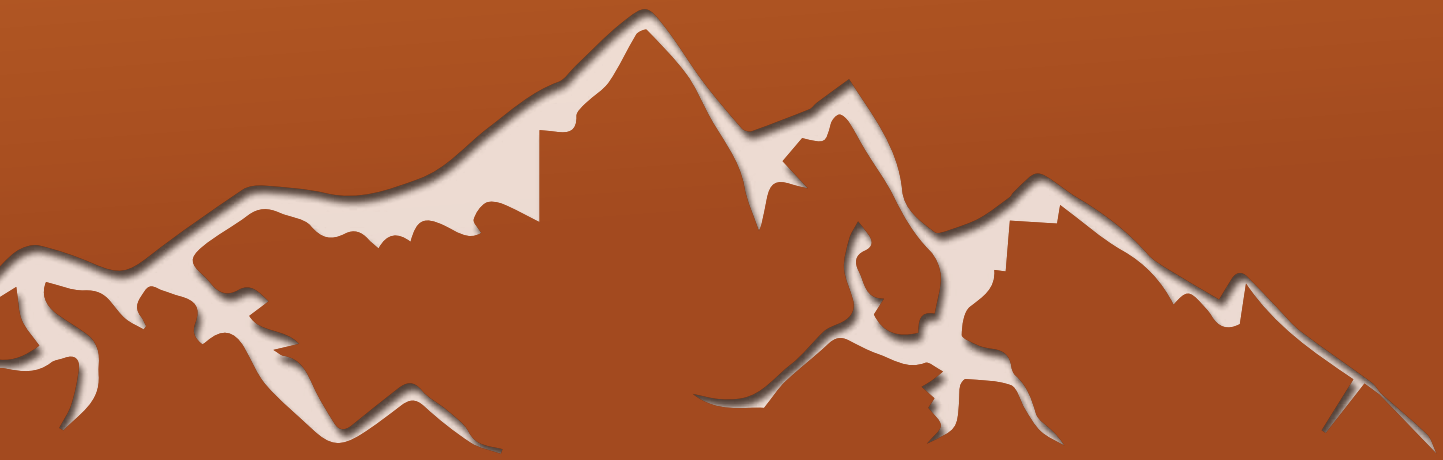
THE REPUBLIC OF UGANDA

# District Multi-hazard, Risk and Vulnerability Profile for Kamwenge District



**Acknowledgement**

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I especially extend my sincere thanks to the Department of Disaster Preparedness and Management in Office of the Prime Minister, under the leadership of Mr. Martin Owor - Commissioner Relief, Disaster Preparedness and Management and Mr. Gerald Menhya - Assistant Commissioner Disaster Preparedness for the oversight and management of the entire exercise. The HRV team was led by Ms. Ahimbisibwe Catherine - Senior Disaster Preparedness Officer, Nyangoma Immaculate - Disaster Preparedness Officer and the team of consultants (GIS/DRR Specialists): Mr. Nsiimire Peter and Mr. Nyarwaya Amos who gathered the information and compiled this document are applauded.
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2. Kamwenge District: Mr. Bakesigaki Stephen – District Fisheries Officer, Mr. Balaam Asiimwe - District Planner, Mr. Twinomujuni Expedito- Clerk to Council and Mr. Ahimbisibwe Vincent – District Physical Planner.
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 Resurces Officer, Yeyambe Steven – Forest Ranger, Mr. Tinkamanyire Jonan – Physical Planner, Mr. Tumushabe Nelson – Lands Officer, Mr. Kabandize Nicholas – Student on Intern (Natural Resources Department).
5. Sheema District: Mr. Tumushabe J. – Production Coordinator, Mr. Mugume Francis – District Health Inspector, Mr. Komujuni Barbarah – Ag. Senior Lands officer, Mr. Turyatunga Patrick – Environment officer.
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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 overlie 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).

### 1.2.2 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."

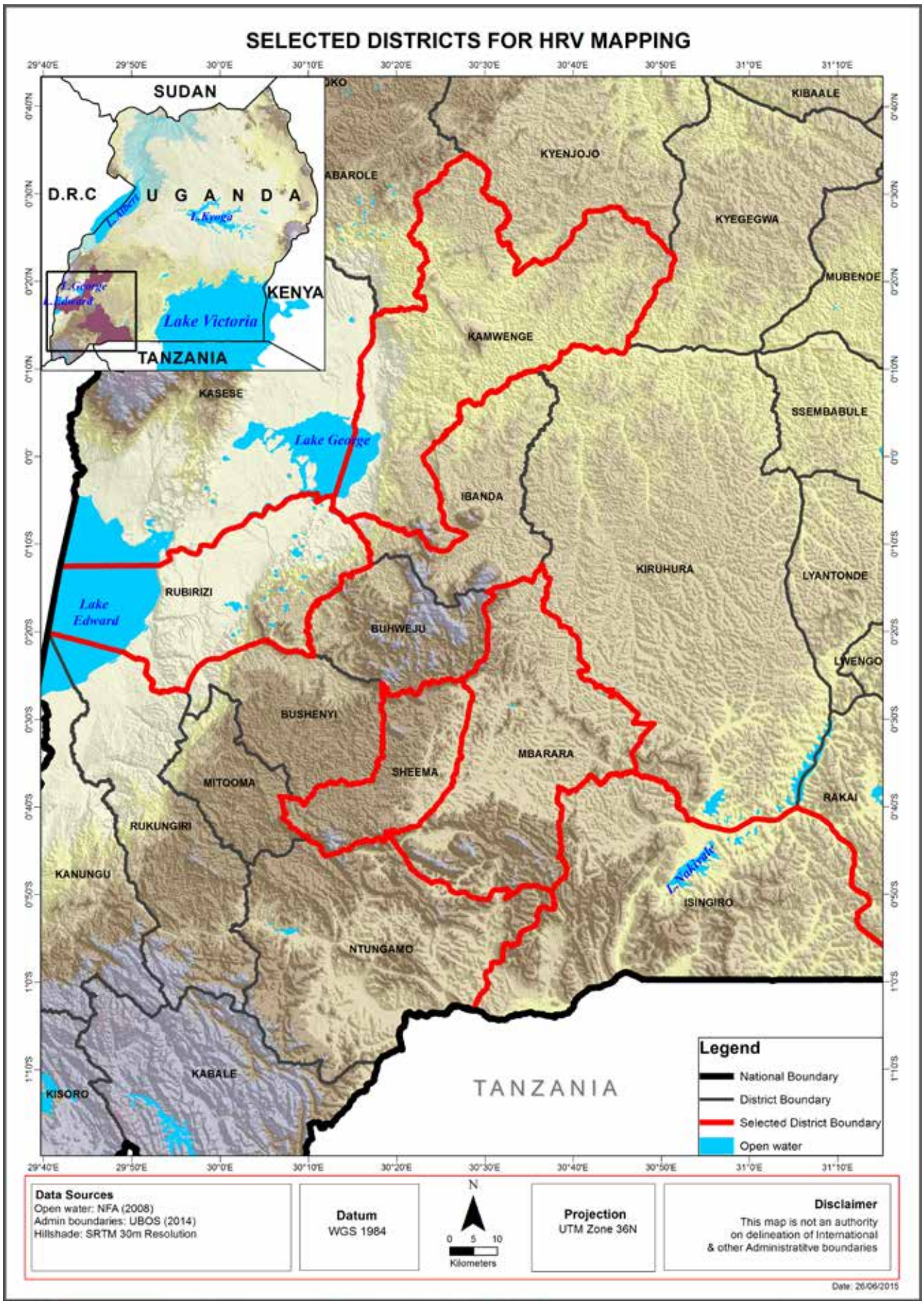


**Figure 1:** Location of Study Area 3

### 1.5 Structure of the Report

This Report is organized into two chapters: Chapter 1 provides Introduction on the assignment. Chapter 2 focuses on the overview and the Multi-hazard, Risks and Vulnerability profiles of Kamwenge district.

# CHAPTER TWO

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

### 2.1 Overview of Kamwenge District

Kamwenge District is located (UTM 216156; 20284) in Western Uganda. Kamwenge District is bordered by Kyenjojo District to the north, Kyegegwa District and Kiruhura District to the northeast, Ibanda District to the east and southeast, Rubirizi District to the southwest, Kasese District to the west and Kabarole District to the northwest. The district has 14 sub-counties, 1 town council as well as 1 refugee settlement. These include: Biguli, Bihanga, Busiriba, Bwizi, Kabambiro, Kahunge, Kamwenge, Nkoma, Buhanda, Kanara, Kicheche, Mahyoro, Ntara and Nyabbani sub-counties, Kamwenge town council and Rwamwanja Refugee Settlement.

#### 2.1.1 Geomorphology

Kamwenge District lies between altitudes of 910m-1950 m.a.s.l. Areas south of the district around Kicheche sub-county have the highest altitudes between 1600m – 1950m towards the district border with Ibanda district. A small high area is also located in the centre of the district in Kamwenge sub-county with altitudes between 1600m – 1800m. High altitude areas in Buhanda, Ntara and Kanara form the great East African rift valley escarpment. Low altitudes are along the great East African rift valley which forms the south western part of the district in Mahyoro and Kanara sub-counties bordering with Kasese district, the lowest spot located in Lake George. Figure 2 shows the Administrative boundaries, gazetted areas and geomorphology of Kamwenge District.

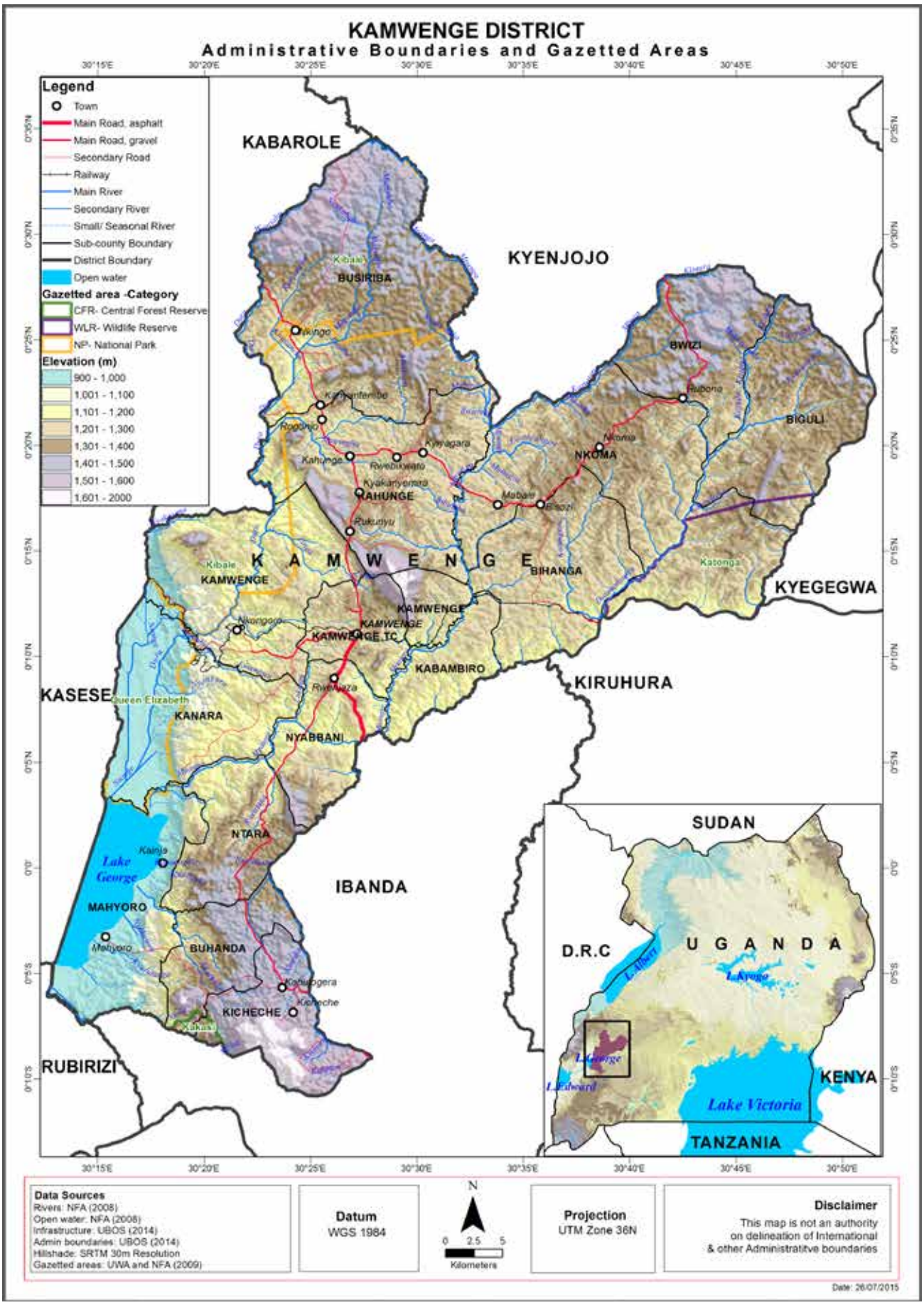


**Figure 2: Administrative Units and Geomorphology of Kamwenge District**

### 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 mica schist with quartzitic interbeds existing in all the sub-counties. The district also has patches of TTG gneiss rocks in the sub-counties of Busiriba, Bihanga, Kamwenge, Ntara and Buhanda. Lake George area is predominantly papyrus swamp flood plain mud especially in Mahyoro sub-county. Areas forming the great East African rift valley in Kanara sub-county are dominated by Alluvium swamp lacustrine deposits and Colluvium. Limestone deposits also exist in Kamwenge sub-county along River Dura in Kibale National Park where mining is currently occurring. Figure 3 shows the geology and lithological structures of Kamwenge District.

