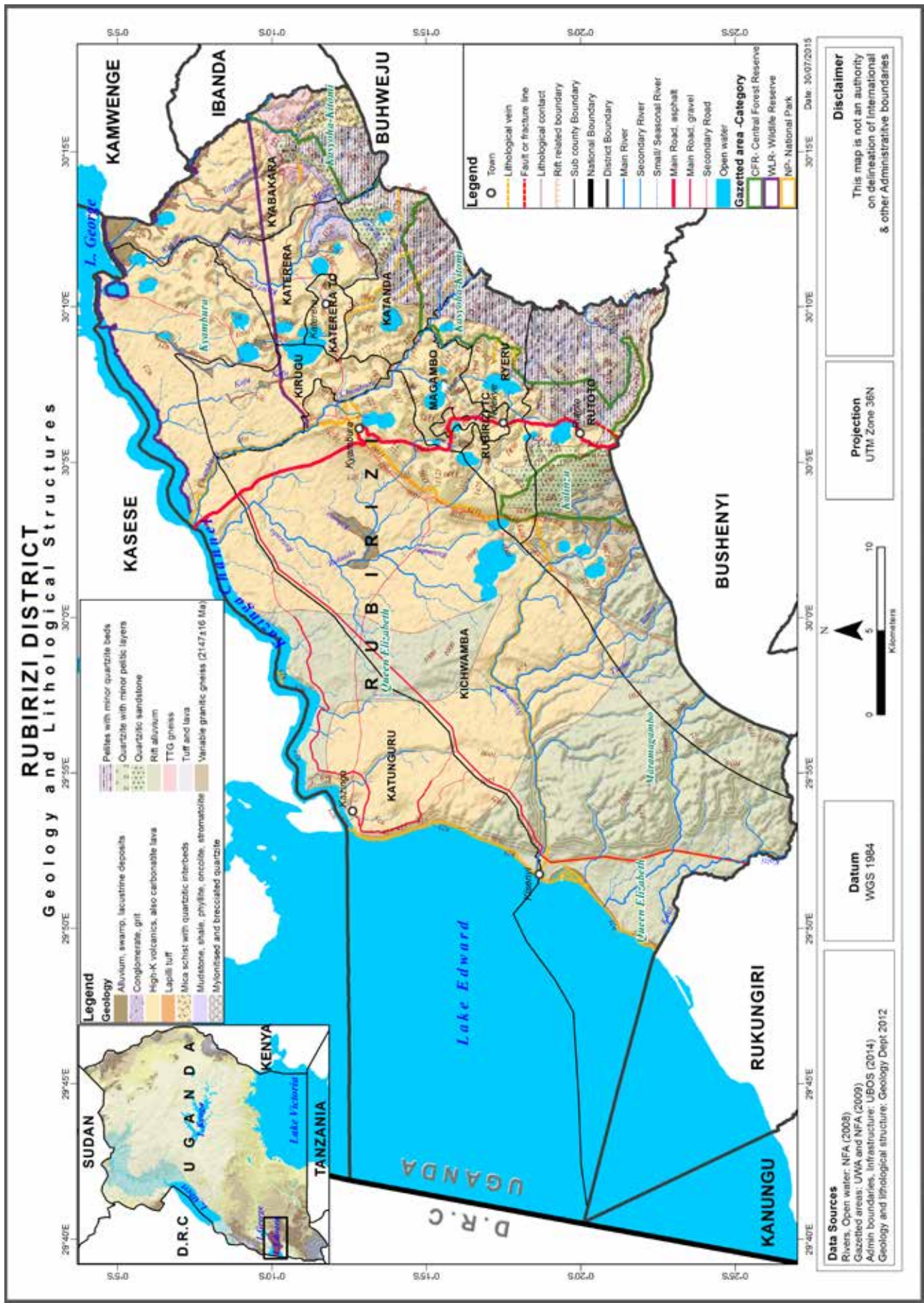


Figure 3: Geology and Lithological structures, Rubirizi District

### **2.1.3 Vegetation and Land use stratification**

The biggest part of the district is covered by conservation areas including Queen Elizabeth National Park covering the biggest part west of the district; Kyambura Wildlife reserve covering the northern part of the district, Kasyoha-Kitomi Central Forest reserve covering the North east and Maramagambo Central Forest reserve (Department Joint Management and Kalinzu Central Forest reserve covering south eastern part of the district. Vegetation cover in the Queen Elizabeth National Park and Kyambura Wildlife reserve is dominated by savanna grasslands, savanna woodlands and bushland pockets. Tropical high forest dominates Kasyoha-Kitomi, Maramagambo and Kalinzu Central Forest reserves. Areas covered by subsistence farmlands especially banana and coffee plantations include: Rutoto, Ryeru, Rubirizi Town council, Kirugu, Katerera, Katerera Town council, Katanda, Magambo and Kyabakara sub-counties (Figure 4)

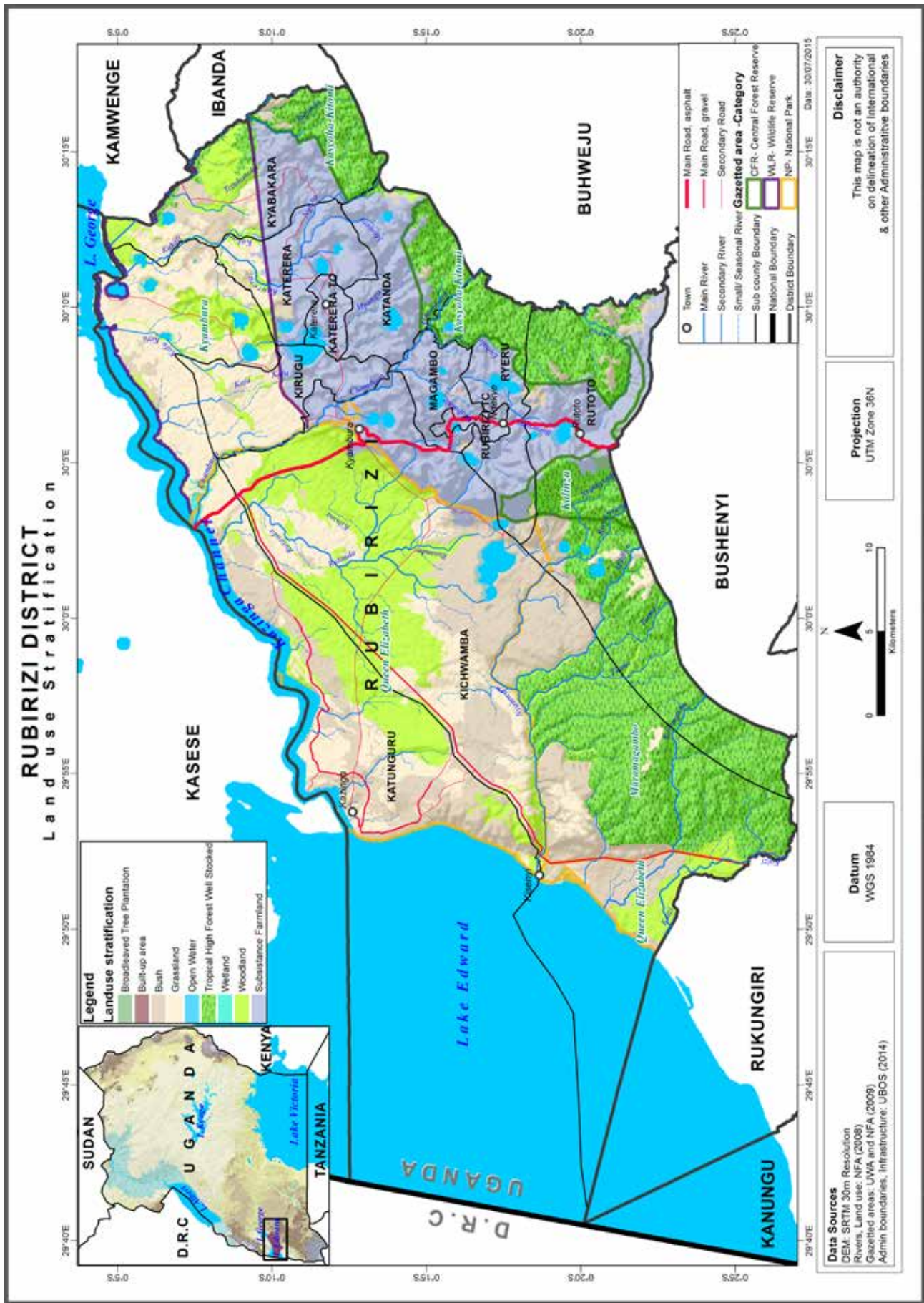


Figure 4: Land use Stratification, Rubirizi District

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

Rubirizi District experiences big annual variation in air temperatures; and the climate may be described as generally warm and humid, with average monthly temperatures varying between 27°C and 31°C. The temperature maximum are consistently above 30°C and sometimes reach 38°C. Average minimum temperatures are relatively consistent and vary between 16°C and 18°C in the hilly areas of Rutoto, Ryeru, and Katanda sub-counties. The relative humidity is higher during rain seasons with maximum levels prevalent in May. Areas covered by Kasyoha-Kitomi, Maramagambo and Kalinzu Central Forest reserves experience the highest the relative humidity levels up to 80% due to high evapotranspiration from the tropical high forest vegetation. The lowest humidity levels occur in dry seasons with minimum levels occurring in December and January. The average monthly humidity for Rubirizi district ranges between 60% and 80%.

#### **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 Mbarara. 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 99days at 0600 hours, and 27 days at 1200 hours, respectively, at Mbarara. The general conclusion from these climatic figures is that for most of the year, Rubirizi District experiences moderate to strong and gusty winds, increasing in the afternoon.

#### **2.1.6 Rainfall**

Total Annual Rainfall received by Rubirizi District ranges between 824mm- 1150mm per annum. Lowest rainfall amounts are experienced along the great East African rift valley especially in Katunguru sub-county with rainfall between about 820mm -830mm per annum. Highest annual rainfall between 1070mm -1150mm are experienced in Rutoto sub-county in the hills neighboring Bushenyi district. Other areas with high rainfall amounts include Kasyoha-Kitomi Central Forest Reserve in Kayabakara sub-county also with rainfall ranging between 1070mm -1150mm (Figure 5).



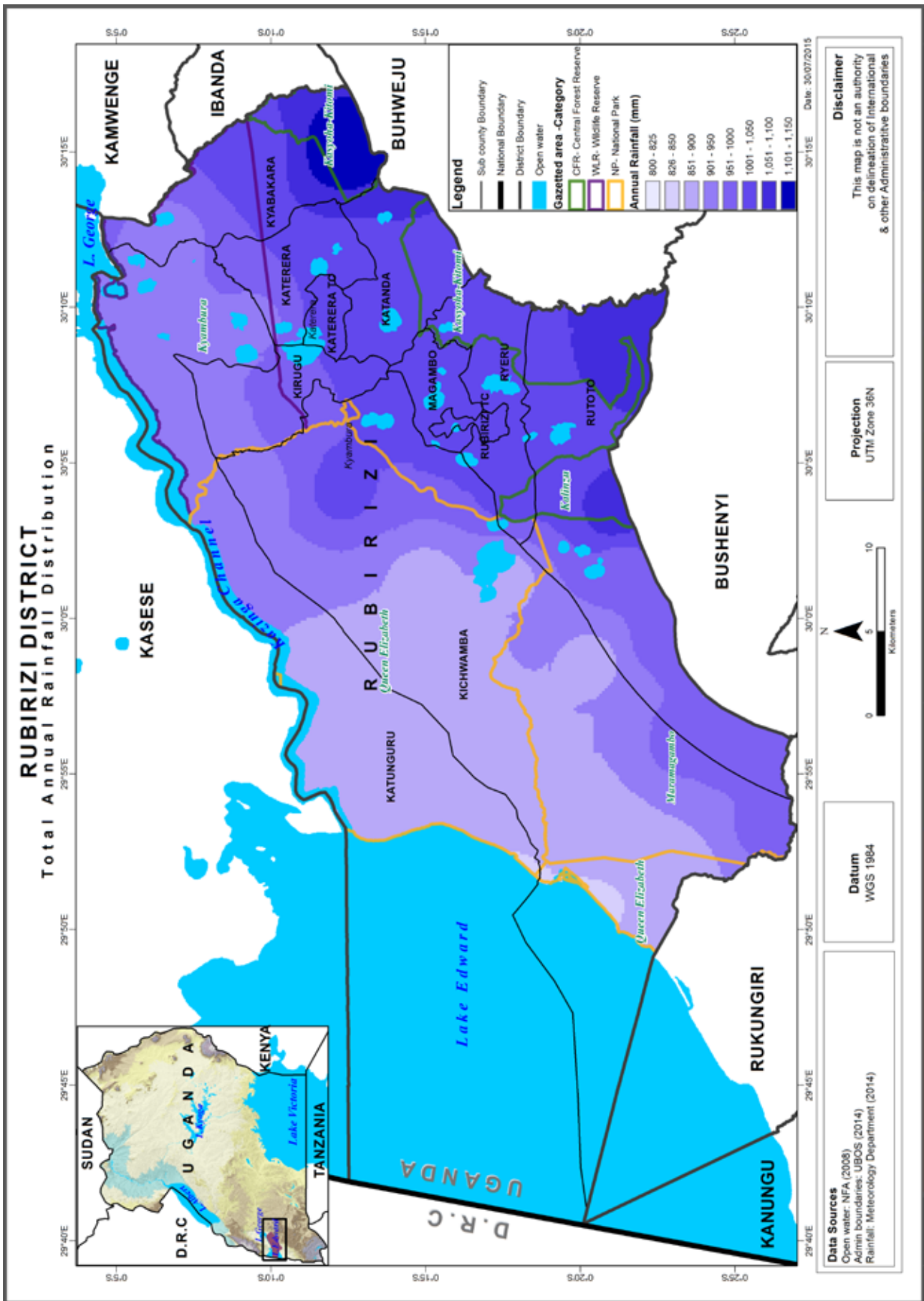


Figure 5: Rainfall Distribution, Rubirizi District

### 2.1.7 Hydrology

Rubirizi District lies in the Lake George - Edward basin. The main water bodies in the district include: Lake Edward west of the district and Lake George north east of the district. The two main water bodies are joined together by Kazinga channel moving along the district border with Kasese district. Other main surface water bodies include permanent rivers that drain from the Bunyaruguru hills into Lake Edward i.e. Rwempungu and Nyamweru. Other rivers drain into Kazinga Channel i.e. Rutanda, Kyambura, Kafu. A few rivers also drain into Lake George including Buhindagi and Kakali rivers. Rubirizi district is endowed with over 80 crater lakes that could have been formed during volcanic activities that occurred in the past. Some of the craters have dried up due to human activities such as agriculture.

