THE REPUBLIC OF UGANDA

# Kayunga District

## Hazard, Risk and Vulnerability Profile

2016

# ACKNOWLEDGEMENT

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

I extend my sincere thanks to the Department of Relief, Disaster Preparedness and Management, under the leadership of the Commissioner, Mr. Martin Owor, for the oversight and management of the entire exercise.

The HRV assessment team was led by Ms. Ahimbisibwe Catherine, Senior Disaster Preparedness Officer supported by Mr. Kirungi Raymond, Disaster Preparedness Officer and the team of consultants (GIS/DRR specialists); Dr. Bernard Barasa, and Mr. Nsiimire Peter, who provided technical support.

Our gratitude goes to UNDP for providing funds to support the Hazard, Risk and Vulnerability Mapping. The team comprised of Mr. Steven Goldfinch – Disaster Risk Management Advisor, Mr. Gilbert Anguyo - Disaster Risk Reduction Analyst, and Mr. Ongom Alfred-Early Warning system Programmer.

My appreciation also goes to Kayunga District Team:

1. Mr. Robby Odyeny Ocen – Deputy , Chief Administrative Officer

2. Mr. Samuel Mukasa – District Production and Commercial Officer

The entire body of stakeholders who in one way or another yielded valuable ideas and time to support the completion of this exercise.

**Hon. Hilary O. Onek**

Minister for Relief, Disaster Preparedness and Refugees

# EXECUTIVE SUMMARY

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

**Preliminary spatial analysis**

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

**Stakeholder engagements**

Stakeholder engagements were carried out in close collaboration with OPM's DRM team and the District Disaster Management focal persons with the aim of identifying the various hazards ranging from; drought, to floods, landslides, human and animal disease, pests, animal attacks, earthquakes, fires, conflicts etc. Stakeholder engagements were done through Focus Group Discussions (FGDs) and key informant interviews guided by checklist tools (Appendix I). At district level Key Informants included: District Agricultural Officer, District Natural Resources Officer, District Health Inspector and District Planner while at sub-county level Key informants included: Sub-county and Parish chiefs, community Development mobilisers and health workers.

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

**Participatory GIS**

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

**Geo-referencing and ground-truthing**

The identified hazard hotspots in the community profile maps were ground-truthed and geo-referenced using a handheld Spectra precision Global Positioning System (GPS) unit, model: Mobile Mapper 20 set in WGS 1984 Datum. The entities captured included:

hazard location, (Sub-county and parish), extent of the hazard, height above sea level, slope position, topography, neighboring land use among others. Hazard hot spots, potential and susceptible areas will be classified using a participatory approach on a scale of “not reported/ not prone”, “low”, “medium” and “high”.

**Data analysis and integration**

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

**Data verification and validation**

In collaboration with OPM, a five-day regional data verification and validation workshop was organized by UNDP in Mukono 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 Kayunga District 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 lightning
- Ecological or Biological hazards including; crop pests and diseases, livestock pests and diseases, human disease outbreaks, vermin and wildlife animal attacks and invasive species.
- Human induced or Technological hazards including; bush fires, road accidents land conflicts.

General findings from the participatory assessment indicated that Kayunga District has over the past two decades increasingly experienced hazards including; rock falls, soil erosion, floods, drought, hailstorms, strong winds, lightning, crop pests and diseases, livestock pests and diseases, human disease outbreaks, vermin, wildlife animal attacks, invasive species, bush fires, road accidents and land conflicts putting livelihoods at increased risk. Hailstorms, lightning, strong winds, crop pest and diseases, livestock and human diseases were identified as most serious problems in Kayunga District with almost all sub-counties being vulnerable to the hazards. This is because the area is generally flat with no remarkable hills and part of it is a wetland.

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

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

- Building capacities to withstand and cope with the hazards and risks;
- Tackling the root causes of the vulnerability such as poverty, poor governance, discrimination, inequality and inadequate access to resources and livelihood opportunities.