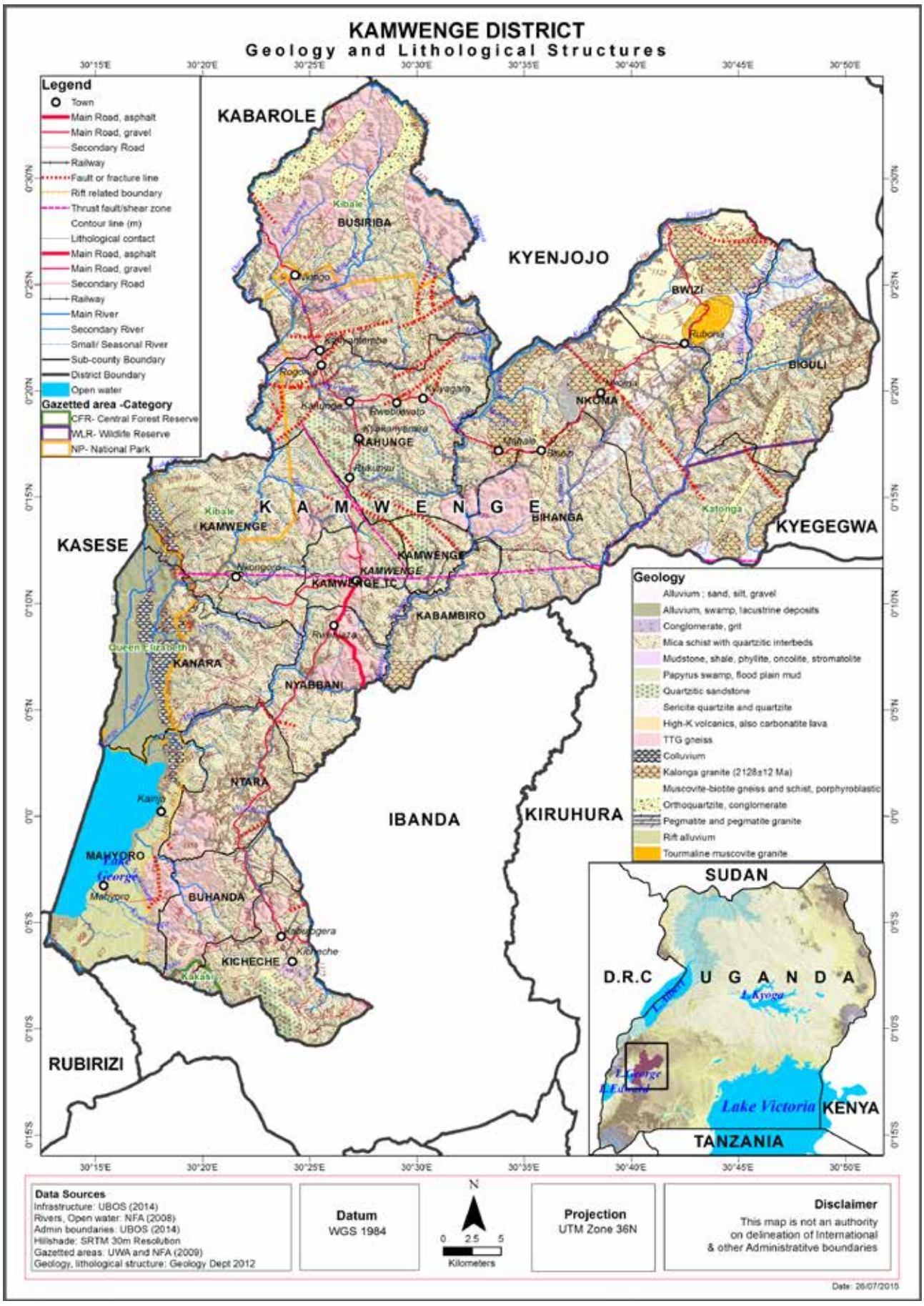


**Figure 3: Geology and Lithological structures, Kamwenge District**

### 2.1.3 Vegetation and Land use stratification

The Biggest area of the district is covered by subsistence farmlands existing in all the sub-counties. The district is endowed with four conservation areas including Queen Elizabeth National Park covering the biggest part west of the district; Kibale National Park covering the northern part of the district, Katonga Wildlife Reserve covering the North east and Kakasi Central Forest reserve in south part of the district. Vegetation cover in the Queen Elizabeth National Park and Katonga Wildlife Reserve is dominated by savanna grasslands, savanna woodlands and bushland pockets. Tropical high forest dominates Kibale National Park and Kakasi Central Forest reserve. Wetlands exist along Dura, Nsonge and Mpanga rivers the main wetland system being located on the shores of Lake George that form the Lake George Ramser site. Other main wetlands exist along Mpanga river in Nkoma and Kahunge sub-counties. Degraded wetlands are strewn along the permanent rivers such as kizikibi in Nkoma, Biguli, Bwizi and Bihaga sub-counties, Magombe river in Busiriba sub-county, Rwentuha river in Ntara, Kyarutanga river forming the boundary with Ibanda district, Nkurungu in Buhanda and Kicheche and Nyakasura in Mahyoro sub-county. Some areas are built up especially in Kamwenge Town council, Kahunge, Kataryeba, Ntara and Kabujogera. Figure 4 shows the land use stratification of Kamwenge District.

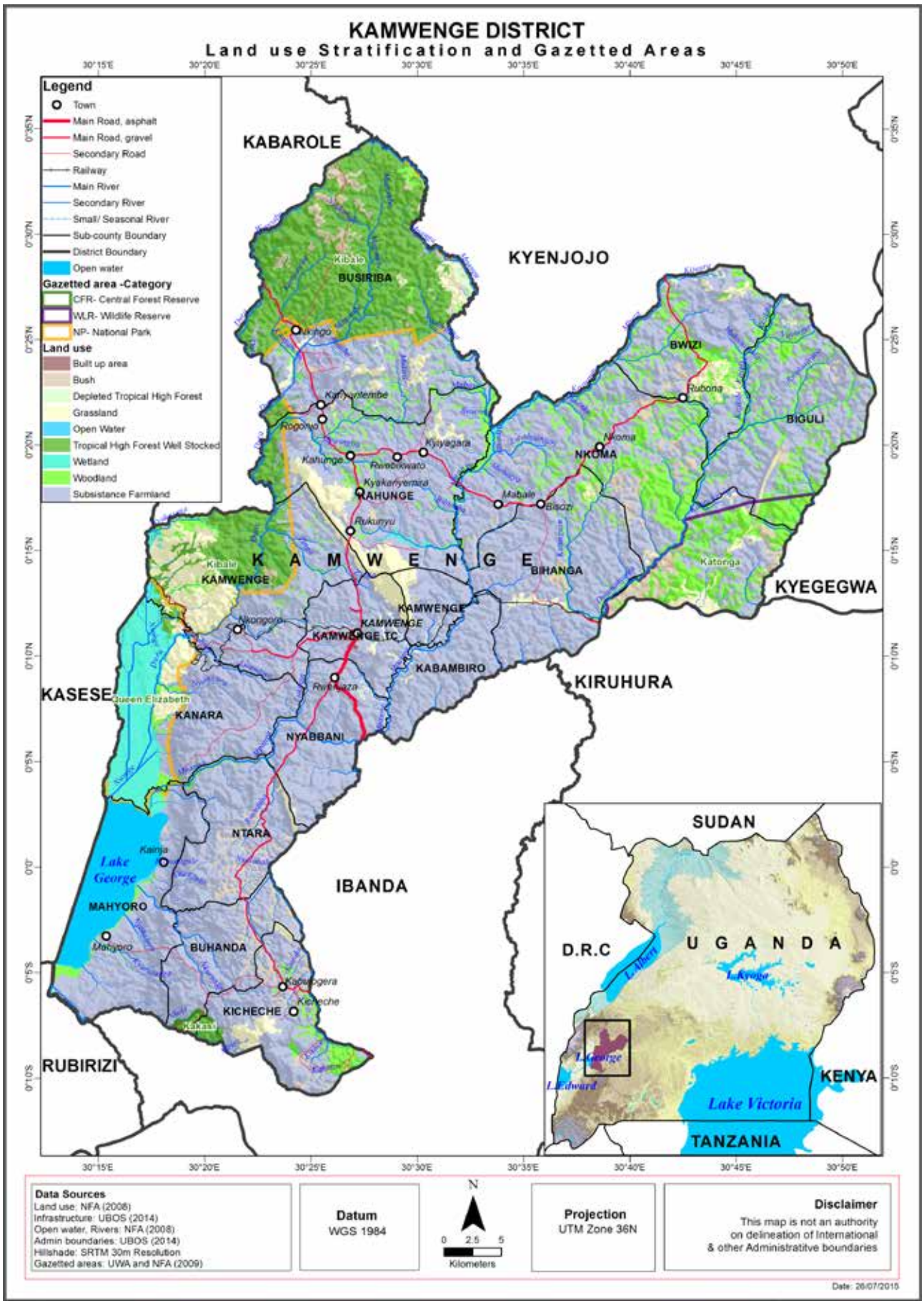


**Figure 4: Land use Stratification of Kamwenge District**

### 2.1.4 Temperature and Humidity

Kamwenge District experiences small annual variation in air temperatures; and the climate may be described as generally hot 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 Kicheche and areas adjacent to Kibale National park in Busiriba sub-county. The relative humidity is higher during rain seasons with maximum levels prevalent in May. Areas covered by Kibale National Park and Kakasi Central Forest reserve experience the highest the relative humidity levels up to 80% due to high evapotranspiration from the tropical high forest. The lowest humidity levels occur in dry seasons with minimum levels occurring in December and January. The average monthly humidity for Kamwenge 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, Kamwenge experiences moderate to strong and gusty winds, increasing in the afternoon.

### 2.1.6 Rainfall

Total Annual Rainfall received by Kamwenge District ranges between 972mm- 1356mm per annum. Lowest rainfall amounts are experienced along the great East African rift valley especially in Mahyoro and Kanara sub-counties with rainfall between about 972mm -1000mm per annum. Highest annual rainfall between 1250mm -1356mm are experienced in Kibale National Park in Busiriba sub-county. Other areas with high rainfall amounts include hilly areas of Kicheche sub-county also with rainfall ranging between 1200mm -1300mm (Figure 5)

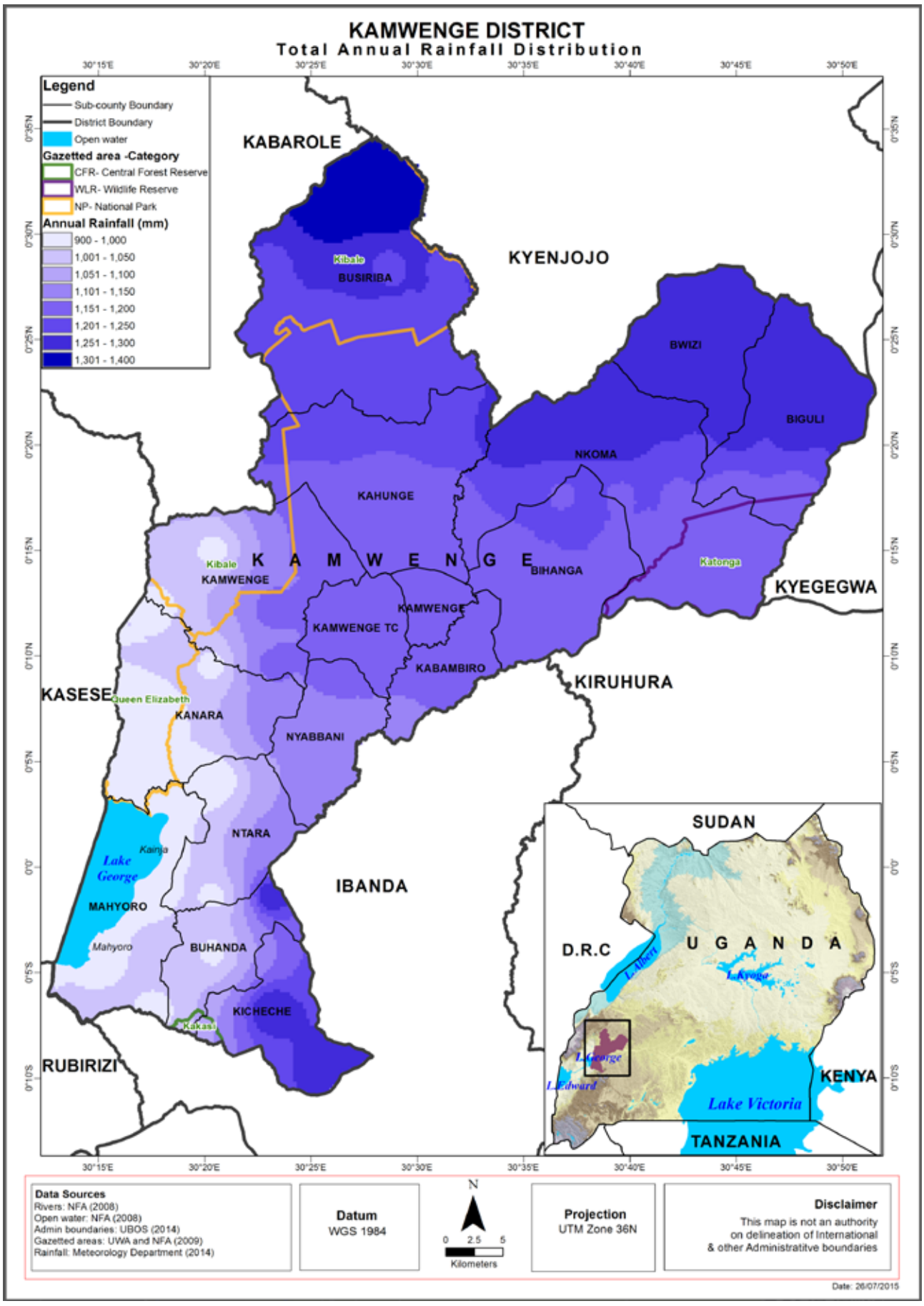


**Figure 5: Rainfall Distribution, Kamwenge District**

### 2.1.7 Hydrology

Kamwenge District lies in the Lake George - Edward basin. The main water body in the district is Lake George located south west of the district and shared by three districts (Kasese, Rubirizi and Kamwenge). Other main surface water bodies include permanent rivers that drain into Lake George i.e. Dura, Nsonge and Mpanga rivers forming the main wetland system on the shores of Lake George. Other rivers draining into Lake George include: Buhindagi forming the boundary with Ribirizi district, Nkurungu in Buhanda and Kicheche sub-counties and Nyakasura in Mahyoro sub-county. Tributaries draining into Mpanga river include kizikibi in Nkoma, Biguli, Bwizi and Bihaga sub-counties, Rwentuha river in Ntara, Kyarutanga river forming the boundary with Ibanda district. Tributaries draining into Dura river include Magombe river in Busiriba sub-county. Areas on the shore of Lake George are poorly drained and flood prone (Figure 9).