Generally areas along the stretch from Lake George, along Kazinga Channel up to Lake Edward are poorly drained and flood prone. The major wetland system lies along the stretch from Lake George, along Kazinga Channel up to Lake Edward forming the Lake George Ramsar site (Figure 4)

### 2.1.8 Population

According to the National population and housing census 2014 provisional results, Rubirizi District had a total population of 129,283. The provisional results also showed that majority of people in Rubirizi District reside in rural centres (111942 (86.8%) compared to only (17341(13.4%) who reside in urban centres. Gender distribution was reported to be males: 61566 (47.6%) and females: 67717 (52.4%). About 99% (128007) of the population form the household population and only 1% (1276) is Non-household. Katanda sub-county had the highest population of 18954 people while Katunguru sub-county had the least population of 4009 people (Figure 6). Table 1 shows the population distribution per sub-county for the different gender.

**Table 1: Population Distribution in Rubirizi 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>
Katunguru	1353	2.8	2325	1684	4009
Kichwamba	3647	4.5	7977	8712	16689
Magambo	2473	4.6	5491	6016	11507
Rubirizi Town Council	1936	4.0	3790	4350	8140
Rutoto	2971	4.4	6069	7074	13143
Ryeru	2786	4.8	6113	7179	13292
Katanda	3916	4.8	9010	9944	18954
Katerera	2342	4.4	4901	5490	10391
Katerera Town Council	2145	4.2	4419	4782	9201
Kirugu	2478	4.5	5418	5903	11321
Kyabakara	2806	4.5	6053	6583	12636

Source: UBOS Census 2014

### **2.1.9 Economic Activities**

Majority of households in Rubirizi District are engaged in subsistence agriculture with the major crops being banana, coffee, maize, sweet potatoes, ground nuts, beans, cassava and millet. A considerable number of the population is involved in livestock production especially rearing cattle, goats and pigs.

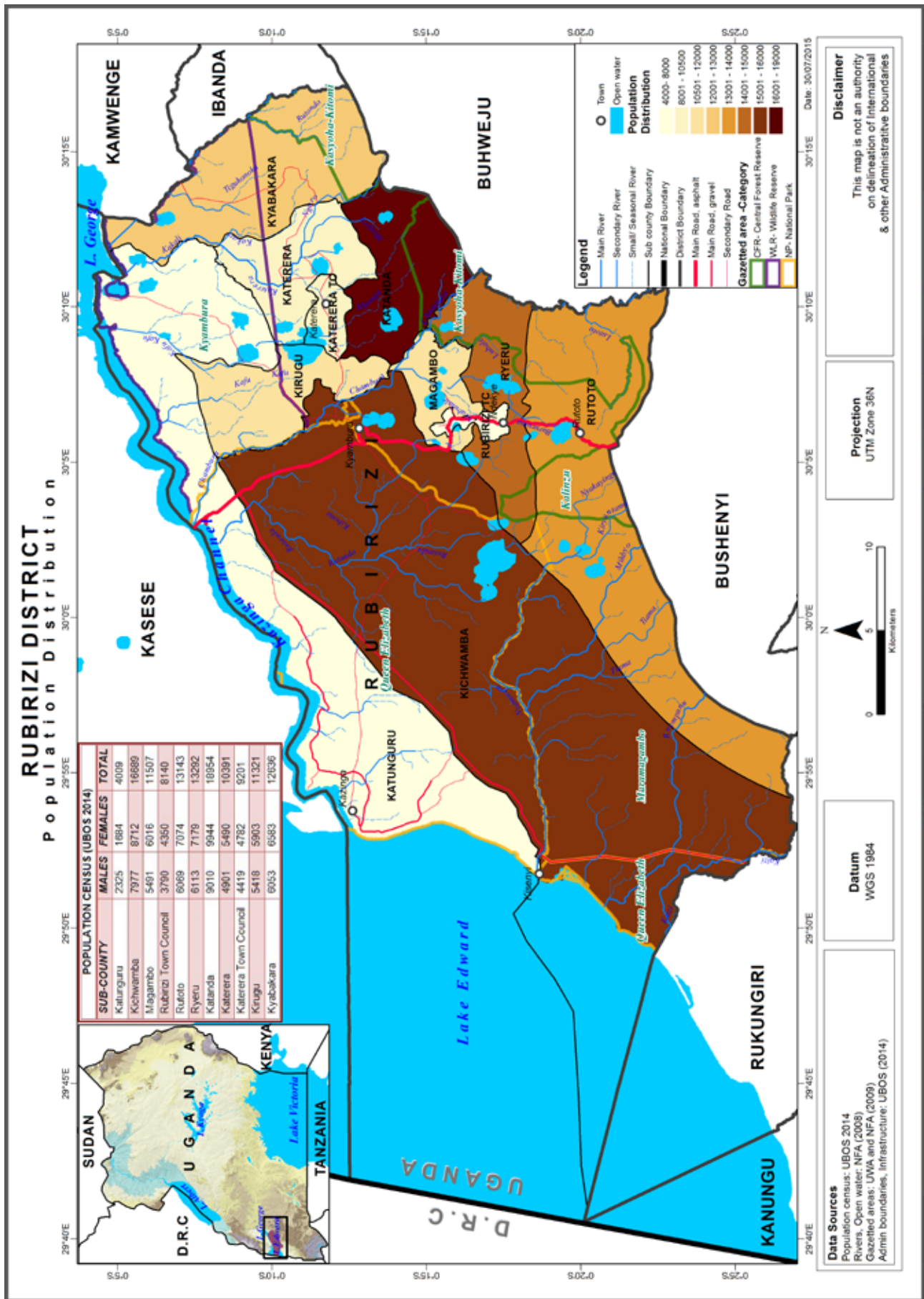


Figure 6: Population Distribution, Rubirizi District



## **2.2 METHODOLOGY**

### **2.2.1 Collection and analysis of field data using GIS**

#### **2.2.1.1 Preliminary spatial analysis**

Hazard prone areas' base maps were generated basing on several numerical models and guidelines using existing environmental and socio-ecological spatial layers, socio-economic data, and meteorological data, etc.) in a GIS environment (ArcGIS 10.1).

#### **2.2.1.2 Stakeholder engagements**

Stake holder 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, to floods, landslides, human and animal disease, pests, animal attacks, earthquakes, fires, conflicts etc. Hazard, risk and vulnerability assessment was done using a stack of methods including participatory approaches such as Participatory GIS (PGIS), Focus Group Discussions (FGDs), key informant interviews, transect drives as well as spatial and non-spatial modelling. Key informant interviews and Focus Group Discussions were guided by a checklist (Appendix 1 and 2). Key Informant Interviews for District officers included: Districts Natural Resources Officers, Environment Officers, Wetland Officers, Forest Officers, Production and Marketing Officers, Veterinary Officers, Health Inspectors. At sub-county level Key informants for this assessment included: Sub-county and parish chiefs, community Development mobilizers and health workers. One Key Informant Interview comprising of five respondents (District Natural Resources officer, Environment officer, Physical planner, Forest ranger and an intern student) was held at Rubirizi District Headquarters (UTM, 178007; 9969810).

Focus Group Discussions were carried out in at least five purposively selected sub-counties that were ranked with highest vulnerability. 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. Three FGDs comprising of an average of 12 respondents (crop farmers, local leaders, nursing officers, police officers and cattle keepers) were conducted at Katerera Sub-county (UTM, 187945; 9978488), Katunguru Sub-county (UTM, 818739; 9965629) and Kirugu Sub-county (UTM, 180274; 9975669). Each Parish of the selected Sub-counties was represented by at least one participant and the selection of participants was engendered. 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 respectfully. 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.

#### **2.2.1.3 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 FDGs and participants were requested through a participatory process to develop a community hazard profile map.

#### **2.2.1.4 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 III). Hazard hot spots, potential and susceptible areas will be classified using a participatory approach on a scale of “not occur”, “low”, “medium” and “high”, consistent with the methodology specified in Annex 3. 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.

### **2.2.2 Develop District specific multi-hazard risk and Vulnerability Profiles**

#### **2.2.2.1 Data analysis and integration**

From the verification of the Hazard prone areas base maps developed basing on several numerical models and guidelines for existing environmental and socio-ecological spatial layers .Final HRV maps will be generated in the GIS environment for each district up to sub-county level and parish level where possible. This is because at a small scale such as at sub-county level, the population could be facing as many hazards as can be listed and so it becomes inappropriate to do the profiling at that small scale. For each of the 5 target districts, specific hazard, risk and vulnerability profiles will be analyzed, discussed and presented in the report and maps.

#### **2.2.2.2 Data verification and validation**

In collaboration with OPM, a five days regional data verification and validation workshop was organized by 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.

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

Once the HRV profiles report and maps have been verified and validated, a final HRV profiles inventory and geo-database will be prepared containing all GIS data and submitted in various file formats to enable use of the maps for future information.

## **2.3 RESULTS FROM MULTI-HAZARD RISK, VULNERABILITY MAPPING**

### **2.3.1 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 Rubirizi 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 lightening
- 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.

## 2.3.2 GEOMORPHOLOGICAL OR GEOLOGICAL HAZARDS

### 2.3.2.1 Landslides, Rock falls and Soil erosion

Multi-hazard, risk and vulnerability assessment was done through participatory approaches and Key Informant interviews were held with the Rubirizi District Natural Resources Officer, Environment Officer, Physical planner and Land officer. Focus Group Discussions were held in Katerera Sub-county (UTM, 187945; 9978488), Katunguru Sub-county (UTM, 818739; 9965629) and Kirugu Sub-county (UTM, 180274; 9975669). Results from the Participatory assessment indicated that soil erosion and landslides are the most prominent hazards during rainy seasons. The increased intensity of soil erosion and landslides during rainy seasons was attributed to the hilly landscape of most parts of Rubirizi District. It was reported that the runoff from the hills usually washes away gardens especially banana plantations where banana stumps are swept or at times left hanging. The most affected sub-counties are; Rutoto, Kirugu, Kichwamba and Ryeru. It was also reported that landslides occur during the peak of the rainy seasons. Landslides usually cover gardens and block roads. Rutoto and Katanda sub-counties are the most affected by landslides. 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 7 shows areas vulnerable to landslides, rock falls and soil erosion. The map also shows hot spot areas where landslides, rock falls and soil erosion have occurred in the past 20 years.