The following were recommended policy actions targeting vulnerability reduction:

- The government should improve enforcement of policies aimed at enhancing sustainable environmental health.
- The government through MAAIF should review the animal diseases control act because of low penalties given to defaulters.
- The government should establish systems to motivate support of political leaders toward government initiatives and programmes aimed at disaster risk reduction.
- The government should increase awareness campaigns aimed at sensitizing farmers/ communities on disaster risk reduction initiatives and practices.
- The government should revive disaster committees at district level and ensure funding of disaster and environmental related activities.
- The government through UNRA and the District Authority should fund periodic maintenance of feeder roads to reduce on traffic accidents.
- The government through MAAIF and the District Production Office should promote drought and disease resistant crop seeds.
- The government through OPM and Meteorology Authority should increase importation of lightning conductors and also reduce taxes on their importation.
- The government through OPM and Meteorology Authority should support establishment of disaster early warning systems.
- The government through MWE increase funding and staff to monitor wetland degradation and non-genuine agro-inputs.
- The government through OPM should improve communication between the disaster department and local communities.
- The government through MWE should promote Tree planting along road reserves.
- The government through MAAIF should fund and recruit extension workers at sub-county level and also facilitate them.

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# LIST OF ACRONYMS

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

## DEFINITION OF KEY TERMS

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

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

**El Niño:** El Niño, in its original sense, is warm water current that periodically flows along the coast of Ecuador and Peru, disrupting the local fishery. This oceanic event is associated with a fluctuation of the inter tropical surface pressure pattern and circulation in the Indian and Pacific Oceans, called the Southern Oscillation. This coupled atmosphere-ocean phenomenon is collectively known as El Niño Southern Oscillation, or ENSO. During an El Niño event, the prevailing trade winds weaken and the equatorial countercurrent strengthens, causing warm surface waters in the Indonesian area to flow eastward to 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).

# INTRODUCTION

## 1.1 Background

Uganda has over the past years experienced frequent disasters that range from drought, to floods, landslides, human and animal diseases, pests, animal attacks, earthquakes, fires, conflicts and other hazards which in many instances resulted in deaths, property damage and losses of livelihood. With the increasing negative effects of hazards that accompany population growth, development and climate change, public awareness and pro-active engagement of the whole spectrum of stakeholders in disaster risk reduction, are becoming critical.

The Government of Uganda is shifting the disaster management paradigm from the traditional emergency response focus toward one of prevention and preparedness. Contributing to the evidence base for Disaster and Climate Risk Reduction action, the Government of Uganda is compiling a National risk Atlas of hazard, risk and vulnerability conditions in the country to encourage mainstreaming of disaster and climate risk management in development planning and contingency planning at National and Local levels.

since 2013, 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 above exercise, local government officials and community members have actively participated in data collection and analysis. The data collected was used to generate hazard risk and vulnerability maps and profiles. Validation workshops were held in close collaboration with Ministries, District Local Government (DLG), Development Partners, Agencies and academic/research institutions. The developed maps show the geographical distribution of hazards and vulnerabilities up to sub-county level of each district. The analytical approach to identify risk and vulnerability to hazards in the pilot sub-regions visited of Rwenzori and Teso was improved in subsequent sub-regions.

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

## 1.2 Objectives of the study

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

### *1.2.1 Main objective*

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

### *1.2.3 Specific Objectives*

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

i. Collect and analyze field data generated using GIS in close collaboration and coordination with OPM.

ii. Develop District specific multi-hazard risk and Vulnerability profile using a standard methodology.

iii. Preserve the spatial data to enable use of the maps for future information.

iv. Produce age and sex disaggregated data in the HRV maps.