### 2.1.8 Population

According to the National population and housing census 2014 provisional results, Kamwenge District had a total population of 421,470. Results also showed that most of the people in Kamwenge District reside in rural areas (402,230(95.4%) compared to (19,240(4.6%) who reside in urban centers. The gender distribution was reported to be males: 205,802 (48.8%) and females: 215,668 (51.2%). About 99% (417,394) of the population form the household population and only 1% (4076) is Non-household. Rwamwanja refugee settlement had the highest population of 39736 people while Kanara sub-county had the least population of 13755 people. Table 1 shows the population distribution per sub-county for the different gender.

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

| | HOUSEHOLDS | | POPULATION | | |
|---|---|---|---|---|---|
| ***Sub-County*** | ***Number*** | ***Average Size*** | ***Males*** | ***Females*** | ***Total*** |
| Biguli | 7,056 | 4.9 | 17,099 | 17,461 | 34,560 |
| Bihanga | 2,987 | 4.8 | 6,872 | 7,367 | 14,239 |
| Busiriba | 5,998 | 4.7 | 13,755 | 14,841 | 28,596 |
| Bwizi | 6,097 | 4.9 | 15,330 | 15,152 | 30,482 |
| Kabambiro | 3,639 | 4.5 | 7,760 | 8,699 | 16,459 |
| Kahunge | 7,640 | 4.8 | 17,703 | 19,098 | 36,801 |
| Kamwenge | 4,947 | 4.6 | 10,918 | 12,039 | 22,957 |
| Kamwenge Town Council | 4,655 | 4 | 9,514 | 9,726 | 19,240 |
| Nkoma | 6,851 | 4.7 | 16,762 | 16,049 | 32,811 |
| Rwamwanja Refugee Settlement | 8,913 | 4.4 | 19,531 | 20,205 | 39,736 |
| Buhanda | 5,238 | 4.7 | 11,775 | 12,759 | 24,534 |
| Kanara | 3,037 | 4.5 | 6,640 | 7,135 | 13,775 |
| Kicheche | 5,774 | 4.6 | 13,023 | 13,860 | 26,883 |
| Mahyoro | 6,811 | 4.3 | 14,566 | 14,700 | 29,266 |
| Ntara | 5,866 | 4.9 | 14,028 | 15,135 | 29,163 |
| Nyabbani | 4,601 | 4.8 | 10,526 | 11,442 | 21,968 |

*Source: UBOS Census 2014*

### 2.1.9 Economic Activities

Majority of the population in Kamwenge District engages in subsistence agriculture where cultivation of food crops such as bananas, maize, beans, finger millet, cassava, groundnuts and sweet potatoes is dominant. However, a considerable number of the households practice livestock production and the animals reared are cattle, goats, sheep, pigs and chicken. Fishing is also a major economic activity for most people in Mahyoro sub-county.

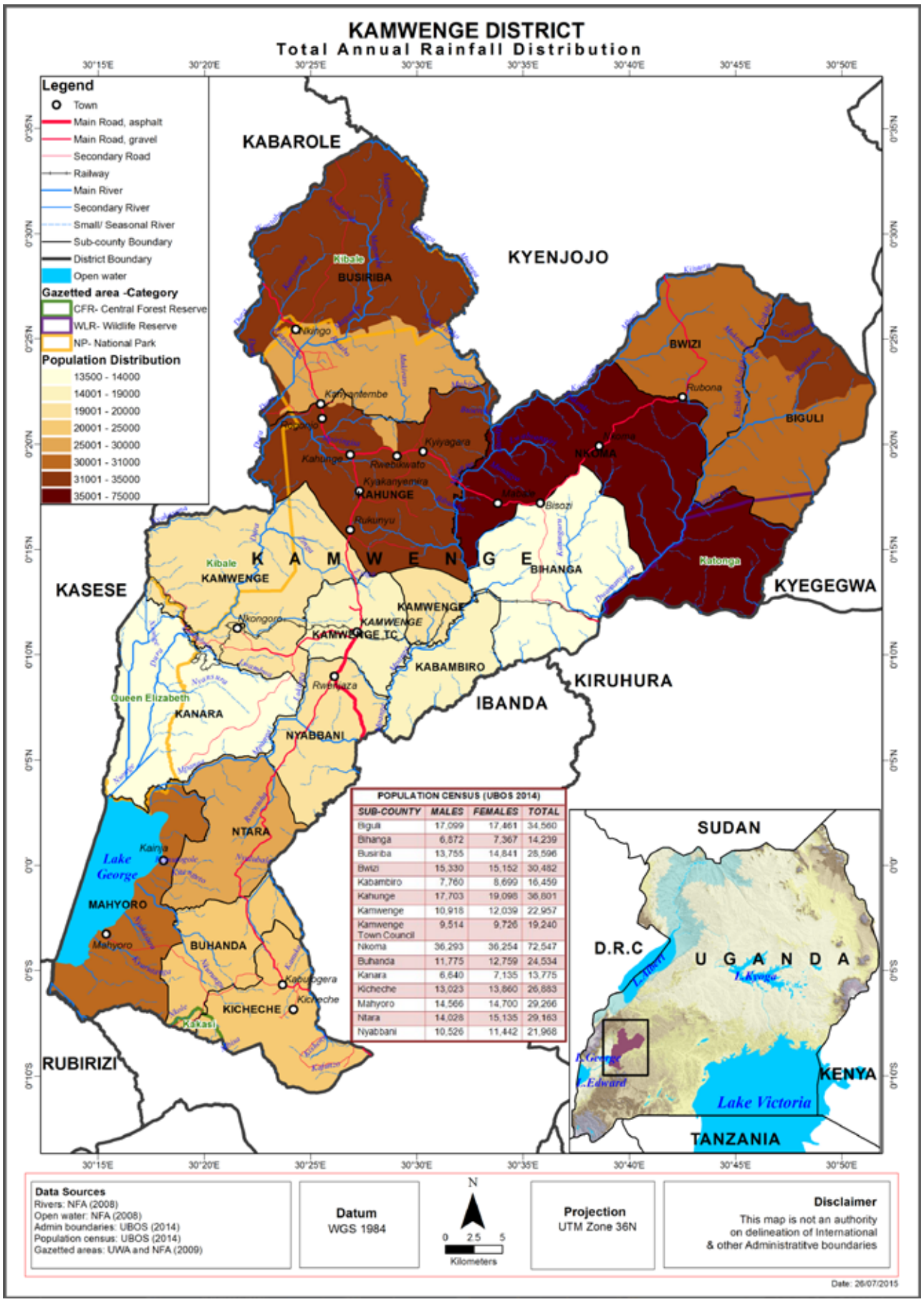


**Figure 6: Population Distribution, Kamwenge District**

## 2.2.0 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 four respondents (District Forest officer, District Planner, Clerk to council and Physical planner) was held at Kamwenge District Headquarters (UTM, 215919; 20078).

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 Busiriba Sub-county (UTM, 211136; 45436), Nkoma Sub-county (UTM, 237691; 36800) and Ntara Sub-county (UTM, 206032; 9999687). 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 FGDs 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 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.

## 2.3.0 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 Kamwenge 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 Kamwenge District Forest officer, District Planner, Clerk to council and Physical planner. Focus Group Discussions were held in Busiriba Sub-county (UTM, 189457; 9919393), Nkoma Sub-county (UTM, 203959; 9944588) and Ntara Sub-county (UTM, 213752; 9949711).

Results from the participatory assessment revealed that soil erosion, landslides and rock falls are some of the hazard that have been experienced in Kamwenge District during the rainy seasons over the past 10 years. Participants reported that incidences of landslides, rock falls and soil erosion are more pronounced at the areas neighboring the rift valley escarpment in Mahyoro, Buhanda, Ntara and Kanara sub-counties. These hazards destroy people's gardens in the above mentioned sub-counties during the rainy season. 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.

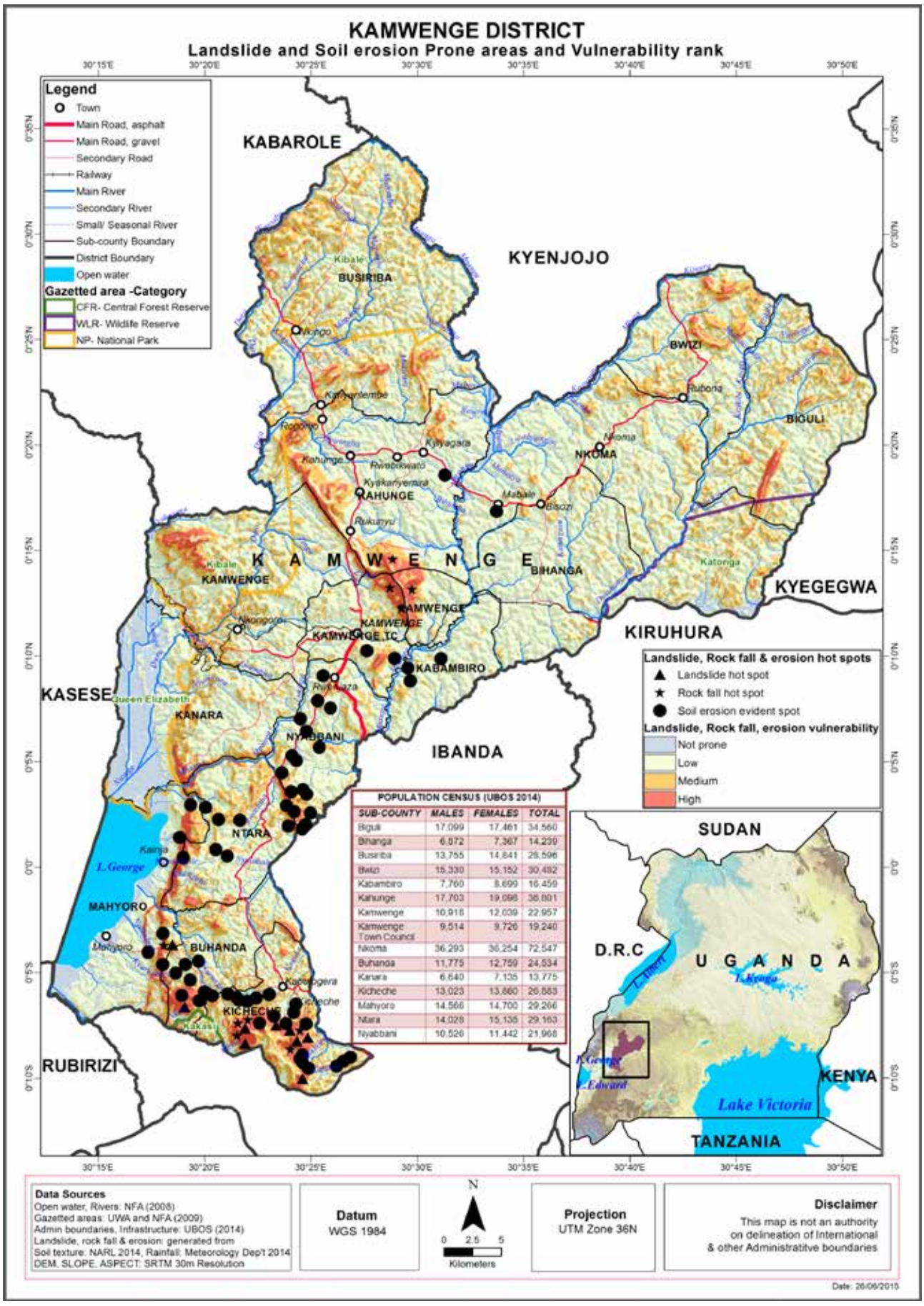


**Figure 7: Landslides, Rock falls, Soil erosion prone areas, Kamwenge District**

### 2.3.2.2 Earthquakes and Faults

Results from the discussions showed that earthquakes and faults weren't a serious problem in Kamwenge District. However, incidences of light tremors were reported to have been experienced in Kamwenge District as a whole. It was also observed that faults and cracks can be seen along the rift valley escarpment in the sub-counties of Mahyoro, Buhanda, Ntara and Kanara. 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.