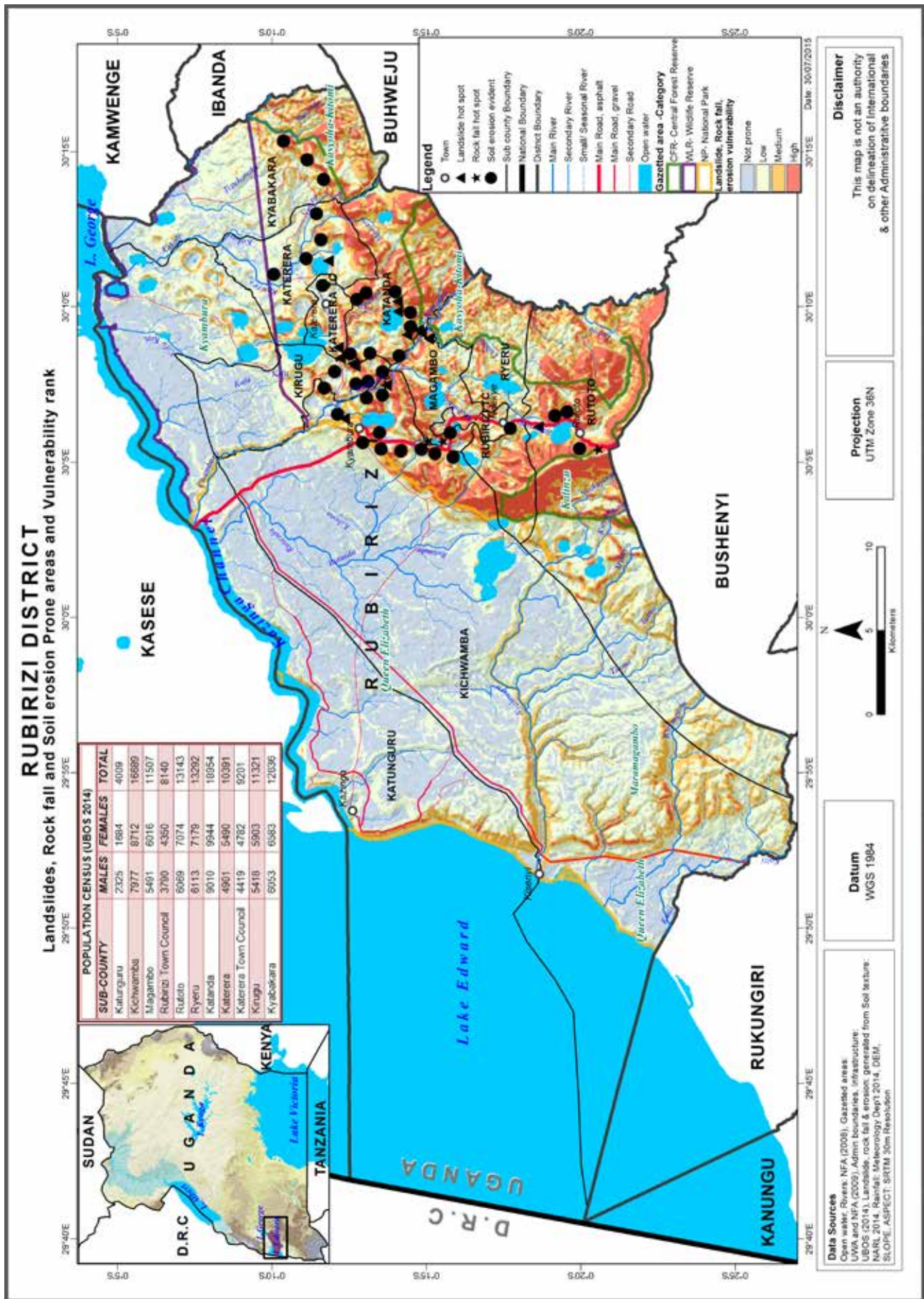


Figure 7: Landslides, Rock falls, soil erosion prone areas and Ranking, Rubirizi District

### **2.3.2.2 Earthquakes**

Participants of the focus group discussions indicated that earth quakes weren't a serious problem in Rubirizi District. However, it was reported that parts of Kirugu sub-county experience minor tremors. Figure 8 indicates areas where faults exist as vulnerable areas where earthquakes have more impact and the ranking is dependent on the distance from the faults and lithological veins.

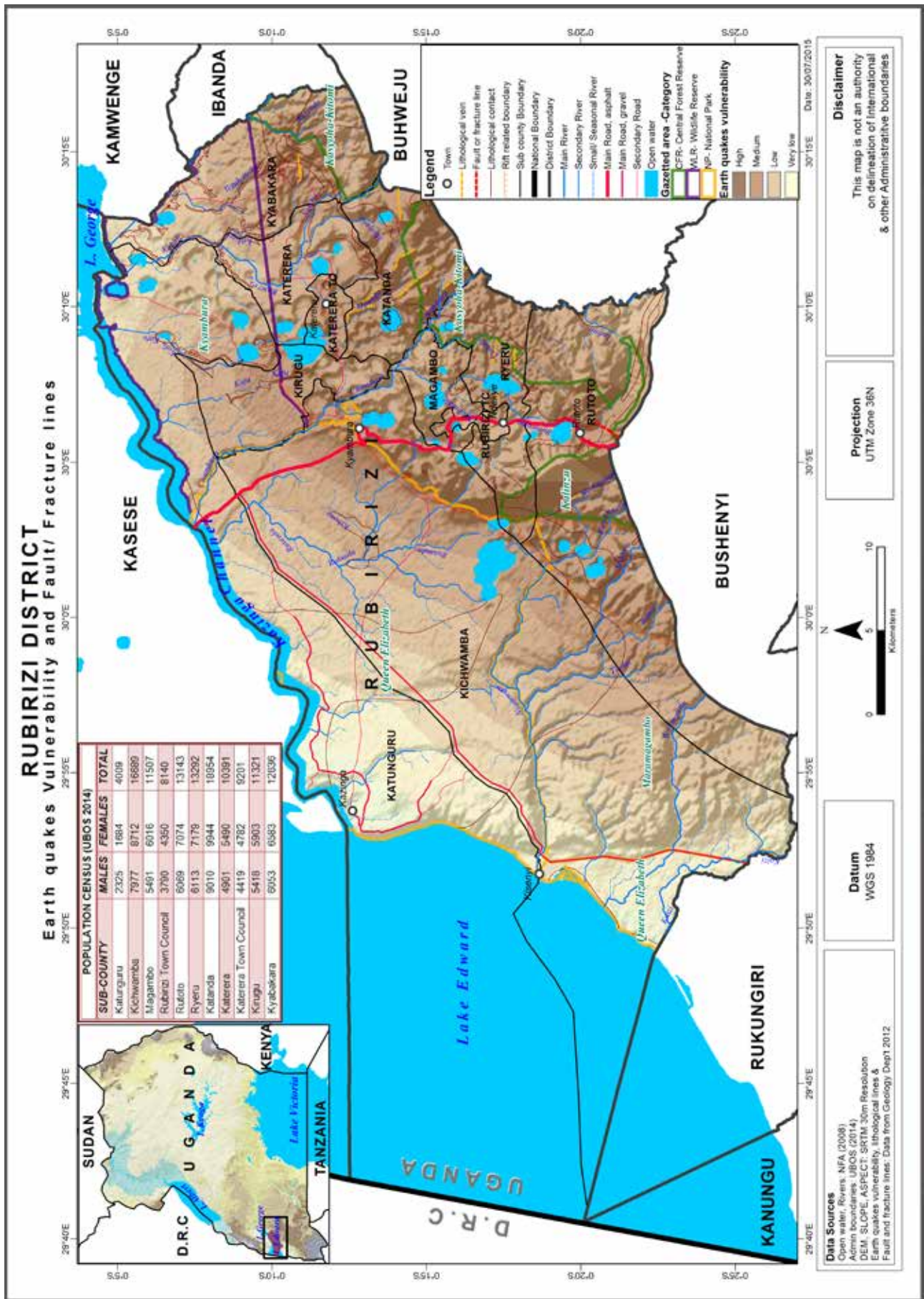


Figure 8: Earth quakes Vulnerability, Fault lines, Rubirizi District

## **2.3.3 CLIMATOLOGICAL OR METEOROLOGICAL HAZARDS**

### **2.3.3.1 Floods**

Results from the Participatory assessment indicated that floods occur in the low lying areas during the rainy season .i.e. from March to April and October to November. It was reported that the floods that hit this district in 2010 created a lake in Katerera sub-county. Most crop gardens especially maize, beans, sweet potatoes were submerged while cassava, coffee and banana plantations were washed away. The most affected sub-counties included: Katerera, Rutoto, Katunguru and Kirugu. 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 vulnerable to floods. The map also shows hot spot areas where floods have occurred in the past 20 years.

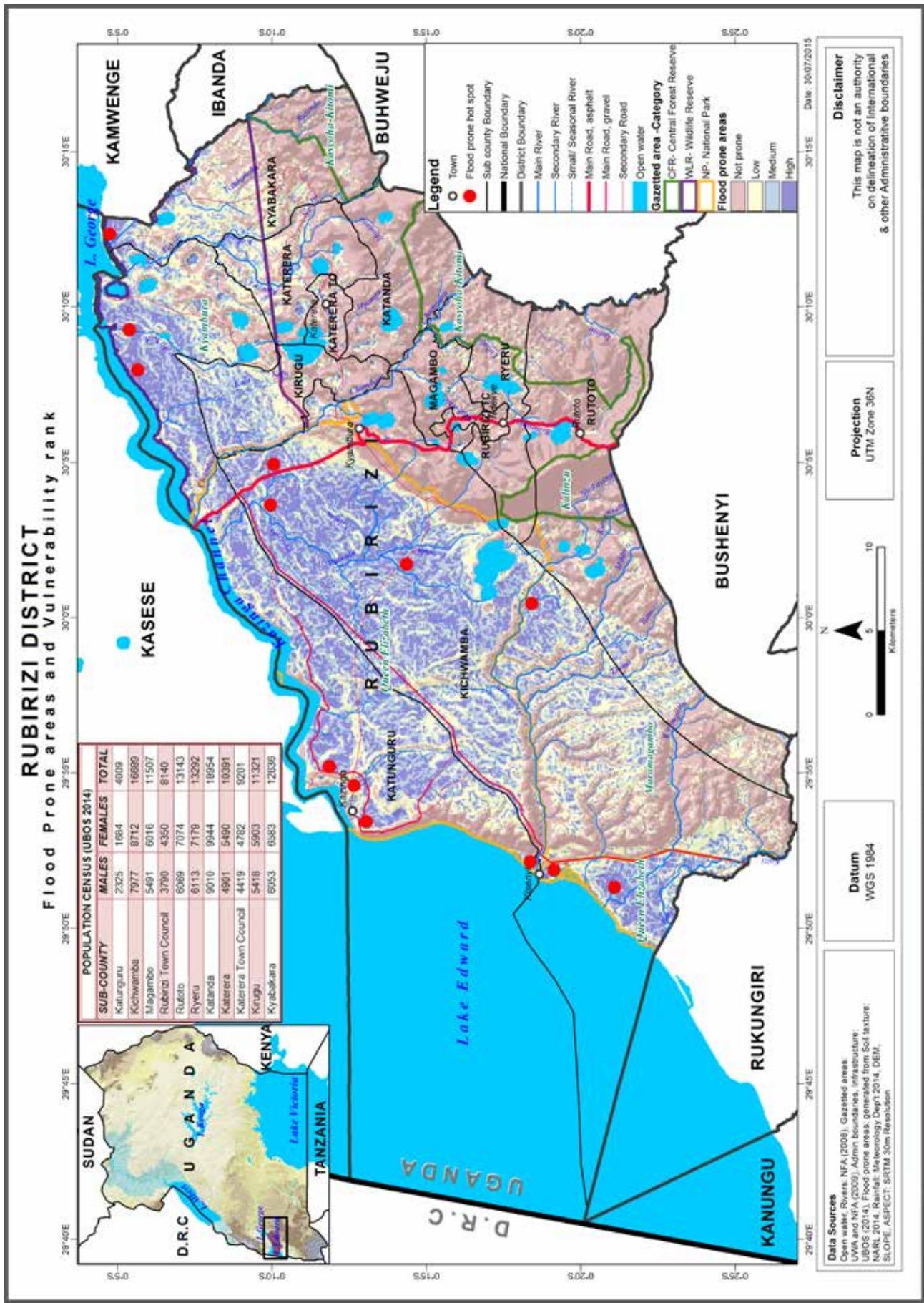


Figure 9: Flood prone areas and Ranking, Rubirizi District

### **2.3.3.2 Drought**

In the subsequent Focus Group Discussions held in Rubirizi District, it was reported that drought and long dry spells were not a serious problem. However, parts of this district especially Katunguru, Katerera, Kyabakara and Kirugu sub-counties experience minimal dry spells from the period beginning December to February and June to August. This information was integrated with the spatial modelling using socio-ecological spatial data i.e. generated from Rainfall and Temperature (Uganda National Meteorological Authority, 2014) using the WASP index. Figure 10 shows areas that are affected by dry spells.