## 1.3 Scope of Work

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

i. Collection of field data using GIS in close collaboration and coordination with OPM in Kayunga district and quantify them through a participatory approach on a scale of "not reported/ not prone", "low", "medium" and "high".

ii. Analysis of field data and review the quality of each hazard map which should be accompanied by a narrative that lists relevant events of their occurrence. Implications of hazards in terms of their effects on stakeholders with the vulnerability analysis summarizing the distribution of hazards in the district and exposure to multi-hazards in sub-counties.

iii. Compilation of the entire district multi-hazard, risk and vulnerability HRV Profiles in the time frame provided.

iv. Generating complete HRV profiles and maps and developing a database for all the GIS data showing disaggregated hazard risk and vulnerability profiles to OPM and UNDP.

## 1.4 Justification

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

Activity 4.1 is “Conduct national hazard, risk and vulnerability (HRV) assessment including sex and age disaggregated data and preparation of district profiles.”

### 1.5 Structure of the Report

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

## OVERVIEW OF KAYUNGA DISTRICT

### 2.1 Location

Kayunga District was curved out of Mukono District in December 2000. It is located between coordinates: 01 00N and 32 52E in Central Uganda. Kayunga district is bordered by Amolatar District to the north, Buyende District to the northeast, Kamuli District to the east, Jinja District to the southeast, Buikwe District to the south, Mukono District to the southwest, Luweero District to the west, Nakasongola District to the northwest. The district has 8 sub-counties and 1 Town Council. These include; Bbaale, Galiraaya, Kayonza, Kitimbwa, Busana, Kangulumira, Kayunga and Nazigo sub-counties and Kayunga Town Council.