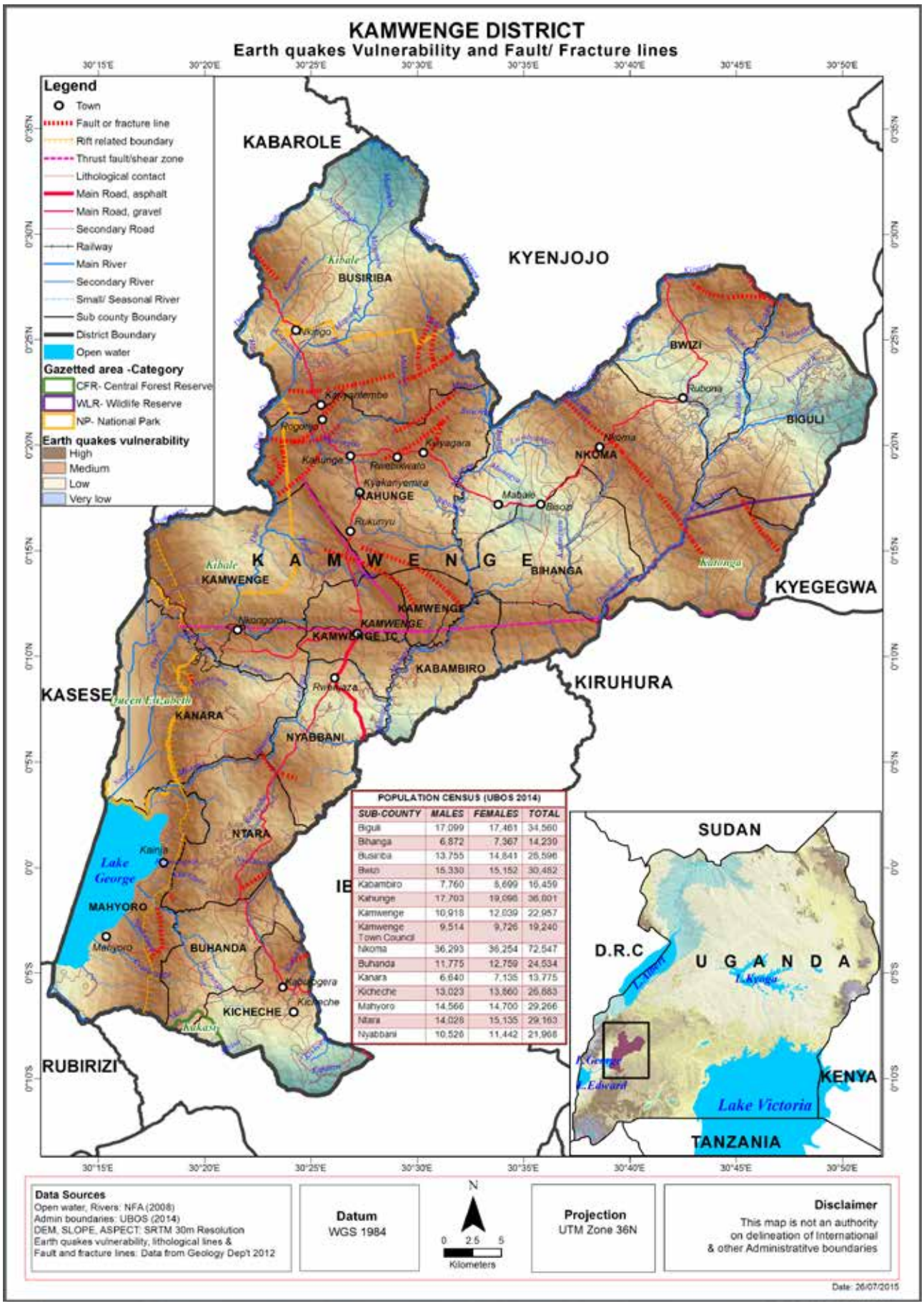


**Figure 8: Earth quakes, Fault/ Fracture lines, Kamwenge District**

### 2.3.3 CLIMATOLOGICAL OR METEOROLOGICAL HAZARDS

#### 2.3.3.1 Floods

Results from the participatory assessments indicated that floods in Kamwenge District mainly occur along the banks of River Mpanga, shores of Lake George, low lying areas and wetlands during the rainy season. Participants also observed that the floods that occur along the shores of Lake George displace households in Mahyoro sub-county. Kikooyo and Rweera wetlands in Kicheche sub-county along the Kitagwenda- Kamwenge and Kitagwenda-Ibanda roads respectively flood in the rainy season thus blocking traffic. The other sub-counties affected by floods include: Busiriba, Kahunge, Nkoma, Kabambiro, Nyabbani and Kanara. 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.


***Plate 1: River Mpanga Bridge prone to Flooding***

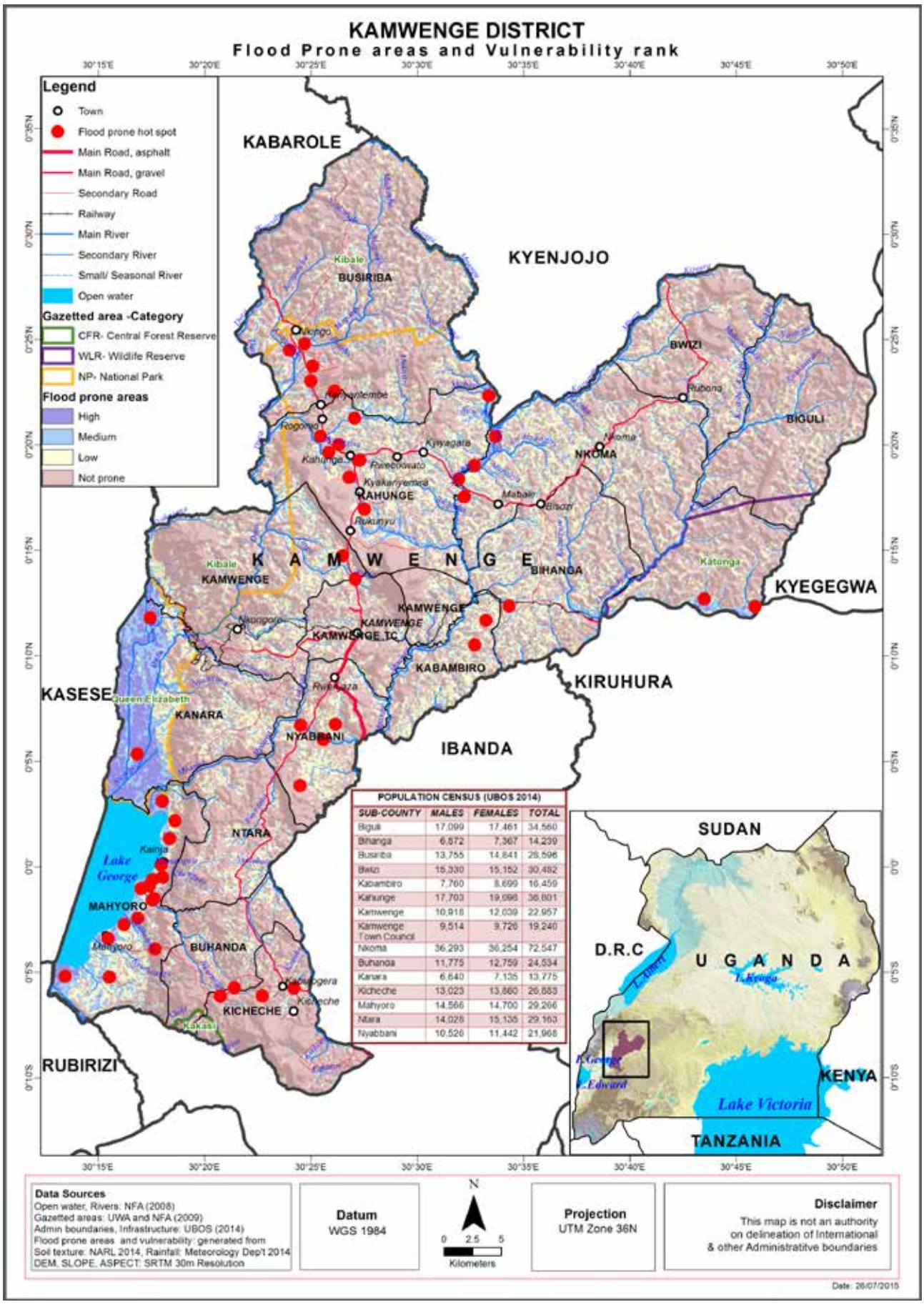


**Figure 9: Flood prone areas and Ranking, Kamwenge District**

### 2.3.3.2 Drought

It was observed in the participatory assessments that the entire District of Kamwenge experiences drought and dry spells during the dry season. Participants of the discussions reported that there has been increased crop failure in Kamwenge District as a whole because of the scarce absolute rainfall that falls unreliably. The most vulnerable sub-counties to drought are; Biguli, Nkoma and Bihanga. 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 drought.

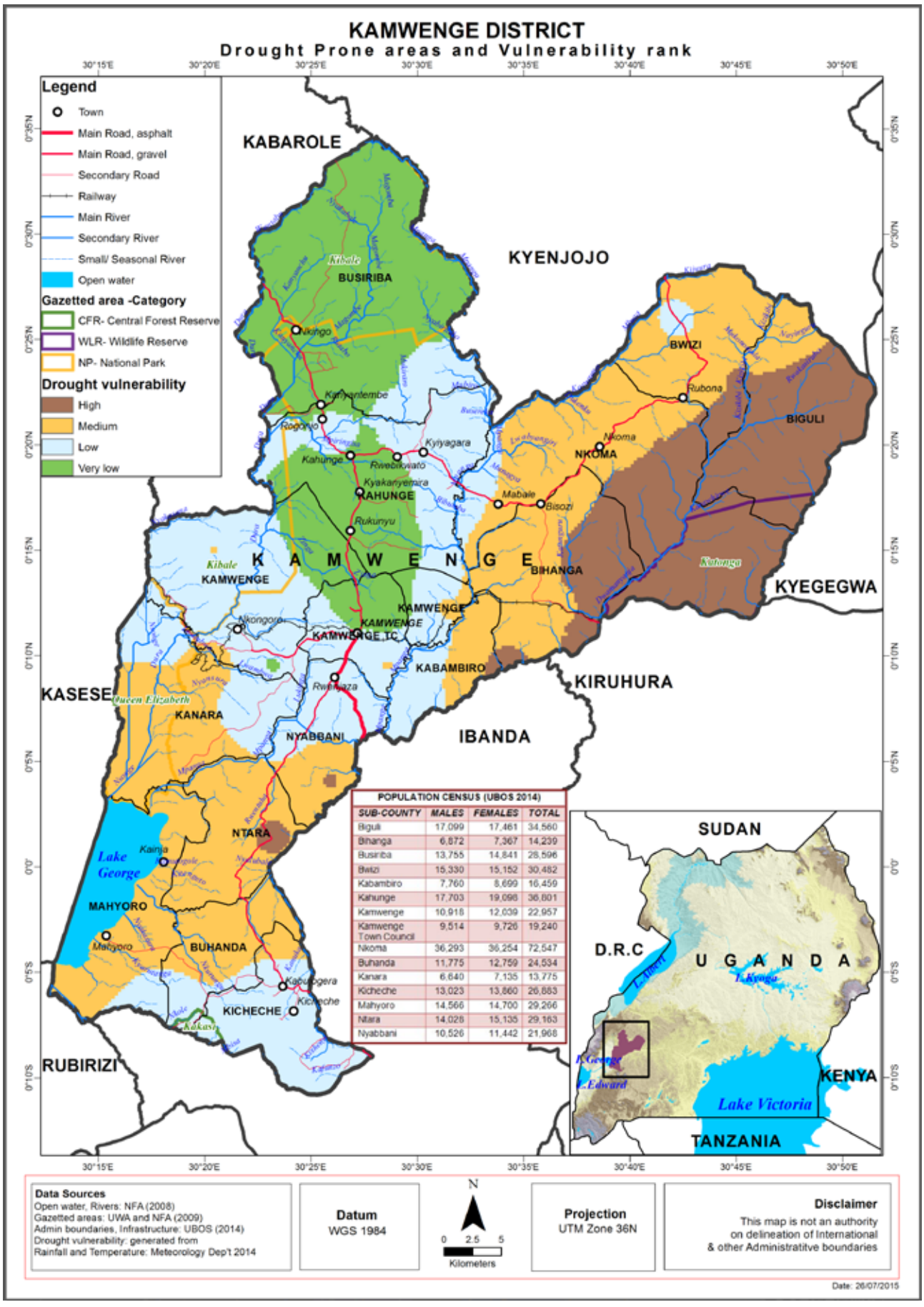


**Figure 10: Drought prone areas and Ranking, Kamwenge District**

### 2.3.3.3 Hailstorms

Results from the discussions indicated that incidences of hailstorms were common in Kamwenge District during the rainy season. Participants reported that hailstorms usually occur in the rainy season and destroy banana and coffee plantations, maize, beans and cassava. In 2012, the hailstorm that hit areas of Kabambiro and Nyabbani sub-counties destroyed banana plantations, maize, beans, cassava and millet. This led to the intervention by the Office of the Prime Minister which provided seeds to the affected communities. The most affected sub-counties include: Nyabbani, Kabambiro, Ntara and Busiriba.