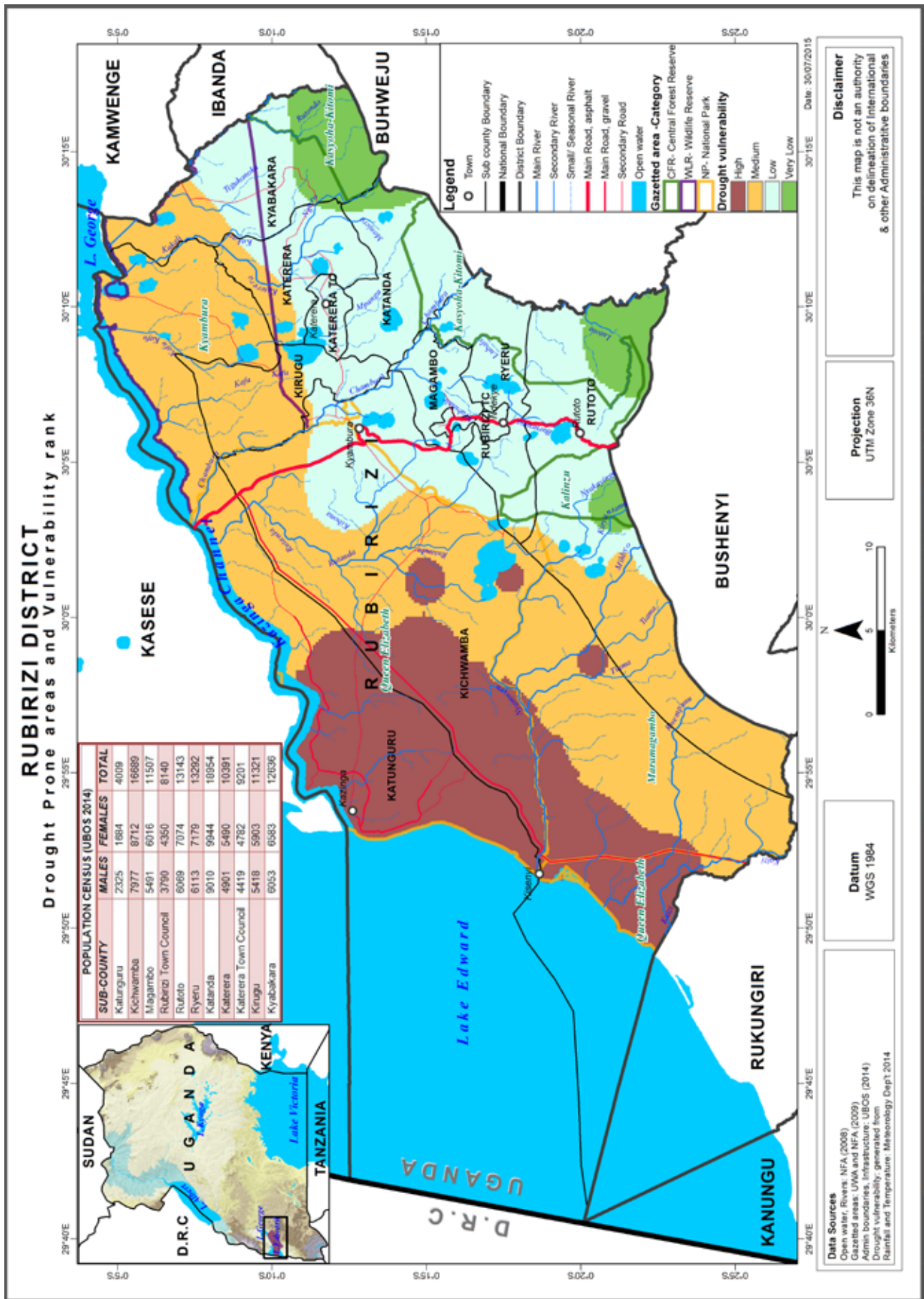


Figure 10: Drought prone areas and Ranking, Rubirizi District

### 2.3.3.3 Hailstorms

Incidences of hailstorms were reported to have increased in the past 10 years. It was observed that hailstorms normally occur during rainy seasons. Results of the participatory assessments indicated that hailstorms destroy crops especially banana plantations thereby leading to loss of crops, low crop productivity, food insecurity and poverty. The most affected sub-counties included: Rutoto, Kyabakara and Kirugu.



**Plate 1: Hailstorms affected Banana plantation in Rutoto, Rubirizi District**



#### **2.3.3.4 Strong winds**

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 Mbarara which is adjacent to Rubirizi district. The general conclusion from these climatic figures is that for most of the year, Rubirizi District experiences moderate to strong and gusty winds. Results from the Participatory assessment indicated that strong winds destroy crops especially in hilly areas causing food insecurity, malnutrition and poverty. The most affected sub-counties included: Katerera, Kirugu, Rutoto and Ryeru in order of severity.

#### **2.3.3.5 Lightening**

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. These conditions occur almost daily in many parts of the Earth and rarely in other areas. Globally, there are about 40 to 50 flashes of lightning every second or nearly 1.4 billion flashes per year. These electrical discharges are powerful and deadly. Each year, lightning strikes kill people, livestock, and wildlife.

From results of FGDs conducted in Rubirizi District, it was observed that there are increased incidences of lightning during rainy seasons. Participants revealed that lightening was a serious problem in Katanda sub-county in 2014 (Figure 11).

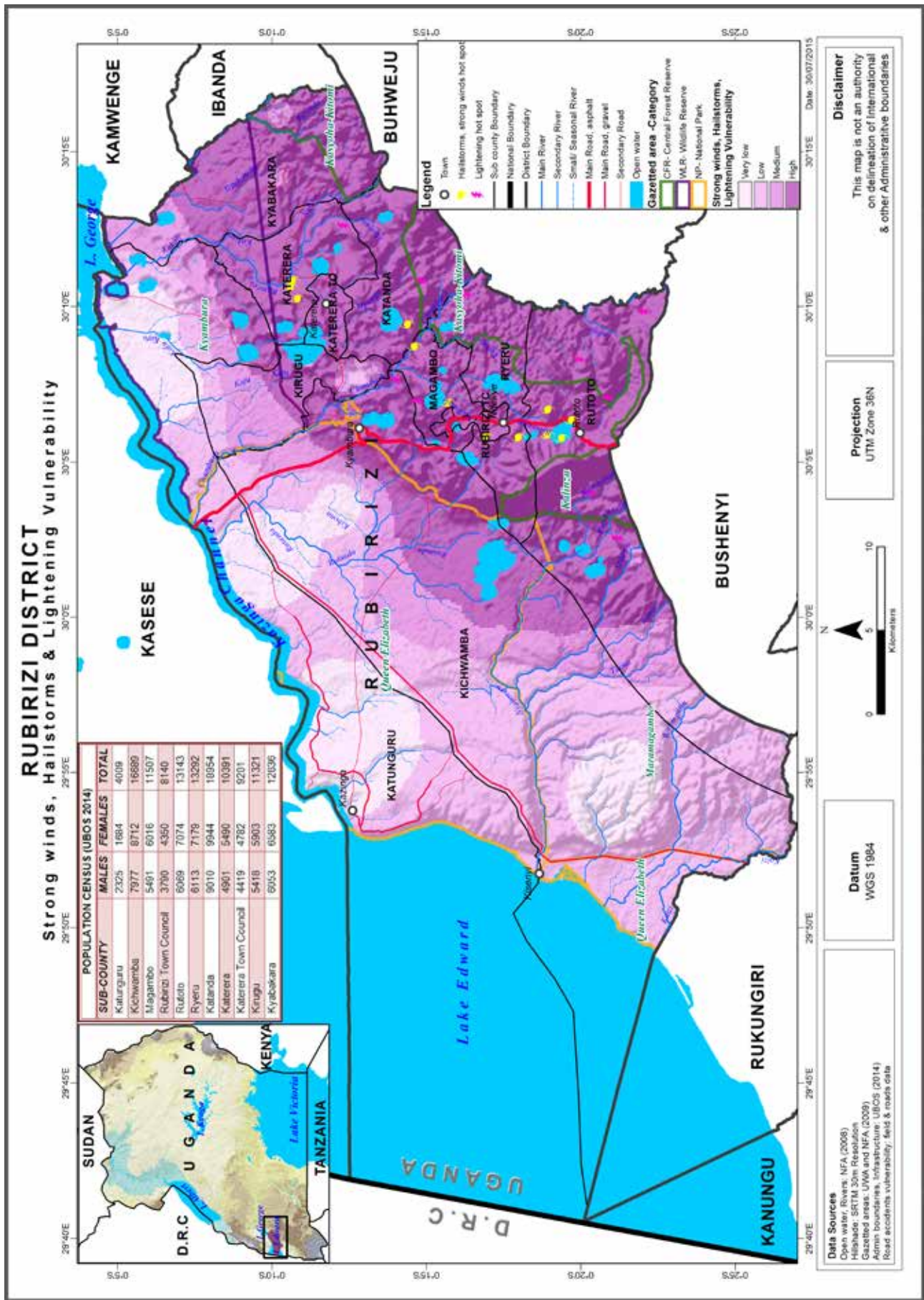


Figure 11: Hailstorms, strong winds, Lightening prone areas and Ranking, Rubirizi District

## 2.3.4 ECOLOGICAL OR BIOLOGICAL HAZARDS

### 2.3.4.1 Crop Pests and Diseases

Participatory assessments through focus group discussions indicated that crop pests and diseases were a serious problem in Rubirizi District. The most affected crops included bananas and coffee while the most reported diseases were banana bacterial wilt, tomato blight and coffee wilt disease. The most mentioned crop pests included black coffee twig borer, root mealy bug, aphids in eucalyptus (new attack reported to Ministry of Environment but no response had been made). It was reported that Kirugu, Kichwamba, Katerera and Rutoto were the most affected sub-counties in order of severity (Figure 12).



**Plate 2: Coffee wilt affected coffee plantation in Katanda, Rubirizi District**

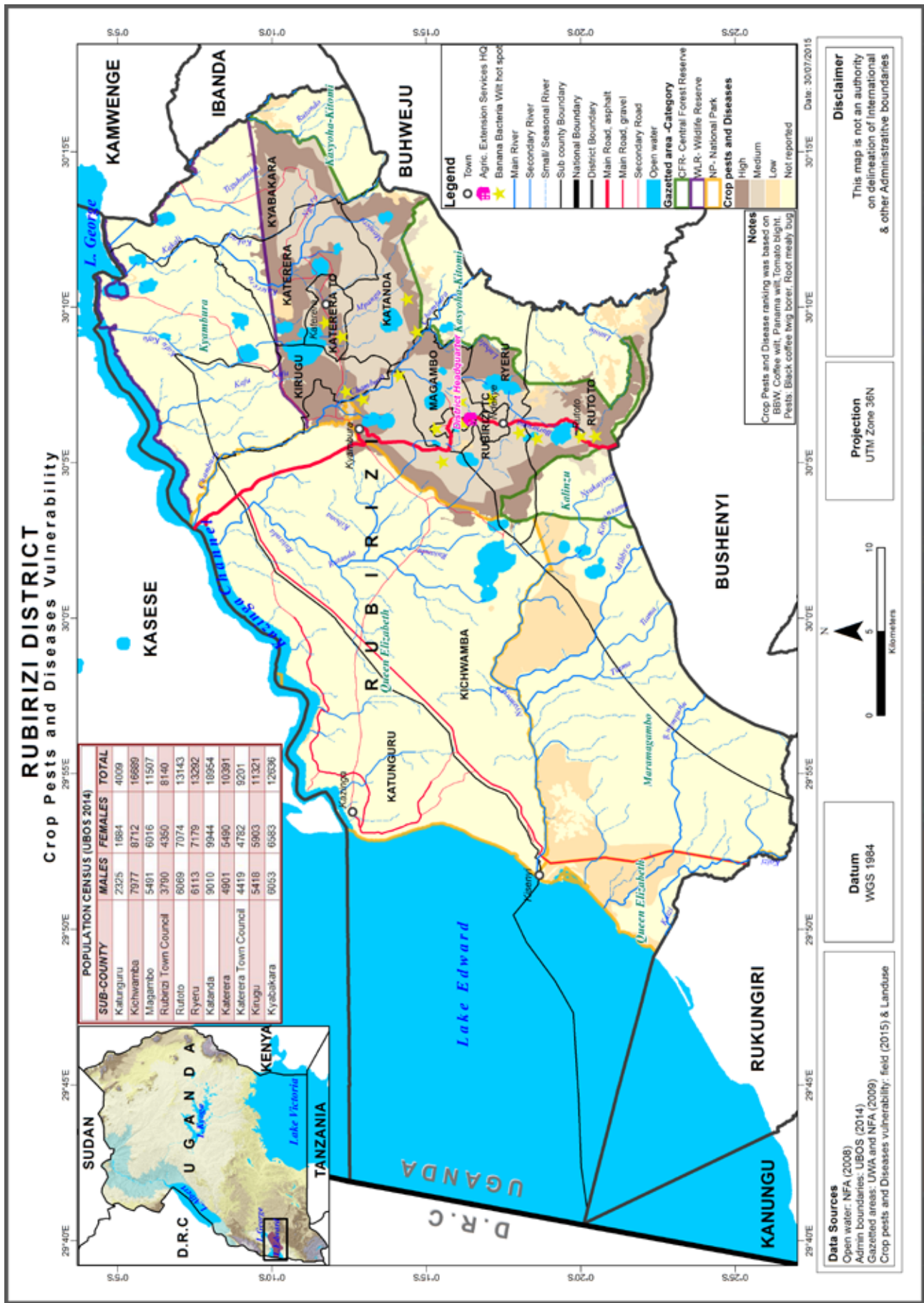


Figure 12: Crop Pests and Diseases prone areas and Ranking, Rubirizi District



#### **2.3.4.2 Livestock Pests and Diseases**

Participatory assessment through the focus group discussions indicated that livestock pests and diseases are a serious problem because part of Rubirizi District is covered by Queen Elizabeth National Park. Results from the discussion showed that foot and mouth disease and anthrax were the most experienced disease outbreaks in Rubirizi district in the past 10 years. Cattle and goats were affected by the above mentioned diseases but not too far reaching levels of an epidemic because government of Uganda intervened and controlled the problem. Measures like vaccination and quarantine were used in the affected sub-counties of Katunguru and Ryeru to prevent outbreaks to the neighboring districts. The most reported livestock pests included: ticks, heart water worms, and biting flies. Figure 13 shows areas vulnerable to Livestock pests and diseases.