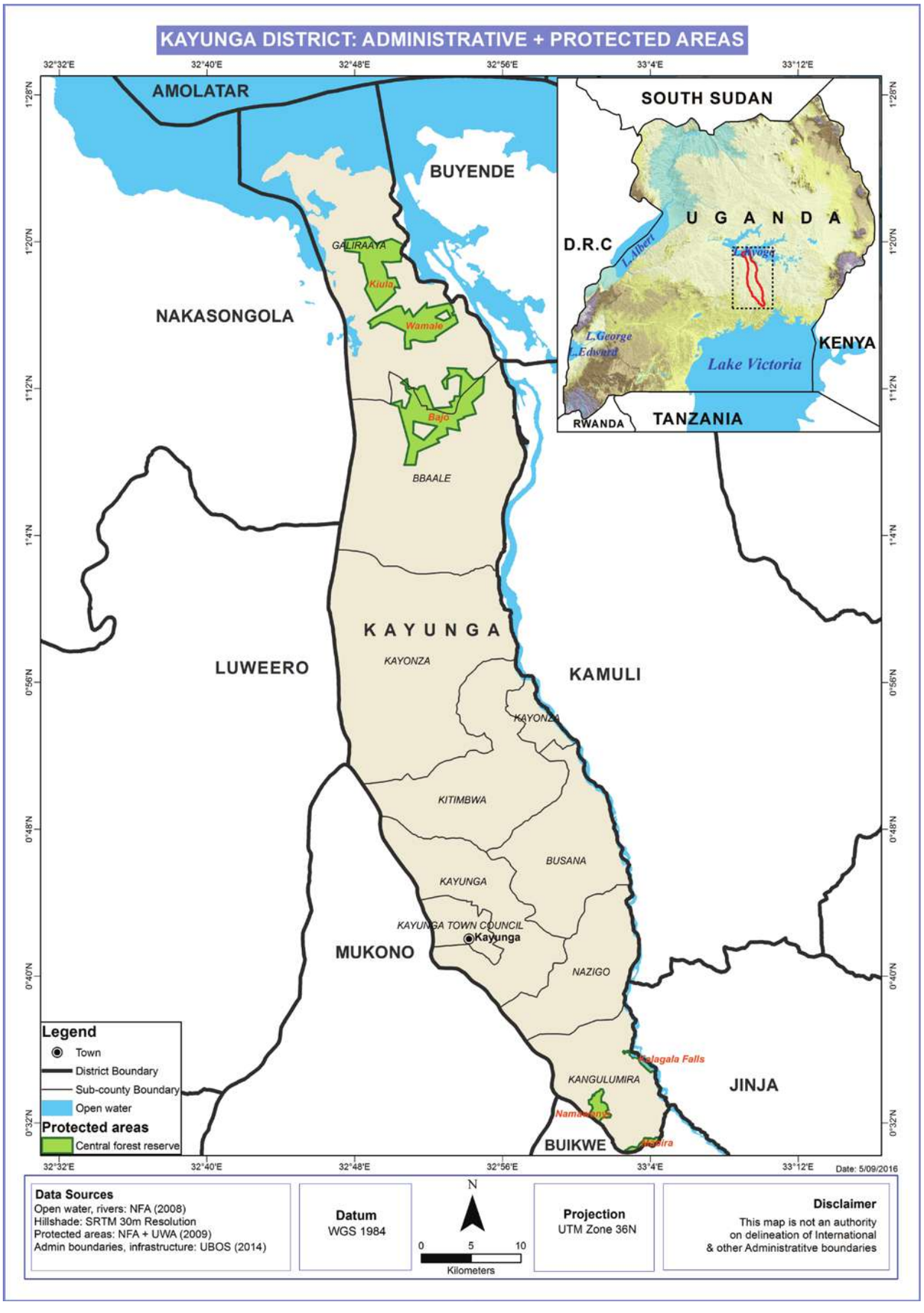



**Figure 1: Administrative Boundaries and Gazetted areas, Kayunga District**

### *2.1.1 Geomorphology*

Kayunga district has a total land area of 1810 sq km. It lies between 1000-1200m above sea level. It is generally flat with no remarkable hills and part of it is a wetland (Ssezibwa), there is Lake Kyoga in the northern part.