### 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 Kamwenge district. The general conclusion from these climatic figures is that for most of the year, Kamwenge District experiences moderate to strong and

gusty winds. Results from the Participatory assessment indicated that strong winds weren't a serious problem in Kamwenge District. However, incidences of strong winds were reported to have destroyed banana plantations and other crops including maize, millet and cassava in Nyabbani and Kabambiro. The other affected sub-counties include: Kamwenge, Bwizi, Mahyoro and Kahunge.

### 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. Results from the participatory assessments showed that there have been incidences of lightning strikes in Kamwenge District during rainy seasons. In 2015, three people were killed by lightening in Kiyagara, Kahunge sub-county. It was reported that schools are more at risk to lightening because they lack lightening conductors. The most affected sub-counties included: Buhanda, Ntara and Nkoma. Figure 11 shows Hailstorms, Strong winds, Lightening Vulnerability and ranking as well as hot spots where the hazards are prominent.

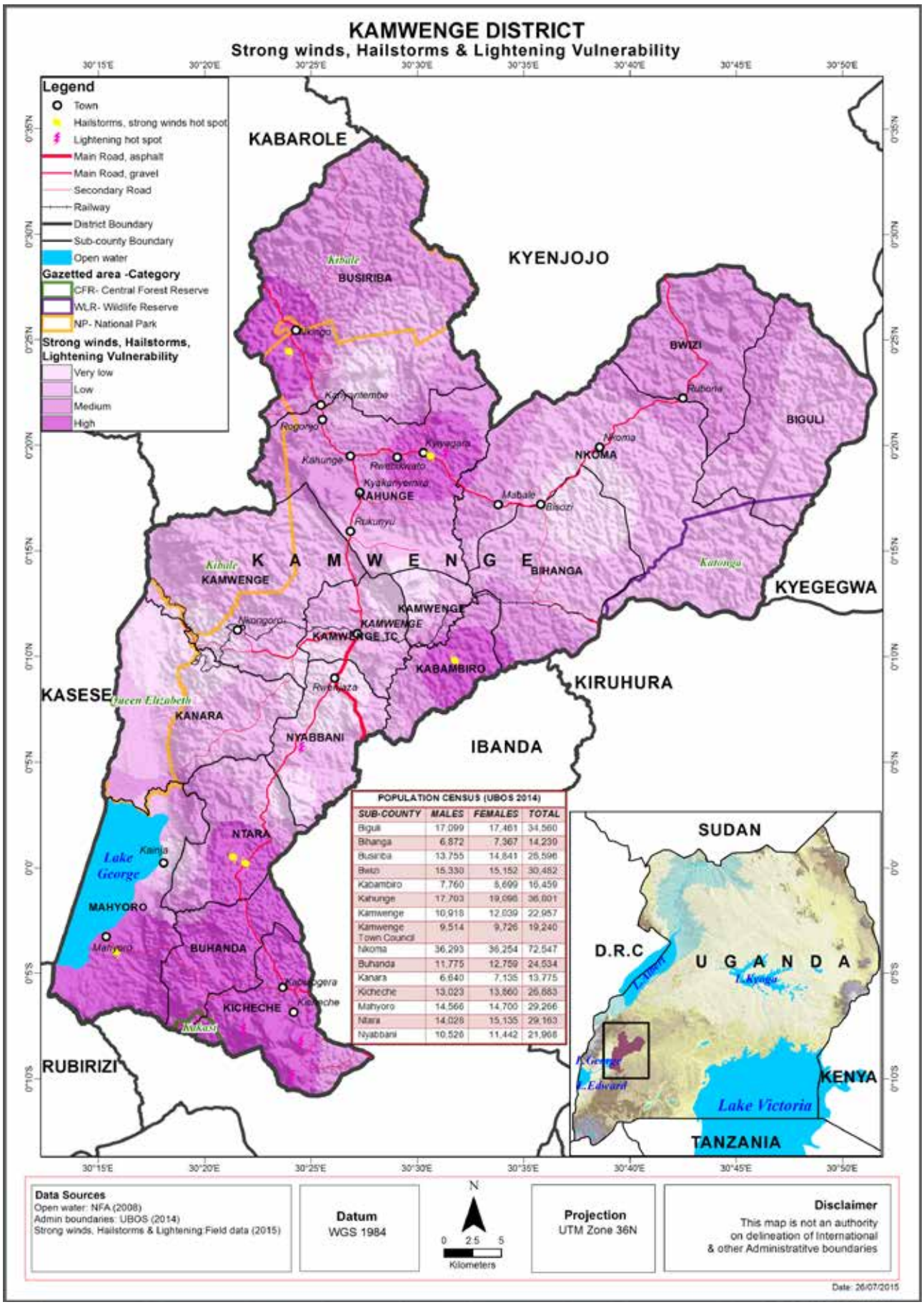


**Figure 11: Hailstorms, Strong winds, Lightening Vulnerability, Kamwenge District**

### 2.3.4 ECOLOGICAL OR BIOLOGICAL HAZARDS

#### 2.3.4.1 Crop Pests and Diseases

Results from participatory assessments revealed that crop farmers in Kamwenge District are vulnerable to crop pests and diseases. The most affected crops were bananas and coffee which were affected by banana bacterial wilt and Panama wilt and coffee wilt disease respectively. The most reported crop pests included: coffee twig borer, root mealy bug and caterpillar. Participants mentioned that the entire district is affected by crop pests and diseases. However, Nyabbani was the most affected sub-county (Figure 12).

***Plate 2: Banana plantation affected by BBW in Ntara, Kamwenge District***

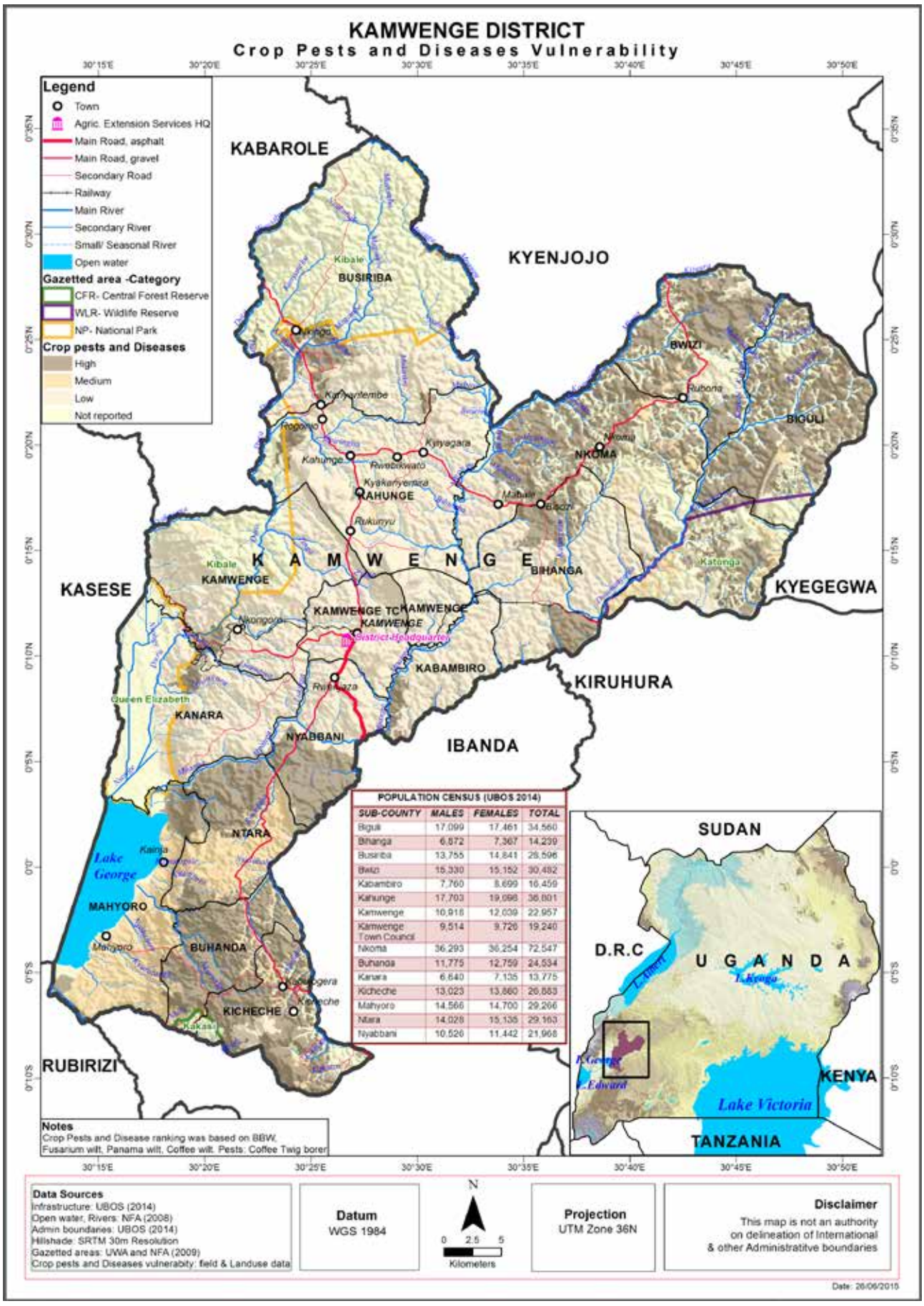


**Figure 12: Crop Pests and Diseases Vulnerability, Kamwenge District**

### 2.3.4.2 Livestock Pests and Diseases

Participatory assessments through focus group discussions indicated that livestock in Kamwenge District are seriously affected by livestock pests and diseases. The most reported livestock diseases included; foot and mouth disease, rabies, Newcastle disease and coccidiosis while the most reported pests were ticks. Several measures such as vaccination of animals and quarantine have been taken by district authorities to control foot and mouth disease. The most affected sub-counties were Nkoma, Busiriba, Ntara, Nyabbani, Kanara and Bihanga. Figure 13 shows areas vulnerable to Livestock pests and diseases.

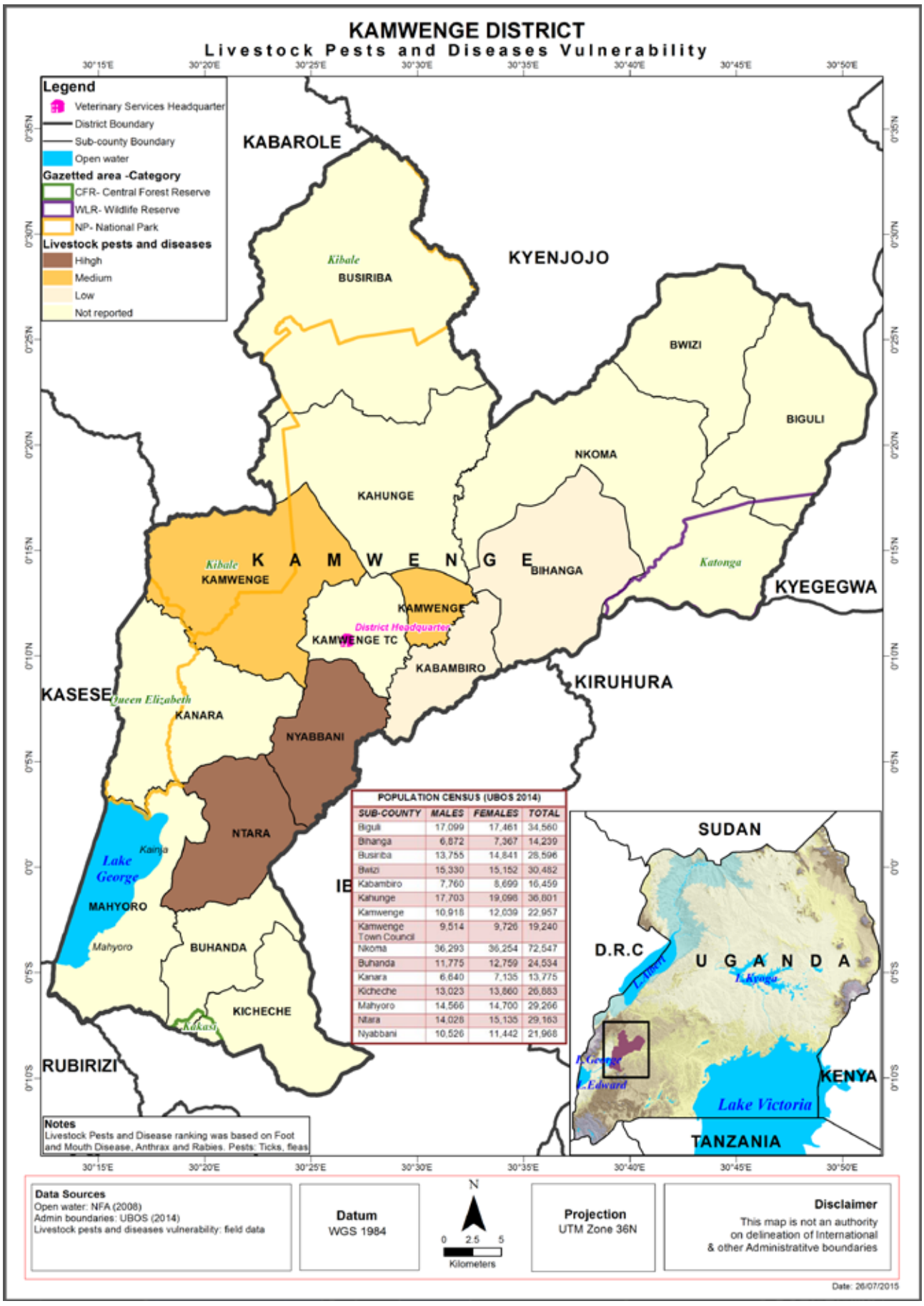


**Figure 13: Livestock Pests and Diseases Vulnerability, Kamwenge District**

### 2.3.4.3 Human Diseases outbreaks

Participatory assessments through focus group discussions revealed that malaria; HIV/AIDS, measles, typhoid, river blindness and elephantiasis are the most prominent human diseases in Kamwenge District. It was reported that Busiriba and Kahunge sub-counties were majorly affected by river blindness, measles and elephantiasis. Participants also indicated that HIV/AIDS prevalence rates were high in Kamwenge town council and at Mahyoro and Kainja landing sites on Lake George. Incidences of cholera outbreaks which killed four people were reported in Rugarama parish, Ntara sub-county. It was observed that the entire district is affected by malaria and typhoid. Figure 14 shows areas vulnerable to Human disease outbreaks basing on malaria; HIV/AIDS, measles, typhoid, river blindness and elephantiasis occurrence rates. The map also shows location of the different Health facilities in the district.