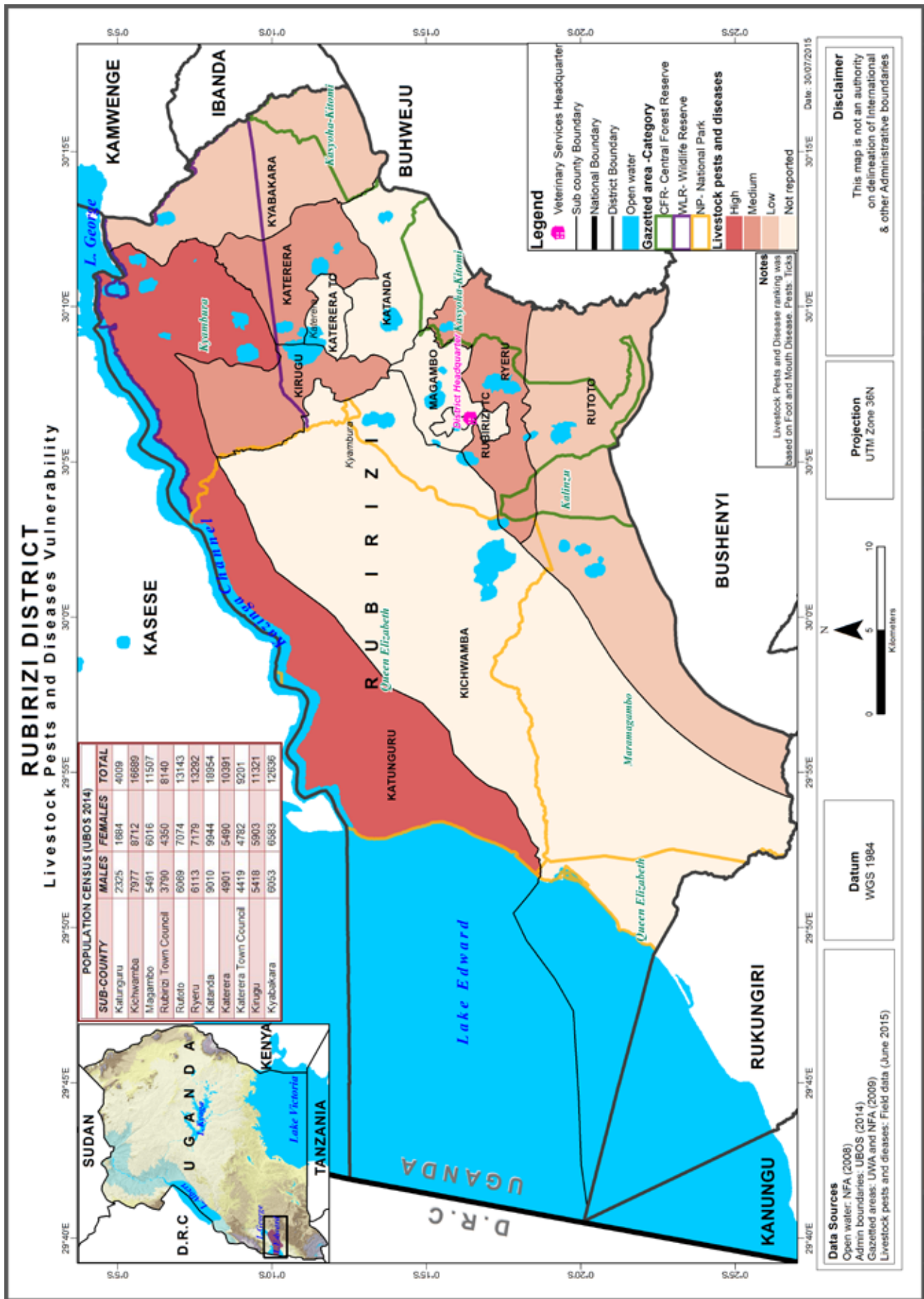


Figure 13: Livestock Pests and Diseases prone areas and Ranking, Rubirizi District

### **2.3.4.3 Human Diseases outbreaks**

Results from the focus group discussion indicated that malaria and HIV and AIDS were the most experienced human diseases in Rubirizi District in the past 10 years. Participants reported that HIV and AIDS had killed very many people in Rubirizi District as a whole. Ministry of Health in collaboration with NGOs such as TASO have intervened to control the spread of HIV AIDS by encouraging safe male circumcision, voluntary counseling and testing services provided free ARVs to the people living with HIV. HIV prevalence was reported to be high at landing sites on Lake George in Katunguru sub-county. Mosquitoes which transmit malaria were the most reported vectors in the district. However, the prevalence of malaria has reduced due to the government interventions of providing treated mosquito nets in 2014.

### **2.3.4.4 Vermin and wildlife animal attacks**

Part of Queen Elizabeth National Park is in Rubirizi District. It was reported that local communities in the sub-counties of Katunguru, Kichwamba, Katerera, Kirugu covered by QENP are vulnerable to vermin and wildlife animal attacks. Participants indicated that elephants, baboons, monkeys and hippos destroy people's gardens a situation that has caused food insecurity in this area. Residents of Katunguru sub-county were most affected by hippo and crocodile attacks (Figure 14).

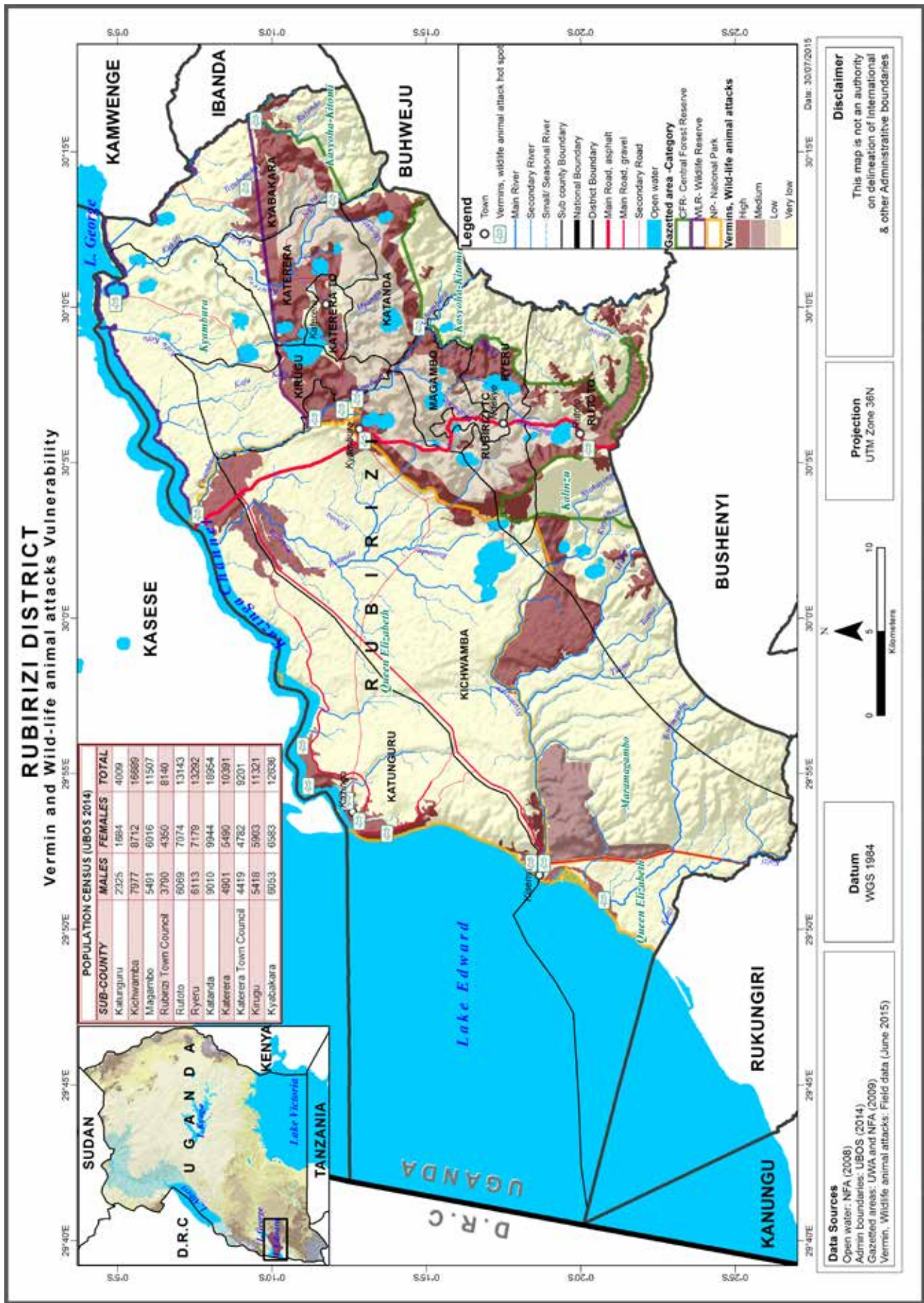


Figure 14: Vermin, Wild-life Animal attacks Vulnerability, Rubirizi District



#### **2.3.4.5 Invasive species**

Participants of the focus group discussions reported that *Lantana camara*, *Phytolacca deodecandra* and *Pasperum Spp* as some of the most common invasive species in QENP. Katunguru and Katerera sub-counties are the most affected by these invasive plants. Some of these species are toxic and have led to livestock (cattle) deaths. Figure 15 shows areas where invasive species are prominent.

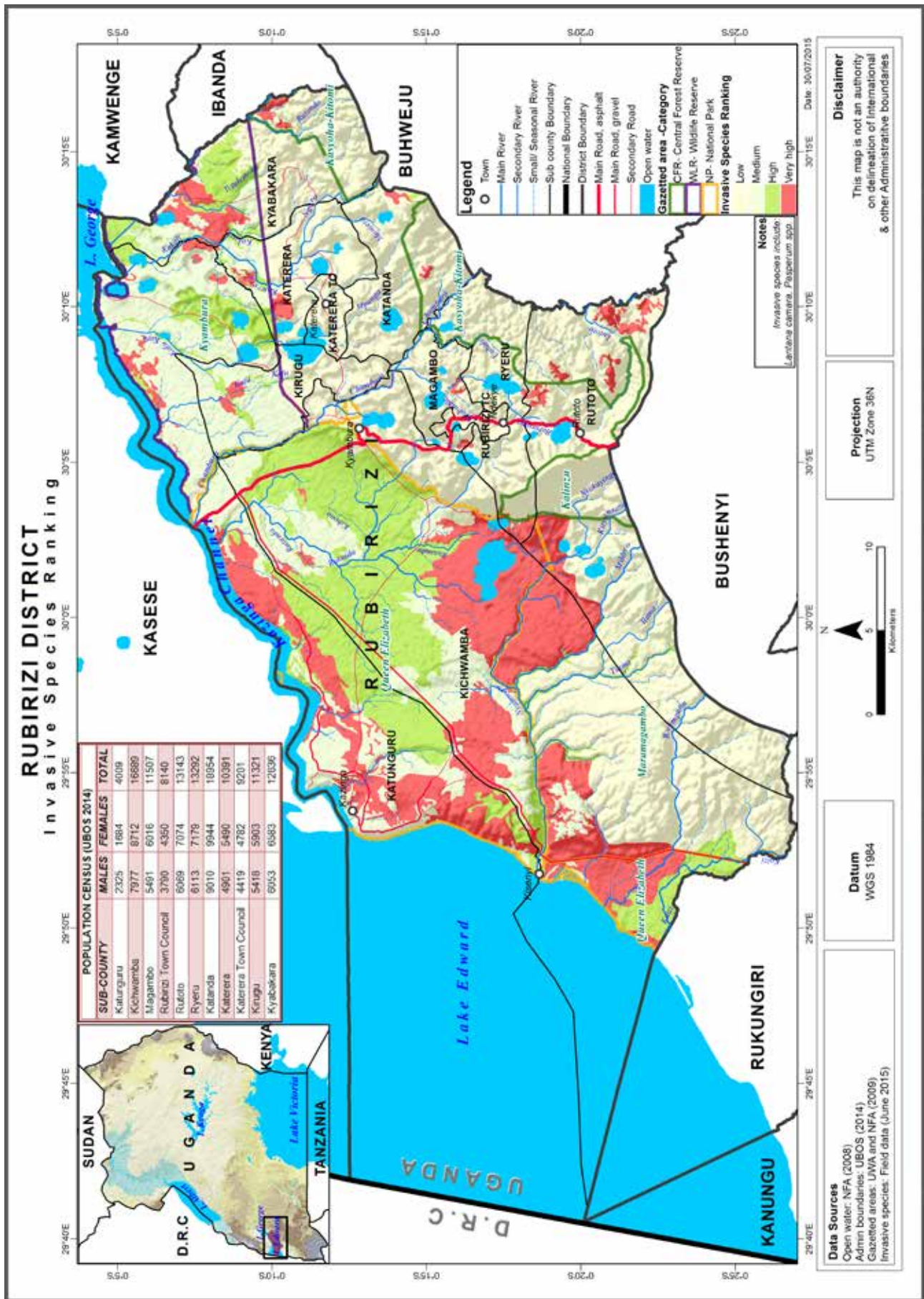


Figure 15: Invasive Species Ranking, Rubirizi District

## **2.3.5 HUMAN INDUCED AND TECHNOLOGICAL HAZARDS**

### **2.3.5.1 Bush fires**

Incidences of forest and bush fires were reported in areas neighboring Queen Elizabeth National Park. It was reported that local communities adjacent to QENP tend to burn vegetation during the dry season for regeneration purposes. The production of charcoal has also caused many bush fires in this area. Many artificial forests such as eucalyptus and pine plantations have been burnt by such fires thereby causing serious economic losses. The most affected sub-counties include: Katunguru, Kirugu, Rutoto, Kyabakara and Kichwamba. Figure 16 shows areas where bush fires are prominent.