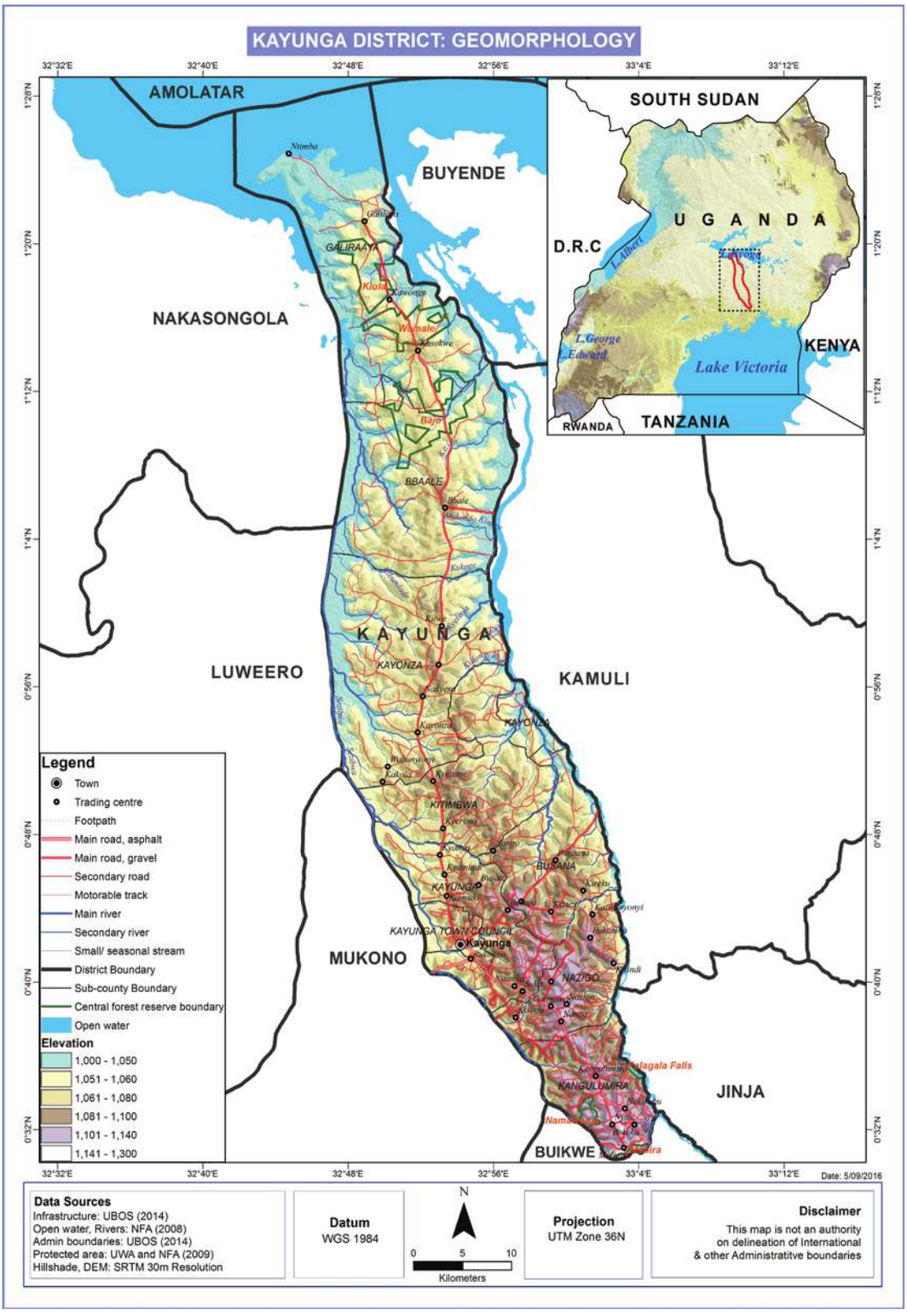



**Figure 2: Geomorphology, Kayunga District**

### *2.1.2 Geology and Soils*

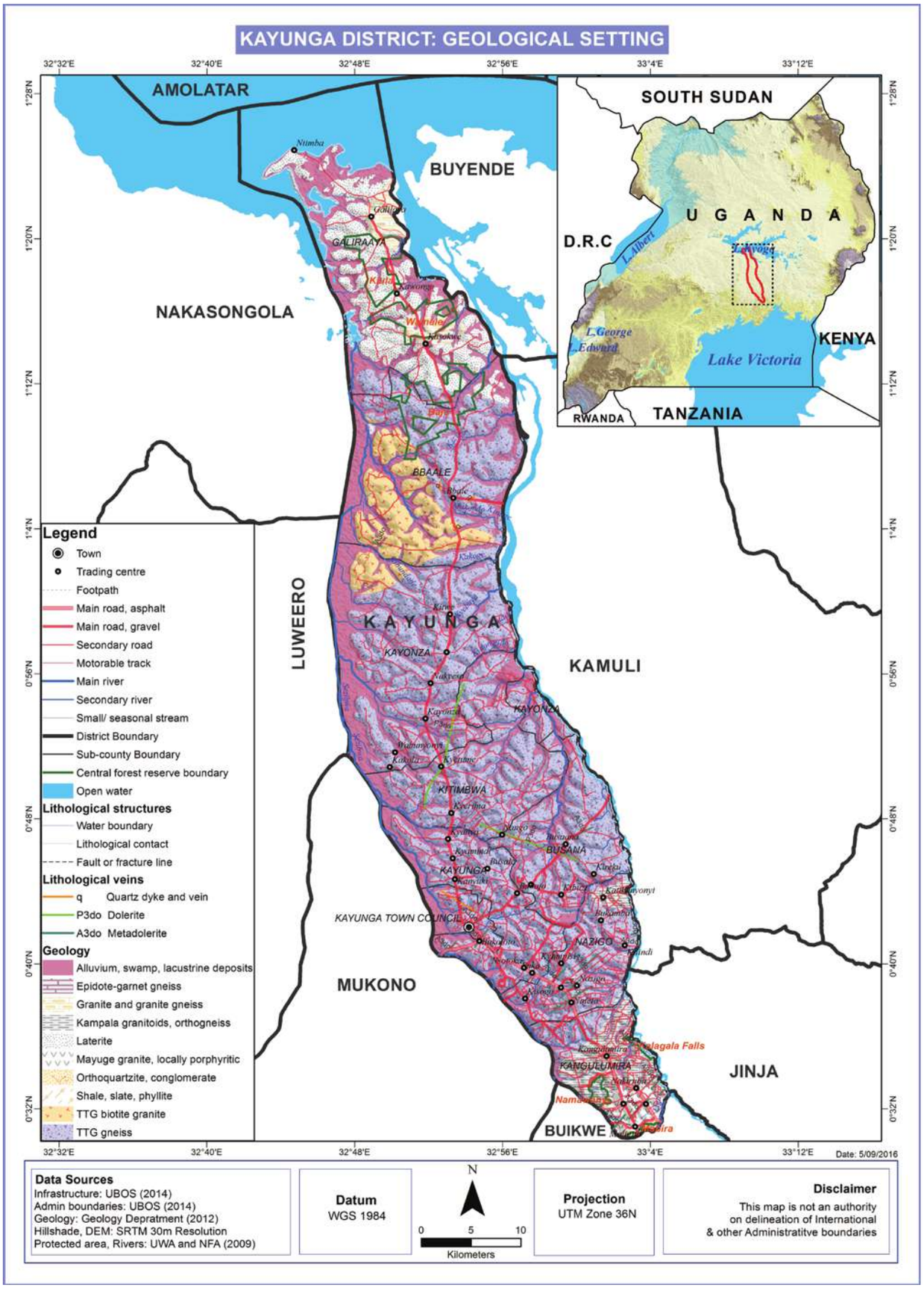


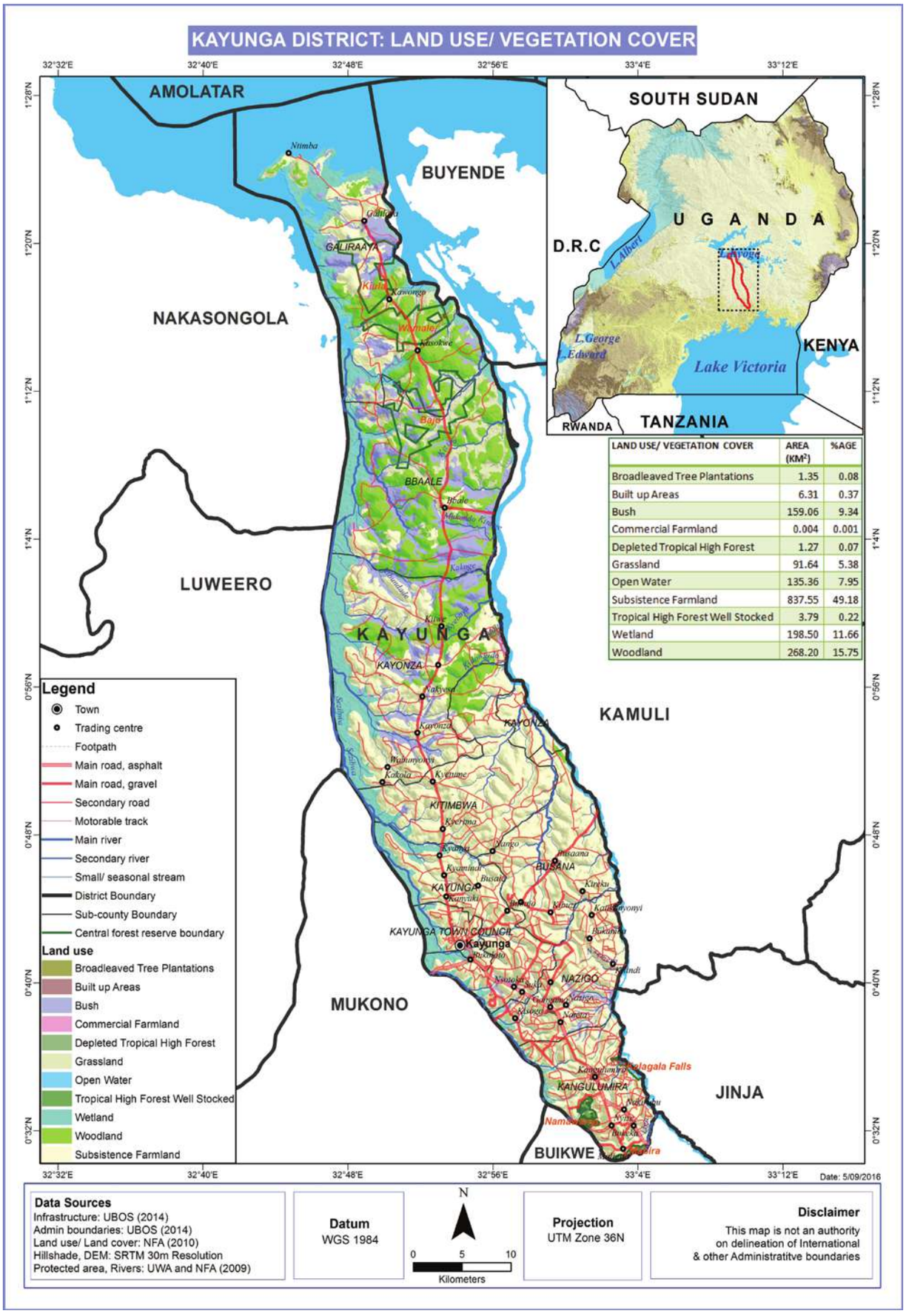

**Figure 3: Geology and Lithological Structures, Kayunga District**

### *2.1.3 Vegetation and Land use Stratification*

The vegetation cover is predominantly savannah  in the northern part of the District ( Kangulumira, Nazigo, Kayunga, Busaana, Kitimbwa and Kayonza Sub counties) with short grasses and thorny bushes majorly in the cattle corridor (Bbaale and Galiraya sub counties). Swampy vegetation however is also traced along river Ssezibwa, Musaamya wetland system, River Nile banks and along the shores of Lake Kyoga Galiraya Sub County.