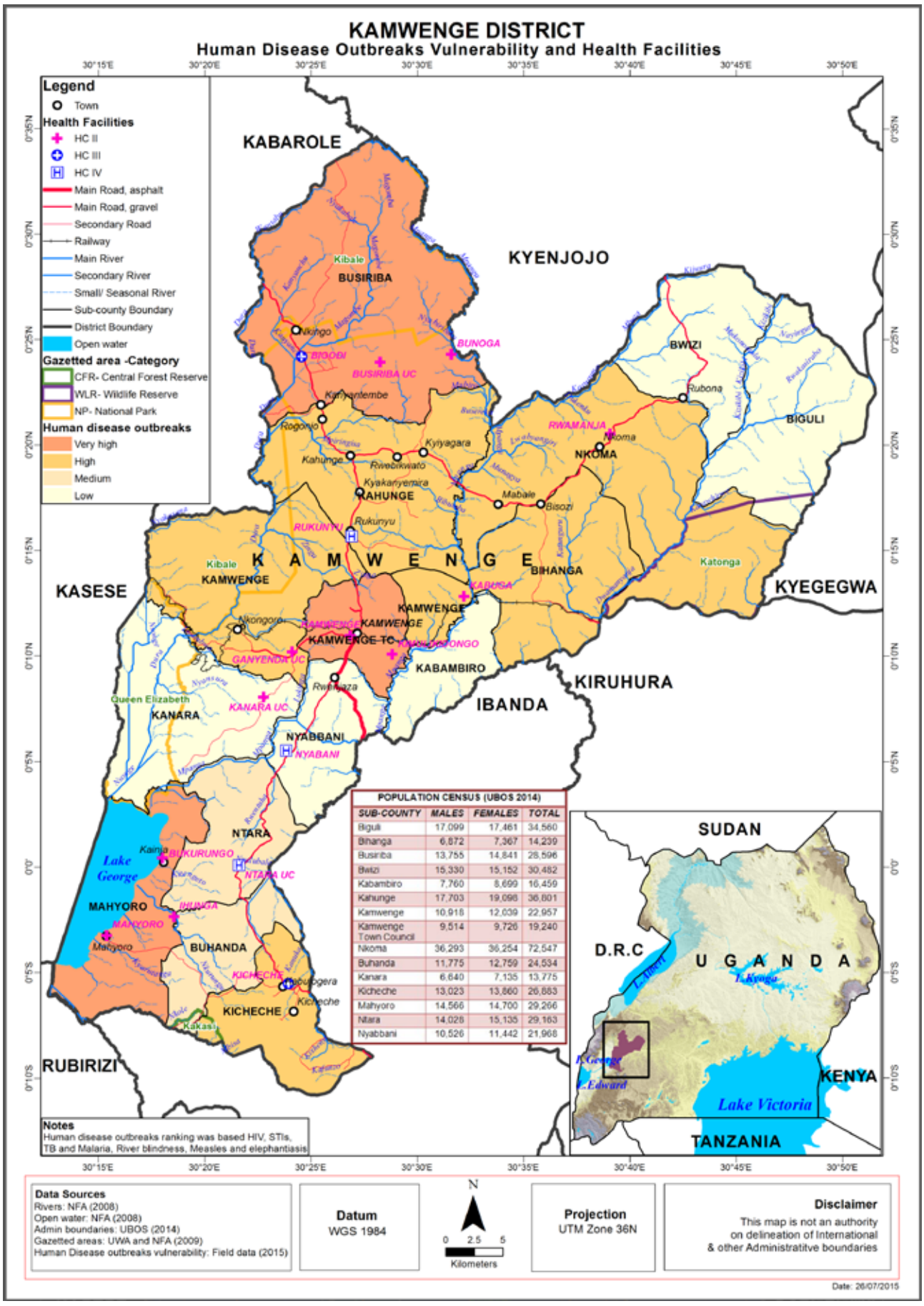


**Figure 14: Human Disease outbreaks Vulnerability, Heath facilities, Kamwenge District**

### 2.3.4.4 Vermin and wildlife animal attacks

In the series of focus group discussions held, participants revealed that vermin and wildlife animal attacks have been on the increase in areas neighboring Kibale and Queen Elizabeth National Parks. Results showed that baboons, monkeys and elephants destroy crops such as sorghum, millet, maize, ground nuts and beans in Busiriba, Kahunge, Kamwenge and Kanara sub-counties. The picture below shows Trench dug in Busiriba sub-county to control elephant attacks and crop rainding.

**Plate 3: Trench dug in Busiriba, Kamwenge District**

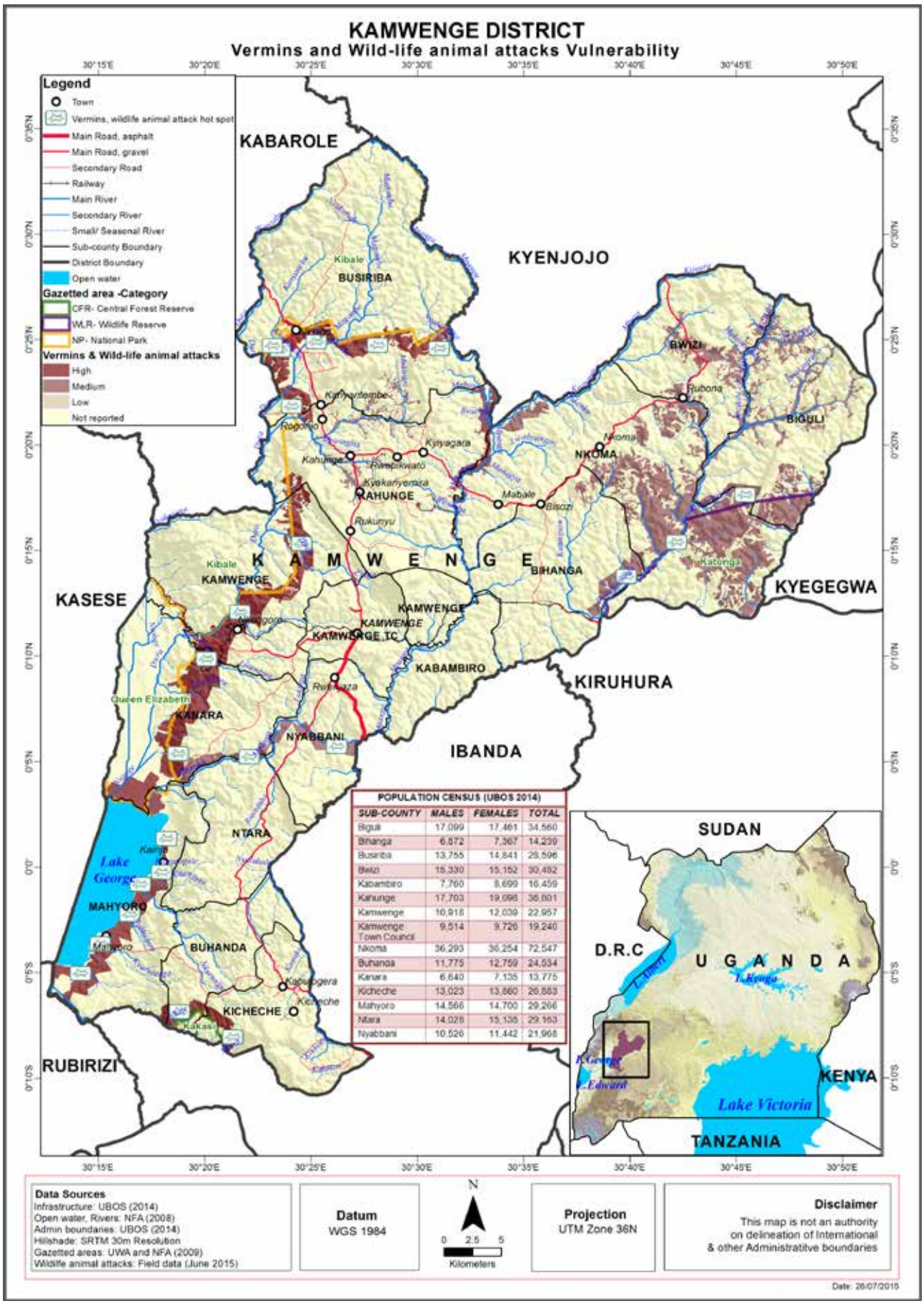


**Figure 15: Vermin, Wild-life Animal attacks, Kamwenge District**

### 2.3.4.5 Invasive species

Results from the discussions indicated that *Lantana camara, Oxalis latifolia* and *Pasperum spp*. were the most mentioned invasive species in Kamwenge District. Pockets of Lantana camara were reported to be dominant in parts of Kibale and Queen Elizabeth National Parks in Busiriba, Kamwenge and Kanara sub-counties while Oxalis latifolia and pasperum spp. were dominant in Kicheche and Ntara sub-counties. Figure 16 shows areas prone to invansive species basing on *Lantana camara, Oxalis latifolia* and *Pasperum spp*. Occurrence.

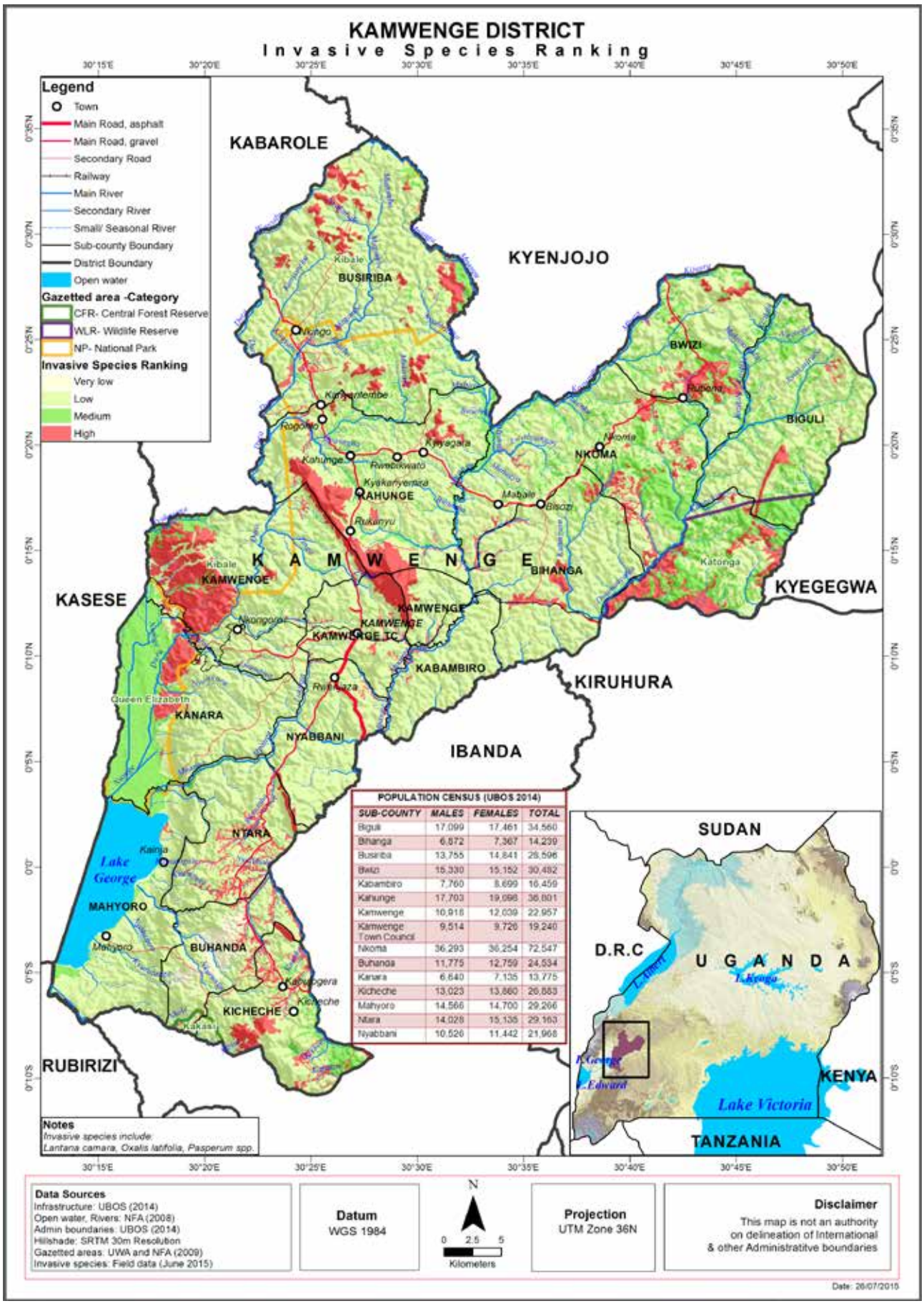


**Figure 16: Invasive Species Ranking, Kamwenge District**

### 2.3.5 HUMAN INDUCED AND TECHNOLOGICAL HAZARDS

#### 2.3.5.1 Bush fires

It was observed that bush fires weren't a serious problem in Kamwenge District. However, few incidences of forest and bush fires were reported in the district especially among pine and eucalyptus growers in Kahunge, Nyabbani and Kamwenge sub-counties and Kamwenge town council.