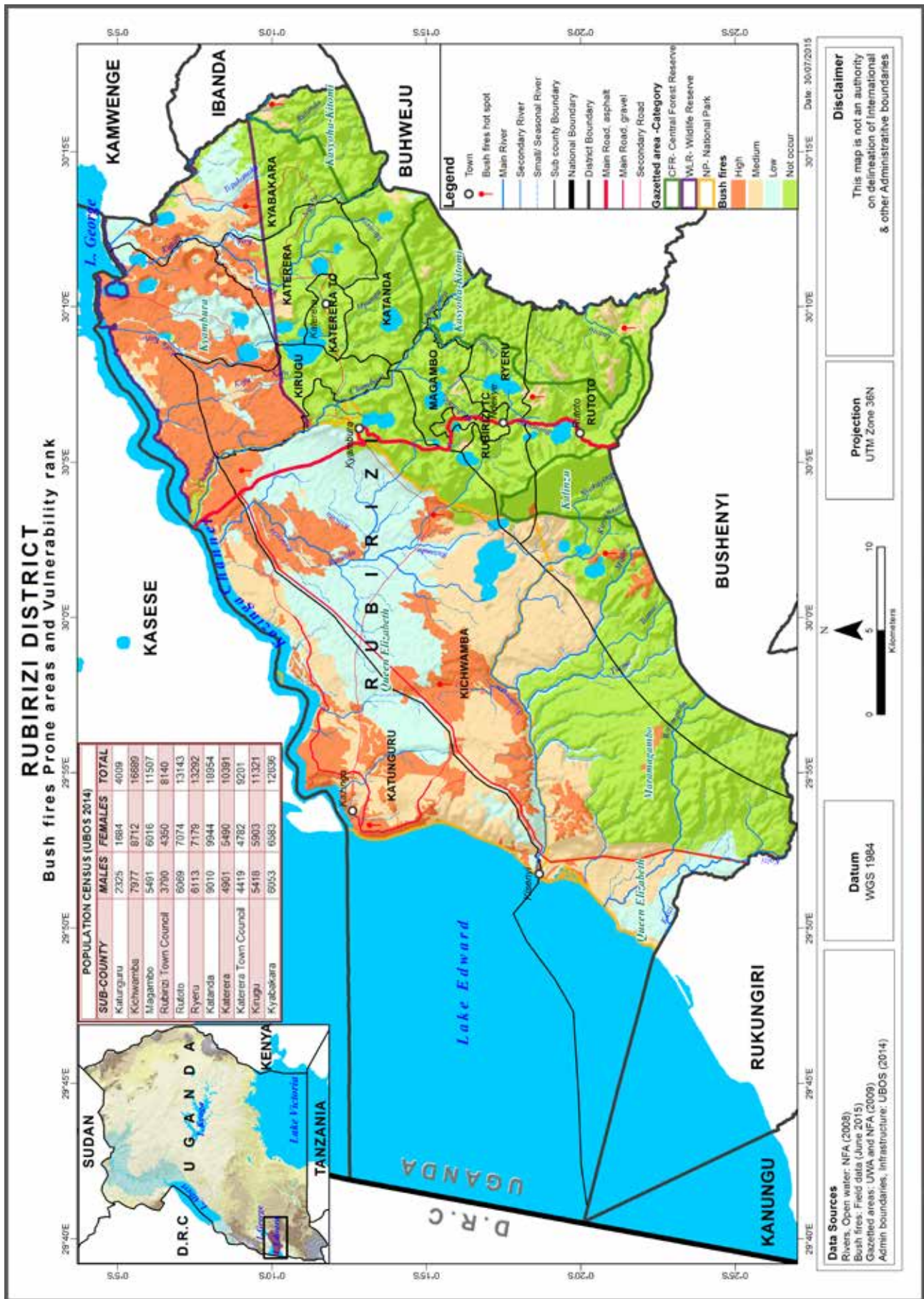


Figure 16: Bush fires Vulnerability and Ranking, Rubirizi District



### **2.3.5.2 Land Conflicts**

Results from the focus group discussions indicated that land conflicts were a serious problem especially among local communities, family members and newly developed town councils. Boundary conflicts between QENP neighboring local communities are also common in Rubirizi District. The most affected sub-counties included: Katunguru and Katerera (Figure 17).

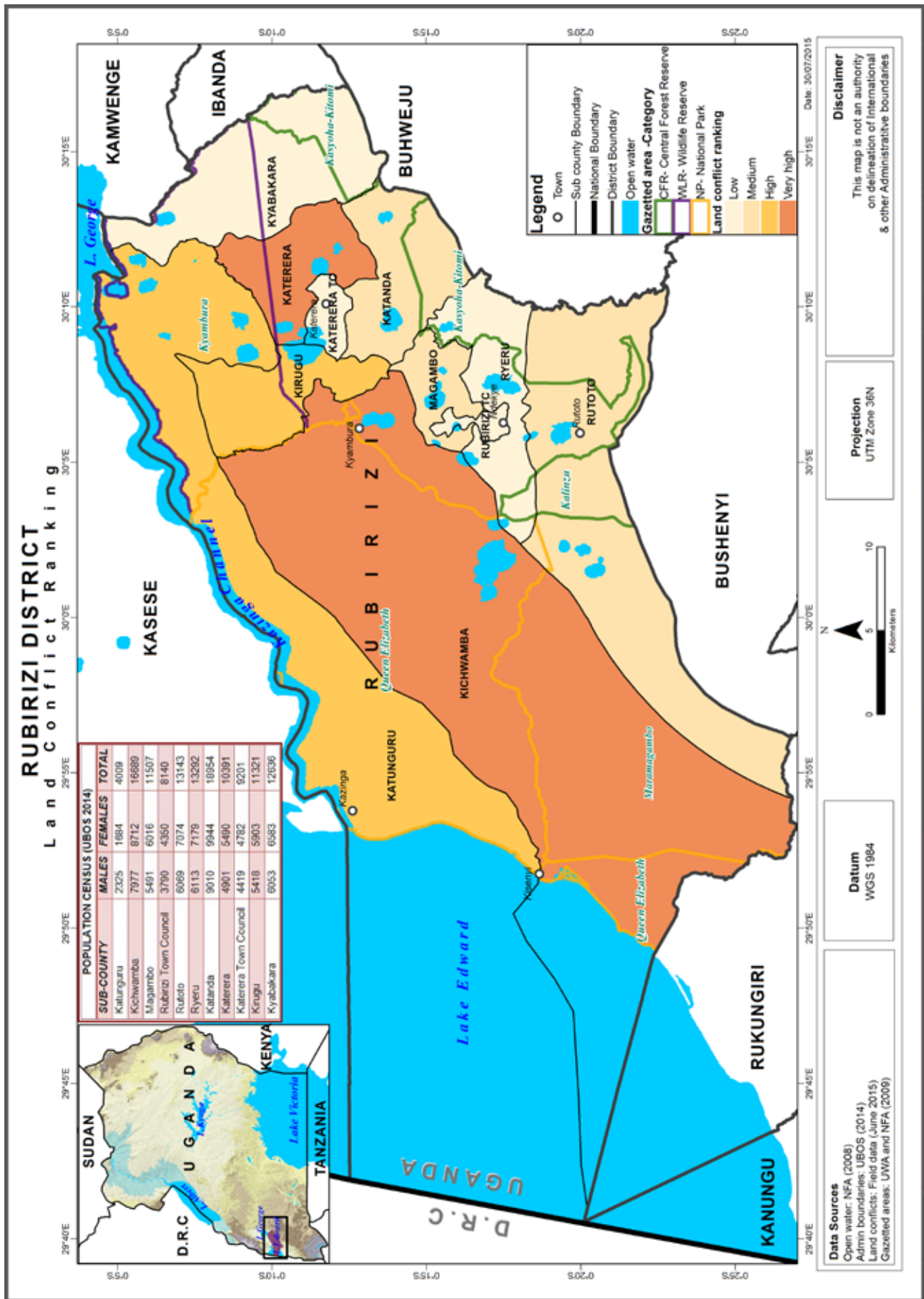


Figure 17: Land Conflicts and Ranking, Rubirizi District

### 2.3.5.3 Environmental degradation

Deforestation, land degradation and wetland reclamation are some of the common forms of environmental degradation in Rubirizi District. Results from the participatory assessment indicated incidences of stone quarrying in some parts of Katerera, charcoal burning in Kichwamba and Katerera, cutting down of trees on the edges of Kasyoha-Kitomi, Kalinzu and Maramagambo Central Forest Reserves for agricultural purposes and settlement. Other reported environmental degradation activities include sand mining along Kazinga channel in Katunguru sub-county, brick making in Katerera and Kichwamba. Hotspots for environmental degradation include sub-counties such as Katunguru, Katerera, Rutoto, Ryeru and Kichwamba. Figure 18 shows environmental degradation risk areas and a few hot spots where environmental degradation has occurred in the past 10 years.



**Plate 3: Land mass collapsing into Crater Lake in Katanda, Rubirizi District**

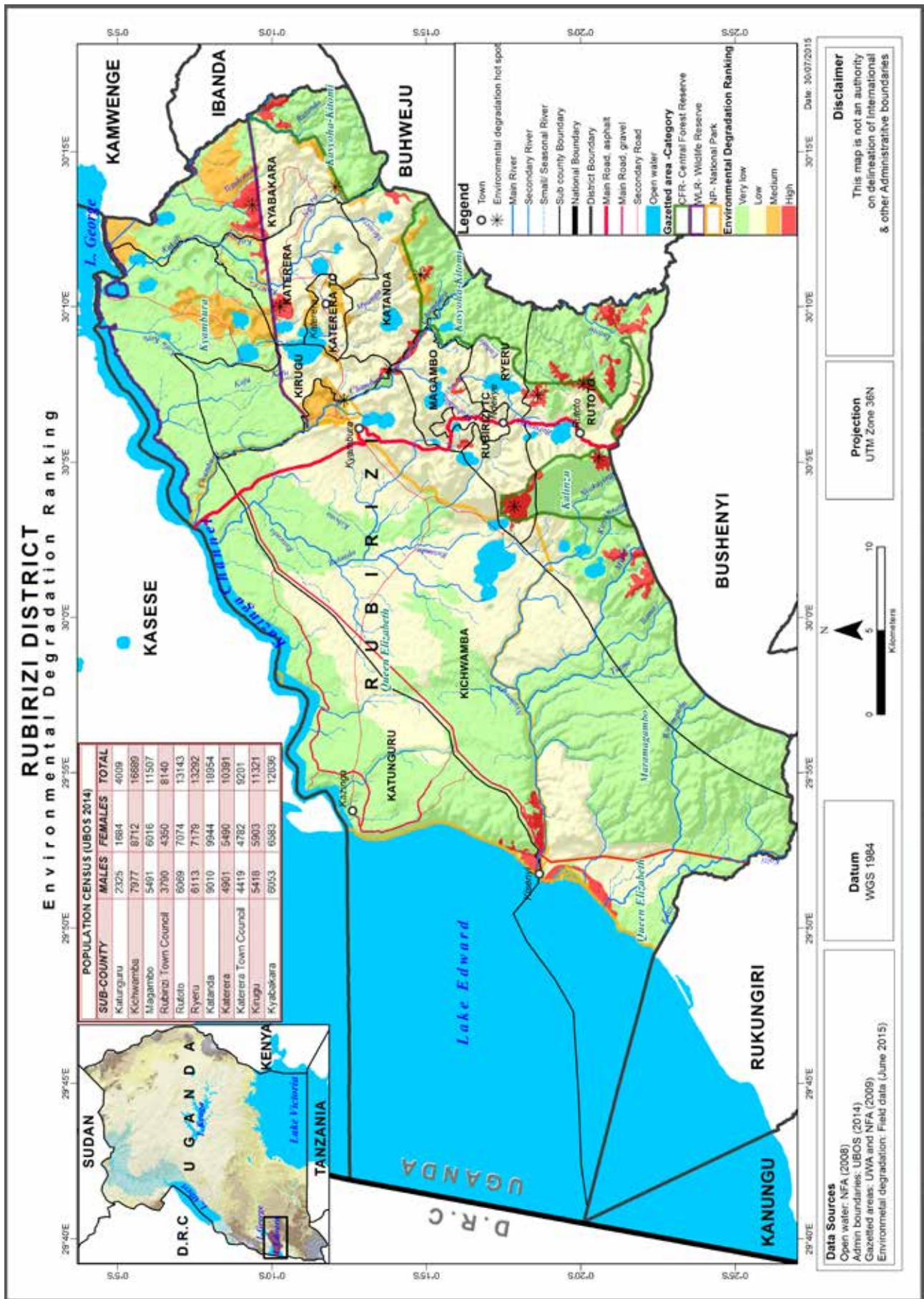


Figure 18: Environmental Degradation Ranking, Rubirizi District



### **2.3.5.3 Road Accidents**

Road accidents usually occur along the high way from Kasese – Rubirizi – Ishaka leading to serious injuries and death. Road accidents in Rubirizi District are attributed to careless driving, over speeding and over loading of banana trucks. Some of the black spots are Rutoto, Nkombe area and corners of Kyambura. The most affected sub-counties included: Rutoto and Ryeru (Figure 19).