#### 2.3.5.2 Land Conflicts

Participatory assessments through focus group discussions revealed that land conflicts were a major problem between local communities surrounding Rwamwanja refugee camp. Incidences of administrative boundary conflicts were also reported between Kanara and Kamwenge sub-counties over Dura limestone quarry (Figure 17).

**Plate 4: Rwamwanja Settlement in Nkoma, Kamwenge District**

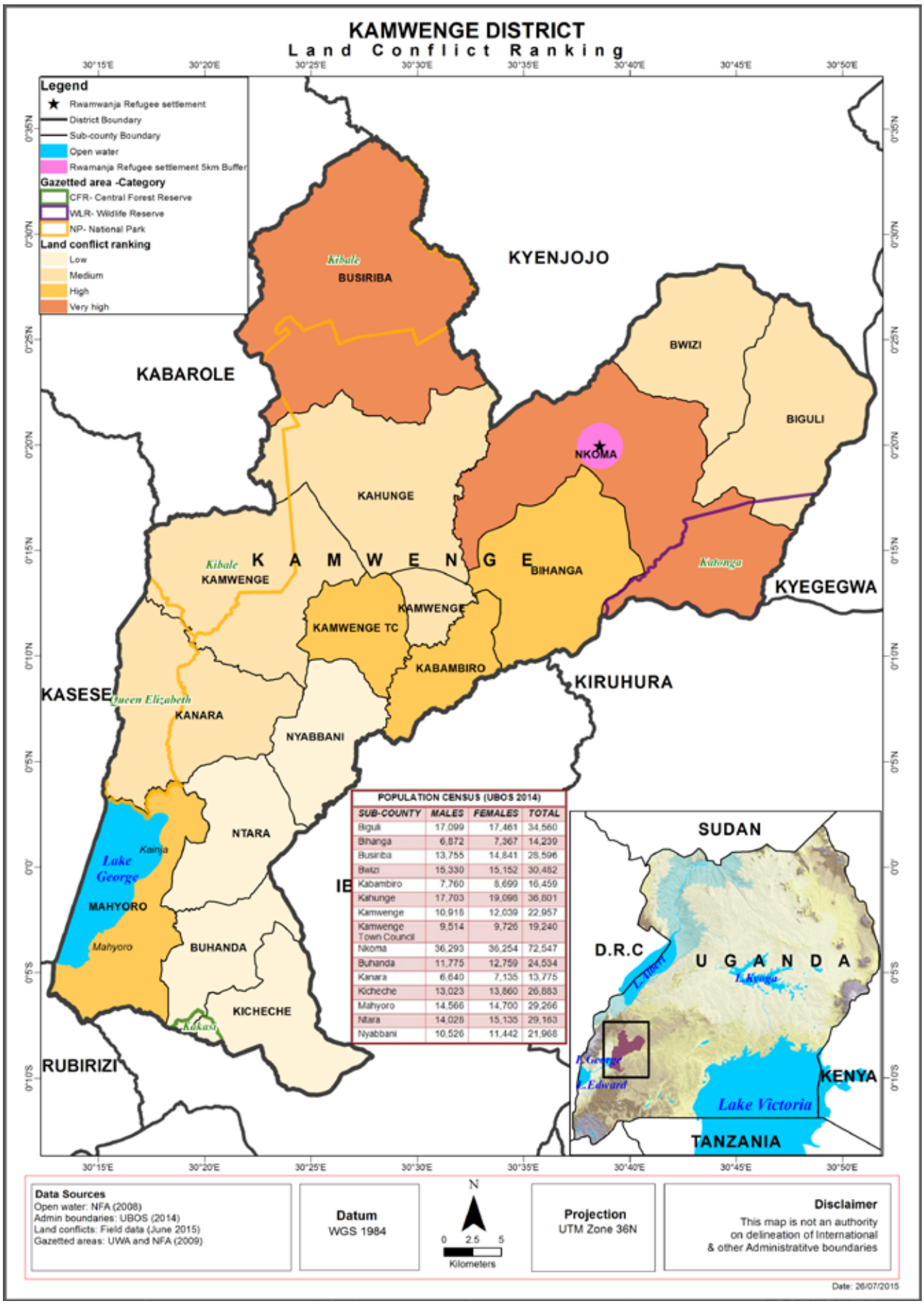


**Figure 17: Land Conflict Ranking, Kamwenge District**

### 2.3.5.3 Environmental Degradation

Deforestation, wetland reclamation, limestone quarrying and bush burning are the most common forms of environmental degradation in Kamwenge District. Results from the participatory assessments indicated that the processes of limestone quarrying such as blasting are a nuisance to the wild animals in Kibale national park covering part of Kamwenge sub-county. Participants reported that deforestation was severe in Busiriba and Kamwenge sub-counties. Activities such as brick-laying and clay extraction were reported to be destroying wetlands Kicheche, Buhanda, Ntara and Kahunge sub- counties (Figure 18).

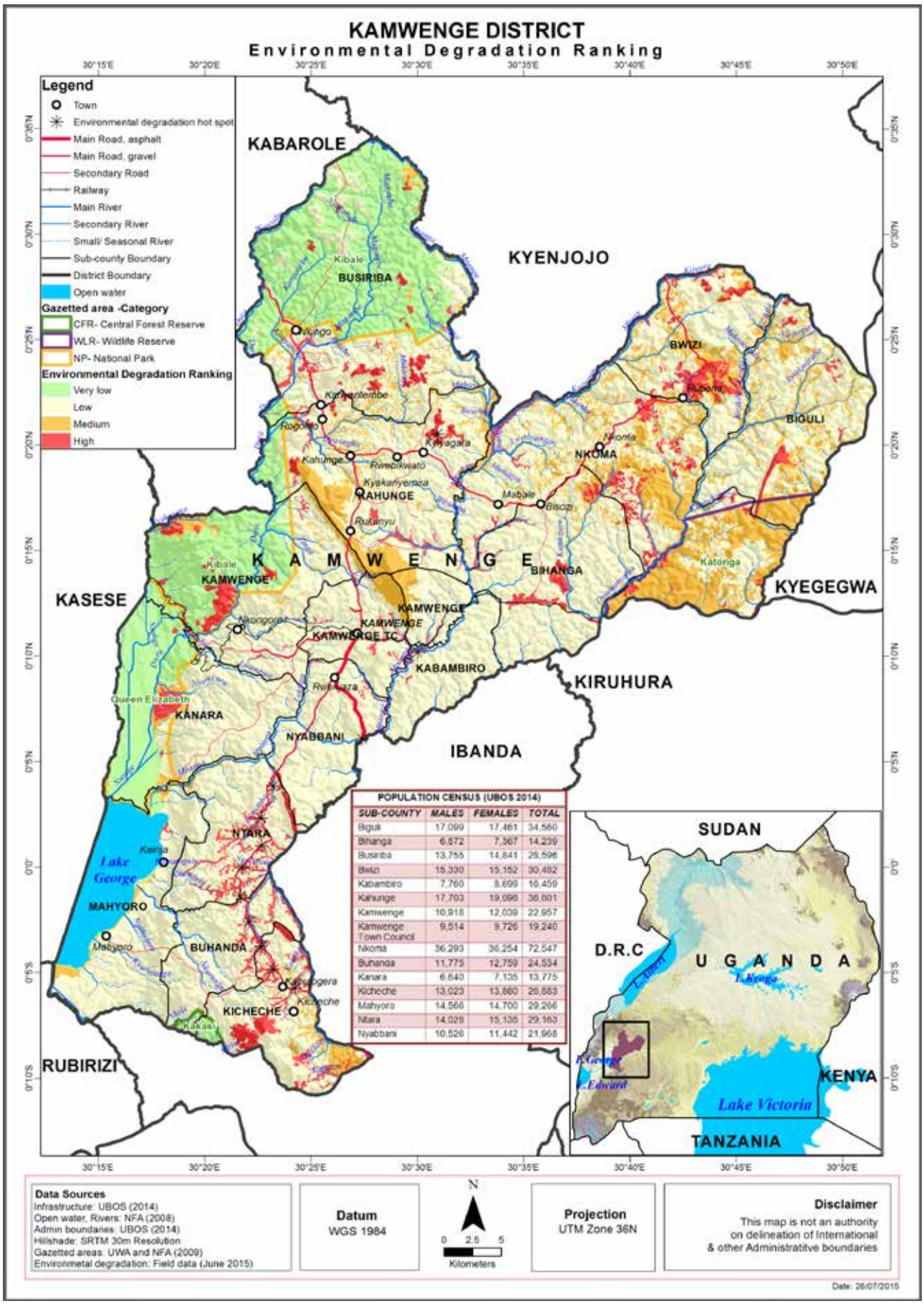


**Figure 18: Environmental Degradation ranking, Kamwenge District**

### 2.3.5.4 Road Accidents

Results from the discussions indicated road accidents mainly occur along Ibanda-Kamwenge-Fort portal highway. Other cases of road accidents were reported along Mahyoro-Kabujogera, Kahunge-Kihura and Kamwenge-Kitagwenda roads leading to livestock and human injuries. The accidents are mainly caused by over speeding, soil erosion gulleys and narrow roads (Figure 19).