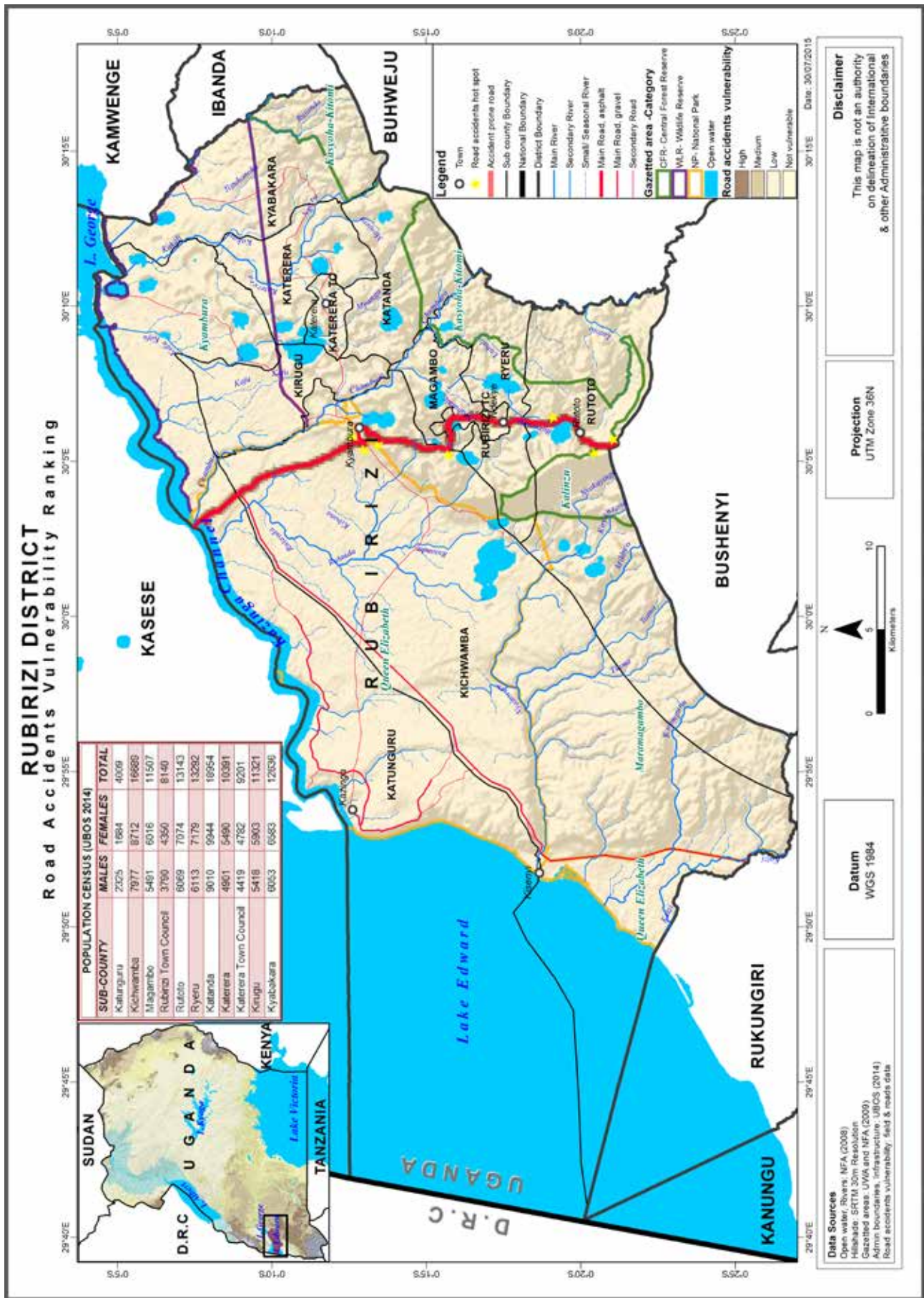


Figure 19: Road Accidents Vulnerability, Rubirizi District

## 2.4 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 2).

**Table 2: Coping strategies to the Multi-hazards in Rubirizi 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> </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 Lightening <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 tire banana against wind</li> <li>• Installation of lightening 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 lightening 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		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> </ul>
10	Invasive species <ul style="list-style-type: none"> <li>• Uproot</li> <li>• Cut and burn</li> <li>• Sensitization on Invasive species management</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> </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> </ul>
13		Road accidents <ul style="list-style-type: none"> <li>• Construction of humps</li> <li>• New road has Signage including speed limits</li> <li>• Sensitisation</li> </ul>
14		Environmental degradation <ul style="list-style-type: none"> <li>• Leave wetlands as water catchments</li> <li>• Plant trees as climate modifiers</li> <li>• Sensitization</li> </ul>

## 2.5 VULNERABILITY PROFILES

Vulnerability depends on low capacity to anticipate, cope with and/or recover from a disaster and is unequally distributed in a society. The vulnerability profiles of Isingiro 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 3).

Table 4 (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 lightening, also create a moderate vulnerability profile in the community (Table 4). Table 5 shows Hazard assessment for Rubirizi District.

**Table 3: Components of Vulnerability in Rubirizi District**

Vulnerability	Exposure			Susceptibility			Resilience
	Hazards	Elements at Risk	Geographical Scale	Susceptibility	Geographical Scale	Coping strategies	Geographical Scale
Socio-economic component	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 Lightening	<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
	Human Disease outbreaks	<ul style="list-style-type: none"> <li>- Human Population</li> </ul>	District	<ul style="list-style-type: none"> <li>- Loss of lives</li> </ul>	District	<ul style="list-style-type: none"> <li>- Mass Immunization</li> <li>- Use of mosquito nets</li> </ul>	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	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 plating -Setting bi-laws	Sub-county

**Table 4: Vulnerability Profile for Rubirizi District**

	PROBABILITY	SEVERITY OF IMPACTS	RELATIVE RISK	VULNERABLE SUB COUNTIES
	<i>Relative likelihood this will occur</i>	<i>Overall Impact (Average)</i>	<i>Probability x Impact Severity</i>	
Hazards	1 = Not occur 2 = Doubtful 3 = Possible 4 = Probable 5 = Inevitable	1 = No impact 2 = Low 3 = medium 4 = High	0-1 = Not Occur 2-10 = Low 11-15 = Medium 16-20 = High	
Floods	5	4	20	Katerera, Rutoto, Katunguru and Kirugu sub-counties and Rubirizi Town council are the most affected by floods.
Droughts	5	3	15	Katunguru, Katerera, Kyabakara, Kichwamba and Kirugu sub-counties are most affected by droughts.
Soil erosion, rock falls and landslides	5	4	20	Katanda, Rutoto, Kirugu, Kichwamba and Ryeru are highly affected by landslides.
Hail storms, lightening and strong winds	5	3	15	The most affected sub-counties include: Rutoto, Kyabakara, Kirugu and Katanda.
Bush fires	3	4	12	Most affected sub-counties are Katunguru, Kirugu, Rutoto, Kyabakara and Kichwamba.
Crop pests and diseases	3	4	12	Most affected sub-counties include: Kirugu, Kichwamba, Katerera and Rutoto.
Livestock pests and diseases	4	3	12	Katunguru, Ryeru, Rutoto, Kirugu and Katerera are the most affected.
Human Diseases outbreaks	5	2	10	Almost all sub-counties in the district are affected by Human diseases. HIV rates were reported highest in Katunguru sub-county.
Land conflicts	5	3	15	Almost all sub-counties in the district are affected by land conflicts. However, Katunguru, Kichwamba, Kirugu and Katerera sub-counties are the most affected.
Vermin and Wild-life animal attacks	5	4	20	Katunguru, Kichwamba, Katerera, Kirugu, Magambo and Kyabakara are the most affected.
Earthquakes and faults	3	2	6	Minor tremors occur in all sub-counties of the district.
Road accidents	3	2	6	Vulnerable black spots along Ishaka– Kasese highway.
Environmental degradation	5	2	10	Katunguru, Katerera and Kichwamba, Rutoto, Ryeru sub-counties are the most affected.

Note: This table presents relative risk for hazards to which the community was able to attach probability and severity scores

**Key for Relative Risk**

H	High
M	Medium
L	Low
N	Not occur



**Table 5: Hazard Risk Assessment**

Hazard	Katunguru	Kichwamba	Magambo	Rubirizi T.C	Rutoto	Ryeru	Katanda	Katerera	Katerera T.C	Kirugu	Kyabakara
Floods	H	M	L	H	H	L	L	H	L	H	L
Drought	M	M	L	L	L	L	L	M	L	M	M
Landslides, Rock falls and Erosion	L	H	H	L	H	H	H	L	L	H	L
Strong winds, Hailstorms and Lightening	M	L	M	M	H	M	H	M	M	M	M
Crop pests and Diseases	L	M	L	L	H	L	L	M	L	M	L
Livestock pests and Diseases	H	H	M	L	M	M	M	M	L	M	M
Human disease outbreaks	M	L	L	M	L	L	L	M	M	L	L
Vermin and Wildlife animal attacks	H	H	M	L	L	L	L	H	L	H	M
Land conflicts	H	H	M	M	M	L	L	H	M	H	M
Bush fires	M	M	L	L	M	L	L	L	L	M	M
Environmental degradation	M	M	L	L	L	L	L	M	L	L	L
Earthquakes and faults	L	L	L	L	L	L	L	L	L	L	L
Road accidents	M	M	L	L	M	M	L	L	L	L	L

**Key**

H	High
M	Medium
L	Low
N	Not occur

## **2.6 GENERAL CONCLUSIONS AND RECOMMENDATIONS**

### **2.6.1 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 etc.) 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 Rubirizi district has over the past two decades increasingly experienced hazards including landslides, rock falls, soil erosion, floods, drought, hailstorms, strong winds, lightening, crop pests and diseases, livestock pests and diseases, human disease outbreaks, vermin, wildlife animal attacks, invasive species, bush fires, road accidents and land conflicts putting livelihoods at increased risk. Generally drought and flooding were identified as most serious problem in Rubirizi 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 Rubirizi district increase their vulnerability to hazard exposure necessitating urgent external support.

Hazards experienced in Rubirizi 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 lightening.
- 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, counteracting 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, 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.

### **2.6.2 Recommendations**

The following recommended policy actions targeting vulnerability reduction include:

- i. Improved enforcement of policies aimed at enhancing sustainable environmental health.
- ii. Quickly review the animal diseases control act because of low penalties given to defaulters.

- iii. Establishment of systems to motivate support of political leaders toward government initiatives and programmes aimed at disaster risk reduction.
- iv. Increased awareness campaigns aimed at sensitizing farmers/communities on disaster risk reduction initiatives and practices.
- v. Revival of disaster committees at the district levels
- vi. Periodic maintenance of feeder roads to reduce on traffic accidents
- vii. Relocation of communities in the affected areas in the district by government
- viii. Promotion of drought and disease resistant crop seeds
- ix. Increase funding in the disaster and environmental departments
- x. Removal taxes on the importation of lightening conductors
- xi. Support establishment of disaster early warning systems
- xii. Increase funding and staff to monitor wetland degradation and non-genuine agro-inputs
- xiii. Improve the communication channel between the disaster department and local Communities
- xiv. Office of the prime minister should decentralize their activities at the district level
- xv. Tree planting along road reserves
- xvi. Fund and equip recruited extension works
- xvii. Government should allocate funds aimed at disaster preparedness and management at district levels
- xviii. Removal of taxes on the importation of lightening conductors
- xix. Support establishment of a disaster risk early warning systems

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## APPENDIX I: DATA COLLECTION TOOLS



**Plate 4: Key Informant Interview with Natural Resources Department Officers, Rubirizi District**



**Plate 5: Focus Group Discussion in Kisenyi landing site, Katunguru Sub-county**

## 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: Floods, Droughts, Landslides, Crop and Animal Production

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 floods in the past 10 years in your area of jurisdiction?
5. Which villages, parishes or sub-counties have been most affected by floods?
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 floods in your area of jurisdiction?
8. In which way are the crops affected by floods?
9. Which domestic animals are majorly affected by floods in your area of jurisdiction?
10. In which way are the domestic animals affected by floods?
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. Have you experienced drought in the past 10 years in your area of jurisdiction?
14. Which villages, parishes or sub-counties have been most affected by drought?
15. As a way of ranking from Low, Medium, High and Very high, rank the villages, parishes or sub-counties that have been most affected?
16. Which crops are majorly affected by drought in your area of jurisdiction?
17. In which way are crops affected by drought?
18. Which domestic animals are majorly affected by drought in your area of jurisdiction?
19. In which way are the domestic animals affected by drought?
20. Which agricultural practices are being adopted by farmers in a bid to mitigate the above challenges?
21. What are the relevant government's interventions focusing at helping farmers mitigate the challenges mentioned?
22. Have you experienced landslides in the past 10 years in your area of jurisdiction?
23. Which villages, parishes or sub-counties have been most affected by landslide?

24. As a way of ranking from Low, Medium, High and Very high, rank the villages, parishes or sub-counties that have been most affected?
25. Which crops are majorly affected by landslides in your area of jurisdiction?
26. In which way are the crops affected by landslides?
27. Which domestic animals are majorly affected by landslides in your area of jurisdiction?
28. In which way are the domestic animals affected by landslides?
29. Which agricultural practices are being adopted by farmers in a bid to mitigate the above challenges?
30. What are the relevant government's interventions focusing at helping farmers mitigate the challenges mentioned?

### **Section B: Animal, crop and human disease outbreaks**

31. Have you experienced any epidemic animal disease outbreaks in the past 10 years in your area of jurisdiction?
32. Which villages, parishes or sub-counties have been most affected by epidemic animal disease outbreaks?
33. As a way of ranking from Low, Medium, High and Very high, rank the villages, parishes or sub-counties that have been most affected?
34. Specify the epidemic animal disease outbreaks that have majorly affected animals in your area of jurisdiction?
35. Which domestic animals are majorly affected by epidemic animal disease outbreaks in your area of jurisdiction?
36. In which way are the domestic animals affected by epidemic animal disease outbreaks?
37. Which mitigation practices are being adopted by farmers in a bid to mitigate the above epidemic animal disease outbreaks?
38. What are the relevant government's interventions focusing at helping farmers mitigate the epidemic animal disease outbreaks mentioned?
39. Have you experienced any crop pests and disease outbreaks in the past 10 years in your area of jurisdiction?



40. Which villages, parishes or sub-counties have been most affected by epidemic animal disease outbreaks?
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. Specify the crop pests and disease outbreaks that have majorly affected animals in your area of jurisdiction?
43. Which crops are majorly affected by crop pests and disease outbreaks in your area of jurisdiction?
44. In which way are the crops affected by crop pests and disease outbreaks?
45. Which mitigation practices are being adopted by farmers in a bid to mitigate the above crop pests and disease outbreaks?
46. What are the relevant government's interventions focusing at helping farmers mitigate the crop pests and disease outbreaks mentioned?
47. Have you experienced any epidemic human disease outbreaks in the past 10 years in your area of jurisdiction?
48. Specify the epidemic human disease outbreaks that have majorly affected animals in your area of jurisdiction?
49. In which way are the humans affected by epidemic human disease outbreaks?
50. Which mitigation measures have been adopted by local communities in a bid to mitigate the above epidemic human disease outbreaks?
51. What are the relevant government's interventions focusing at helping local communities mitigate the epidemic human disease outbreaks mentioned?

### **Section C: Land, wild-life conflicts and Road accidents**

52. Have you experienced land conflicts in the past 10 years in your area of jurisdiction?
53. Which villages, parishes or sub-counties have been most affected by land conflicts?
54. As a way of ranking from Low, Medium, High and Very high, rank the villages, parishes or sub-counties that have been most affected?
55. Which particular villages, parishes or sub-counties have been majorly affected by land conflicts in your area of jurisdiction?

56. What impacts have been caused by land conflicts?
57. To what extent have the land conflicts affected livelihoods of the local communities in your area of jurisdiction?
58. Which conflict resolution measures have been adopted local communities in a bid to mitigate the above challenges?
59. What are the relevant government's interventions focusing at helping local communities mitigate the challenges mentioned?
60. Do you have any national park or wildlife reserve in your area of jurisdiction?
61. Have you experienced wildlife attacks in the past 10 years in your area of jurisdiction?
62. Which particular villages, parishes or sub-counties have been majorly affected by wildlife attacks in your area of jurisdiction?
63. As a way of ranking from Low, Medium, High and Very high, rank the villages, parishes or sub-counties that have been most affected?
64. What impacts have been caused by wildlife attacks?
65. To what extent have the wildlife attacks affected livelihoods of the local communities in your area of jurisdiction?
66. Which mitigation measures have been adopted local communities in a bid to mitigate the above challenges?
67. What are the relevant government's interventions focusing at helping local communities mitigate the challenges mentioned?
68. Have you experienced Road accidents in the past 20 years in your area of jurisdiction?
69. Which roads have experienced Road accidents?
70. What impacts have been caused by Road accidents?
71. To what extent have the Road accidents affected livelihoods of the local communities in your area of jurisdiction?
72. Which conflict resolution measures have been adopted local communities in a bid to mitigate the above challenges?
73. What are the relevant government's interventions focusing at helping local communities

mitigate the challenges mentioned?

**Section D: Hailstorms, lightening, bush fires, earthquakes, faults/ cracks**

**74.**Have you experienced hailstorms or lightening in the past 10 years in your area of jurisdiction?

**75.**Which villages, parishes or sub-counties have been most affected by hailstorms or lightening?

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

**77.**What impacts have been caused by hailstorms or lightening?

**78.**To what extent have the hailstorms or lightening affected livelihoods of the local communities in your area of jurisdiction?

**79.**Which mitigation measures have been adopted local communities in a bid to mitigate the above challenges?

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

**81.**Have you experienced any serious bush fires in the past 10 years in your area of jurisdiction?

**82.**Which particular villages, parishes or sub-counties have been majorly affected by or lightening in your area of jurisdiction?

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

**84.**What impacts have been caused by serious bush fires?

**85.**To what extent have the serious bush fires affected livelihoods of the local communities in your area of jurisdiction?

**86.**Which mitigation measures have been adopted local communities in a bid to mitigate the above challenges?

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

**88.**Do you have any earth faults or earth cracks as lines of weakness in your area of

jurisdiction?

- 89.** Have you experienced any earth quakes in the past 10 years in your area of jurisdiction?
- 90.** Which particular villages, parishes or sub-counties have been majorly affected by earth quakes in your area of jurisdiction?
- 91.** As a way of ranking from Low, Medium, High and Very high, rank the villages, parishes or sub-counties that have been most affected?
- 92.** What impacts have been caused by earth quakes?
- 93.** To what extent have the earth quakes affected livelihoods of the local communities in your area of jurisdiction?
- 94.** Which mitigation measures have been adopted local communities in a bid to mitigate the above challenges?
- 95.** 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.

### Section A: Floods, Droughts, Landslides, Crop and Animal Production

1. Which crops are majorly grown in this community?
  
2. Which domestic animals are dominant in your community?
  
3. Have you experienced floods in the past 10 years?

4. Since when did you last experience floods?
5. In a period of 10 years, how often do you experienced floods?
  - i. Monthly...
  - ii. 2 months...
  - iii. 3 months...
  - iv. Quarterly ...
  - v. 6 months...
  - vi. Annually...
  - vii. Others specify...
6. Which crops are majorly affected by floods in your community?
7. In which way are the crops affected by floods in your community?
8. Which domestic animals are majorly affected by floods in your community?
9. In which way are the domestic animals affected by floods in your community?
10. What measures have been taken by the Government to mitigate the effects of floods?
11. Have you experienced drought in the past 10 years?
12. Since when did you last experience drought?
13. In a period of 10 years, how often do you experience drought?
  - i. Monthly...
  - ii. 2 months...
  - iii. 3 months...
  - iv. Quarterly ...
  - v. 6 months...
  - viii. Annually...
  - ix. Others specify...
14. Which crops are majorly affected by drought in your community?
15. In which way are crops affected by drought in your community?
16. Which domestic animals are majorly affected by drought in your community?
17. In which way are the domestic animals affected by drought in your community?
18. What measures have been taken by the Government to mitigate the effects of drought?
19. Have you experienced landslide in the past 10 years?

**20.** Since when did you last experience landslide?

**21.** In a period of 10 years, how often do you experience landslide?

vi. Monthly...

vii. 2 months...

viii. 3 months...

ix. Quarterly ...

x. 6 months...

x. Annually...

xi. Others specify...

**22.** Which crops are majorly affected by landslide in your community?

**23.** In which way are crops affected by landslide in your community?

**24.** Which domestic animals are majorly affected by landslide in your community?

**25.** In which way are the domestic animals affected by landslide in your community?

**26.** What measures have been taken by the Government to mitigate the effects of landslide?

### **Section B: Animal, crop and human disease outbreaks**

**27.** Have you experienced any epidemic animal disease outbreaks in the past 10 years in your community?

**28.** Specify the epidemic animal disease outbreaks that have majorly affected animals in your community?

**29.** Which domestic animals are majorly affected by epidemic animal disease outbreaks in your community?

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

**31.** Which measures have you adopted to mitigate the above epidemic animal disease outbreaks in your community?

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

**33.** Have you experienced any crop pests and disease outbreaks in the past 10 years in your community?

**34.** Specify the crop pests and disease outbreaks that have majorly affected animals in your community?

35. Which crops are majorly affected by crop pests and disease outbreaks in your community?
36. In which way are the crops affected by crop pests and disease outbreaks?
37. Which measures have you adopted to mitigate the above crop pests and disease outbreaks in your community?
38. What are the relevant government's interventions focusing at helping farmers mitigate the crop pests and disease outbreaks mentioned?
39. Have you experienced any epidemic human disease outbreaks in the past 10 years in your community?
40. Specify the epidemic human disease outbreaks that have majorly affected animals in your community?
41. In which way are the humans affected by epidemic human disease outbreaks?
42. Which measures have you adopted to mitigate the above epidemic human disease outbreaks?
43. What are the relevant government's interventions focusing at helping local communities mitigate the epidemic human disease outbreaks mentioned?

**Section C: Land, wildlife conflicts and Road accidents**

44. Have you experienced land conflicts in the past 10 years in your community?
45. Which particular villages, parishes or sub-counties have been majorly affected by land conflicts in your community?
46. What impacts have been caused as result of land conflicts?
47. To what extent have the land conflicts affected livelihoods in your community?
48. Which conflict resolution measures have you adopted to mitigate the above challenges?
49. What are the relevant government's interventions focusing at helping local communities mitigate the challenges mentioned?
50. Do you have any national park or wildlife reserve in your community?
51. What is the distance of your community from the national park or wildlife reserve?
52. Have you experienced wildlife attacks in the past 10 years in your community?



53. Which particular villages, parishes or sub-counties have been majorly affected by wildlife attacks in your community?
54. What impacts have been caused by wildlife attacks?
55. To what extent have the wildlife attacks affected livelihoods in your community?
56. Which measures have you adopted to mitigate the above challenges?
57. What are the relevant government's interventions focusing at helping local communities mitigate the challenges mentioned?
58. Have you experienced Road accidents in the past 20 years in your community?
59. Which roads have experienced Road accidents?
60. What impacts have been caused by Road accidents?
61. To what extent have the Road accidents affected livelihoods in your community?
62. Which conflict resolution measures have been adopted local communities in a bid to mitigate the above challenges?
63. What are the relevant government's interventions focusing at helping local communities mitigate the challenges mentioned?

**Section D: Hailstorms, lightening, bush fires, earthquakes, faults**

64. Have you experienced hailstorms or lightening in the past 10 years in your community?
65. Which particular villages, parishes or sub-counties have been majorly affected by hailstorms or lightening in your community?
66. What impacts have been caused by hailstorms or lightening?
67. To what extent have the hailstorms or lightening affected livelihoods in your community?
68. Which measures have you adopted to mitigate the above challenges?
69. What are the relevant government's interventions focusing at helping local communities mitigate the challenges mentioned?
70. Have you experienced serious bush fires in the past 10 years in your community?
71. Which particular villages, parishes or sub-counties have been majorly affected by or

lightening in your community?

**72.** What impacts have been caused by serious bush fires?

**73.** To what extent have the serious bush fires affected livelihoods in your community?

**74.** Which measures have you adopted to mitigate the above challenges?

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

**76.** Do you have any earth faults or earth cracks as lines of weakness in your community?

**77.** Have you experienced any earth quakes in the past 10 years in your community?

**78.** Which particular villages, parishes or sub-counties have been majorly affected by earth quakes in your community?

**79.** What impacts have been caused by earth quakes?

**80.** To what extent have the earth quakes affected livelihoods in your community?

**81.** Which measures have you adopted to mitigate the above challenges?

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

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

Observer Name:	District:	Coordinates			
	Sub- county:	X:			
Date:	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, lightening, 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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United Nations Development Programme  
Plot 11, Yusuf Lule Road  
P.O. Box 7184  
Kampala, Uganda  
Site: [www.undp.org](http://www.undp.org)



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