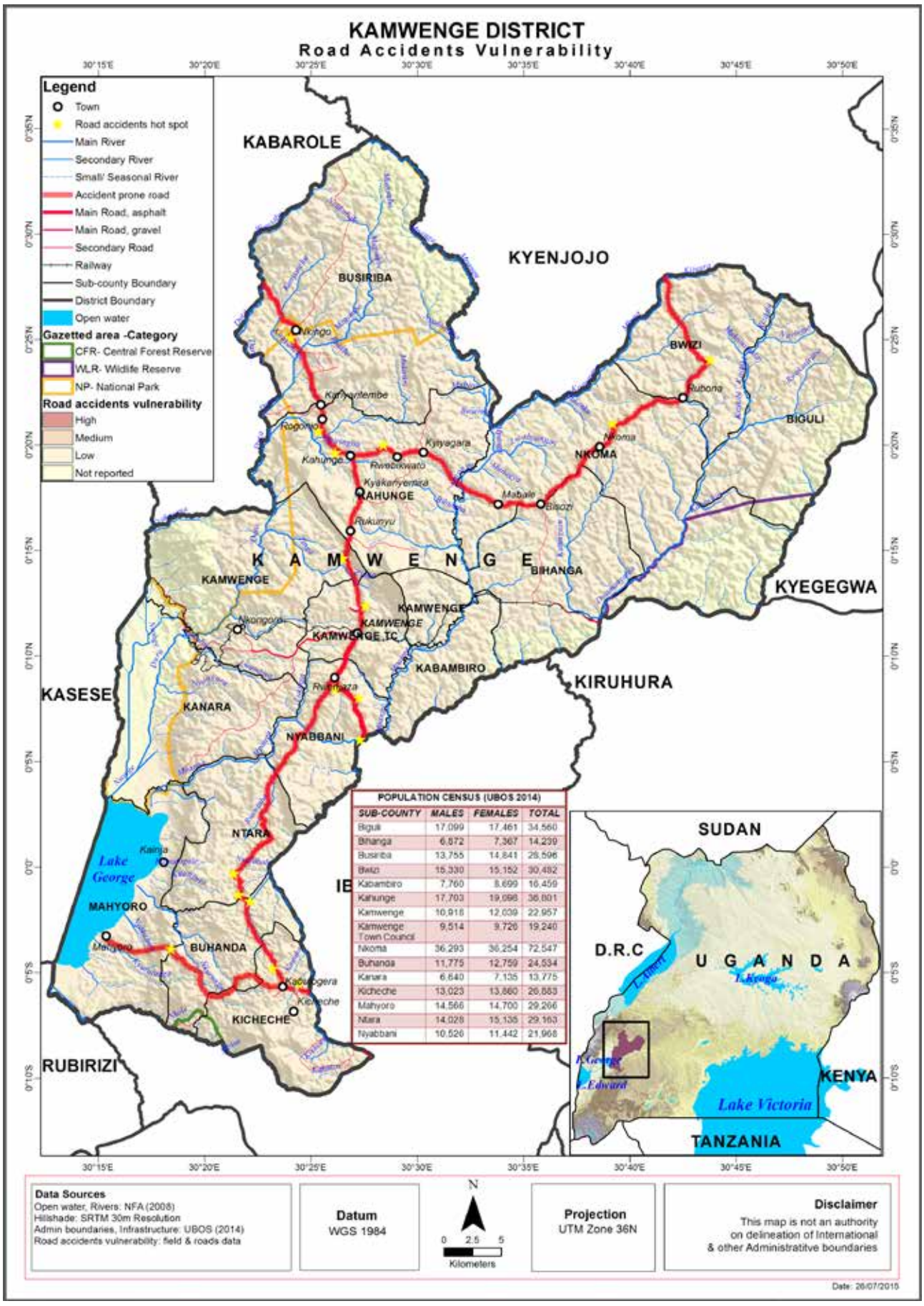


**Figure 19 Road Accidents Ranking, Kamwenge District**

## 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 Kamwenge District**

| No | Multi-Hazards | | Coping strategies |
|---|---|---|---|
| 1 | Geomorphological or Geological | Landslides, Rock falls and Erosion | • Migration to safe areas<br>• Terracing/ contour farming<br>• Plant trees to control water movement on hill slopes<br>• Mulching in banana plantations<br>• Plant grass in banana plantations on hill slopes<br>• Removal of stones from banana farmlands |
| 2 | | Earthquakes and faults | • No action, communities think the tremors are minor |
| 3 | Climatological or Meteorological | Floods | • Digging up of trenches in the flood plains<br>• Planting trees to control water movement to flood plains<br>• Migration to other areas<br>• Seek for government food aid |
| 4 | | Drought | • Leave wetlands as water catchments<br>• Plant trees as climate modifiers<br>• Buy food elsewhere in case of shortage<br>• Buy water from the nearby areas<br>• Food Storage especially dry grains |
| 5 | | Strong winds, Hailstorms and Lightening | • Plant trees as wind breakers<br>• Use of stakes against wind in banana plantations<br>• Use of ropes to tire banana against wind<br>• Installation of lightening conductors<br>• Stay indoors during rains<br>• Changing building designs and roof types<br>• Removal of destroyed crops<br>• Request for aid from the Office of the Prime Minister<br>• Installation of lightening conductors on newly constructed schools |
| 6 | Ecological or Biological | Crop pests and Diseases | • Spraying pests<br>• Cutting and burying BBW affected crops<br>• Burning of affected crops<br>• Vigilance |
| 7 | | Livestock pests and Diseases | • Spraying pests<br>• Vaccinations<br>• Burying animals that have died from infection<br>• Quarantine |
| 8 | | Human epidemic Diseases | • Mass immunisation<br>• Visiting health centres<br>• Use of mosquito nets |
| 9 | | Vermin and Wild-life animal attacks | • Guarding the gardens<br>• Poisoning<br>• Hunt and kill<br>• Report to UWA |
| 10 | | Invasive species | • Uproot<br>• Cut and burn<br>• Sensitization on Invasive species management |
| 11 | Human induced or technological | Land conflicts | • Community dialogues<br>• Report to court<br>• Migration |
| 12 | | Bush fires | • Stop the fires in case of fire outbreak<br>• Fire lines (may be constructed, cleared grass)<br>• Fire breaks planted along gardens e.g. euphorbia spp.<br>• Vigilance especially in dry seasons where most burning is done |
| 13 | | Road accidents | • Construction of humps<br>• New road has Signage including speed limits<br>• Sensitisation |
| 14 | | Environmental degradation | • Leave wetlands as water catchments<br>• Plant trees as climate modifiers<br>• Sensitization |

## 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 Kamwenge 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 Kamwenge District.

## Table 3: Components of vulnerability in Kamwenge 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 | - Human and livestock adjacent to hill slopes<br>- Crops on hill slopes<br>- Infrastructure e.g. houses, schools, roads adjacent to hill slopes | Parish | - Loss of lives<br>- Complete crop failure<br>- Destruction of infrastructure e.g. homes, and schools | Parish | -Migration<br>-Sensitization by both government and non-governmental agencies | Parish |
| | Earth quakes | - Infrastructure e.g. houses, schools | District | - Loss of lives<br>- Destruction of Infrastructure e.g. houses, schools | District | -No much measure so far | District |
| | Floods | - Livestock adjacent to flood plain<br>- Crops on flood plain<br>- Infrastructure e.g. houses, schools, roads adjacent to flood plain | Parish | - Livestock loss<br>- Destruction of crops<br>- Destruction of infrastructure e.g. houses, schools, roads adjacent to flood plain | Parish | -Migration<br>-Sensitization on wetland conservation<br>-Dig trenches | Parish |
| | Drought | - Livestock<br>- Crops<br>- Human population | Village | - Hunger & poverty<br>- Livestock loss<br>- Crop failure<br>- Shortage of pasture<br>- Shortage of water | Village | -Migration<br>-Sensitization on tree planting<br>-Buy food from elsewhere | Village |
| | Hailstorms, strong winds and Lightening | - Human and livestock populations<br>- Crops<br>- Infrastructure e.g. houses, schools, health centres | Parish | - Loss of lives<br>- Destruction of crops<br>- Destruction of infrastructure e.g. houses, schools, roads adjacent to flood plain | Parish | | Parish |
| | Crop Pests and Diseases | - Crops | District | - Complete crop failure | District | - Spraying<br>- Cut and burry affected crops<br>-Sensitization on crop disease management | District |
| | Livestock Pests and Diseases | -Livestock (cattle, goats etc.) | District | - Loss of livestock<br>- Reduced livestock productivity | District | - Vaccination<br>- Burry and burn animals that have died from infection<br>- Quarantine | District |
| | Human Disease outbreaks | - Human Population | District | - Loss of lives | District | - Mass Immunization<br>- Use of mosquito nets | District |
| | Invasive species | -indigenous species<br>-Animals | District | - Outcompete the indigenous spp., suppress growth of indigenous spp<br>- Loss of indigenous spp.<br>- Complete crop Failure<br>- suppress growth of pasture | District | - Cut and burn<br>-Sensitization on Invasive species management | District |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Bush fires | - Livestock<br>- Crops<br>- Infrastructure e.g. houses, schools | Sub-county | - Loss of livestock<br>- Shortage of pasture<br>- Destruction of crops<br>- Destruction of infrastructure e.g. houses, schools | Sub-county | -Sensitization | Sub-county |
| | Road accidents | - Human population<br>- Infrastructure adjacent to accident black spots e.g. houses, schools etc. | Sub-county | - Loss of lives<br>- Destruction of vehicles<br>- Destruction of Infrastructure adjacent to accident black spots e.g. houses, schools etc. | Sub-county | -Humps on roads<br>-Signage on speed limits<br>-Sensitization on traffic rules | Sub-county |
| | Land conflicts | - Human population | Village | -Loss of lives<br>-Family violence and break outs | Village | - Community dialogue<br>- District court in charge of land issues | Village |
| | Vermins and Wildlife animal attacks | - Human population<br>- Livestock<br>- Crops | Parish | -Loss of lives<br>-Livestock loss<br>-Crop destruction | Parish | - Report to UWA<br>- Guard gardens<br>-Poison<br>-Hunt and kill<br>-Fence water collection points with Wildlife animals | Village |
| | Environmental degradation | - Human and livestock populations<br>- Crops<br>- Natural vegetation | Sub-county | -Crop failure<br>-Shortage of pasture<br>-Shortage of water<br>-Decline of water quality | Sub-county | -Sensitization on wetland conservation<br>-Sensitization on tree plating<br>-Setting bi-laws | Sub-county |

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

| | PROBABILITY | SEVERITY OF IMPACTS | RELATIVE RISK | VULNERABLE SUB COUNTIES |
|---|---|---|---|---|
| | *Relative likelihood this will occur* | *Overall Impact (Average)* | *Probability x Impact Severity* | |
| Hazards | *1 = Not occur<br>2 = Doubtful<br>3 = Possible<br>4 = Probable<br>5 = Inevitable* | *1 = No impact<br>2= Low<br>3=medium<br>4 = High* | *0-1= Not Occur<br>2-10 = Low<br>11-15=Medium<br>16-20= High* | |
| Floods | 4 | 2 | 8 | The most affected sub-counties included: Mahyoro, Kahunge and Busiriba. |
| Droughts | 4 | 3 | 12 | Biguli, Bihanga, Bwizi and Nkoma are the most affected sub-counties. |
| Soil erosion, rock falls and landslides | 5 | 2 | 10 | Buhanda, Kanara, Mahyoro and Ntara are the most affected. |
| Hail storms, lightening and strong winds | 5 | 2 | 10 | Bwizi, Kabambiro, Kahunge, Kamwenge, Mahyoro and Nyabbani are the most affected sub-counties. |
| Bush fires | 3 | 2 | 6 | Most affected sub-counties are Biguli, Bihanga, Bwizi, Kahunge, Kamwenge, Nkoma, Kanara and Nyabbani. |
| Crop pests and diseases | 4 | 3 | 12 | The entire district is affected. However, Nyabbani is the most vulnerable. |
| Livestock pests and diseases | 4 | 3 | 12 | Nkoma, Busiriba, Ntara, Nyabbani, Kanara and Bihanga are the most affected sub-counties. |
| Human Diseases outbreaks | 5 | 3 | 15 | Busiriba, Kahunge, Mahyoro, Ntara sub-counties, Kamwenge town council and Rwamwanja refugee settlement are the most affected. |
| Land conflicts | 5 | 3 | 15 | Kamwenge, Nkoma and Kanara sub-counties and Rwamwanja refugee settlement are the most affected. |
| Vermin and Wild-life animal attacks | 5 | 3 | 15 | Biguli, Busiriba, Kahunge, Kamwenge and Kanara are the most affected sub-counties. |
| Earthquakes and faults | 3 | 2 | 6 | Minor tremors occur in all sub-counties of the district. |
| Road accidents | 3 | 3 | 9 | Kamwenge sub-county and Kamwenge town council are the most affected. |
| Environmental degradation | 5 | 2 | 10 | Busiriba, Kamwenge, Nkoma and Kanara 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 reported/ Not prone |

**Table 5: Hazard Risk Assessment**

| Hazard | Biguli | Bihanga | Busiriba | Bwizi | Kabambiro | Kahunge | Kamwenge | Kamwenge T.C | Nkoma | Rwamwanja Refugee | Buhanda | Kanara | Kicheche | Mahyoro | Ntara | Nyabbani |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Floods | M | M | H | M | M | H | M | M | M | L | M | M | M | H | M | M |
| Drought | H | H | L | H | M | L | L | L | H | H | M | M | L | M | M | L |
| Landslides, Rock falls and Erosion | L | L | L | L | L | M | M | M | M | L | H | H | M | H | H | M |
| Strong winds, Hailstorms and Lightening | L | L | L | M | M | M | M | L | L | L | L | L | L | M | L | M |
| Crop pests and Diseases | M | M | M | M | M | M | M | L | M | L | M | M | M | L | M | M |
| Livestock pests and Diseases | H | H | M | H | M | M | M | L | H | L | L | M | M | L | M | M |
| Human disease outbreaks | M | M | H | M | M | H | M | H | M | H | M | M | M | H | H | M |
| Vermin and Wildlife animal attacks | H | M | H | M | M | H | H | M | M | L | M | H | M | M | M | M |
| Land conflicts | M | L | L | L | L | L | H | M | H | H | L | H | L | L | L | L |
| Bush fires | M | M | L | M | L | M | M | M | M | L | L | M | L | L | L | M |
| Environmental degradation | M | M | H | M | M | M | H | M | H | L | M | H | M | M | M | M |
| Earthquakes and faults | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L |
| Road accidents | L | L | L | L | L | L | M | M | L | L | L | L | L | L | L | L |

Key

| | |
|---|---|
| H | High |
| M | Medium |
| L | Low |
| N | Not reported/ Not prone |

## 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 Kamwenge 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 Kamwenge 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 Kamwenge district increase their vulnerability to hazard exposure necessitating urgent external support.

Hazards experienced in Kamwenge 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 5: Key Informant Interview with District Officers at Kamwenge District**

**Plate 6: Focus Group Discussion in Nyabani Sub-county**

**Plate 7: Focus Group Discussion in Mahyoro Sub-county**

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

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

| No. | Name of Participants | Designation | Contact | Signature |
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**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:<br>Sub- county:<br>Parish:<br>Village: | GPS Coordinates | |
| | | X: | |
| | | Y: | |
| | | Altitude | |

| No. | Name of Participants | Village/ Parish | Contact | Signature |
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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, wild-life 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

<table>
<tr><td colspan="2" rowspan="4">Observer Name:<br><br><br>Date:</td><td colspan="2" rowspan="4">District:<br>Sub- county:<br><br>Parish:<br><br>Village:</td><td colspan="2">Coordinates</td></tr>
<tr><td>X:</td><td></td></tr>
<tr><td>Y:</td><td></td></tr>
<tr><td>Altitude</td><td></td></tr>
<tr><td colspan="2">Slope characterization</td><td colspan="2">Bio-physical characterization</td><td colspan="2">Vegetation characterization</td><td rowspan="6">Land use type (tick)<br>Bush<br>Grassland<br>Wetland<br>Tree plantation<br>Natural forest<br>Cropland<br>Built-up area<br>Grazing land<br>Others</td></tr>
<tr><td>Slope degree (e.g 10, 20, …)</td><td></td><td>Soil Texture</td><td></td><td>Veg. cover (%)</td><td></td></tr>
<tr><td>Slope length (m) (e.g 5, 10, …)</td><td></td><td>Soil Moisture</td><td></td><td>Tree cover (%)</td><td></td></tr>
<tr><td>Aspect (e.g N, NE…)</td><td></td><td>Rainfall</td><td></td><td>Shrubs cover (%)</td><td></td></tr>
<tr><td>Elevation (e.g high, low…)</td><td></td><td>Drainage</td><td></td><td>Grass / Herbs cover (%)</td><td></td></tr>
<tr><td>Slope curvature (e.g concave, covex…)</td><td></td><td>Temperature</td><td></td><td>Bare land cover</td><td></td></tr>
<tr><td colspan="7">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)</td></tr>
<tr><td colspan="7"></td></tr>
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**With support from:**
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