There are five forest reserves in the District covering a total of 7,631 hectares. These are: Wamale, Bajjo, Kiwula, Nazigo and Kalagala in the respective sub counties as shown in the table below.

| Name | Status | Type | Area (Ha) | Location |
|---|---|---|---|---|
| Bajjo | CFR | Savanna wood land | 3,373 | Galiraya |
| Kiwula | CFR | Savanna wood land | 2,147 | Galiraya |
| Wamale | CFR | Savanna wood land | 1,950 | Bbaale |
| Nazigo | LFR | Eucalyptus Plantation | 57 | Nazigo |
| Kalagala | CFR | Natural High Forest | 104 | Kangulumira |




| LAND USE/ VEGETATION COVER | AREA (KM²) | %AGE |
|---|---|---|
| Broadleaved Tree Plantations | 1.35 | 0.08 |
| Built up Areas | 6.31 | 0.37 |
| Bush | 159.06 | 9.34 |
| Commercial Farmland | 0.004 | 0.001 |
| Depleted Tropical High Forest | 1.27 | 0.07 |
| Grassland | 91.64 | 5.38 |
| Open Water | 135.36 | 7.95 |
| Subsistence Farmland | 837.55 | 49.18 |
| Tropical High Forest Well Stocked | 3.79 | 0.22 |
| Wetland | 198.50 | 11.66 |
| Woodland | 268.20 | 15.75 |

**Figure 4: Land use stratification, Kayunga District**

### *2.1.4 Temperature and Humidity*

### *2.1.5 Wind*

### *2.1.6 Rainfall*

Kayunga district has a varied climate. The southern part is characterized by tropical climate where the rainfall pattern is bi-modal. The district gets its first rains in March-May and its second September - December. The rainfall is evenly distributed in the southern part of the District while equally unpredictable in the Northern part. The northern part of the district is characterized with short thorny acacia species with short vegetation (this is part of the cattle corridor) where unpredictable rains is experienced and is not evenly distributed.

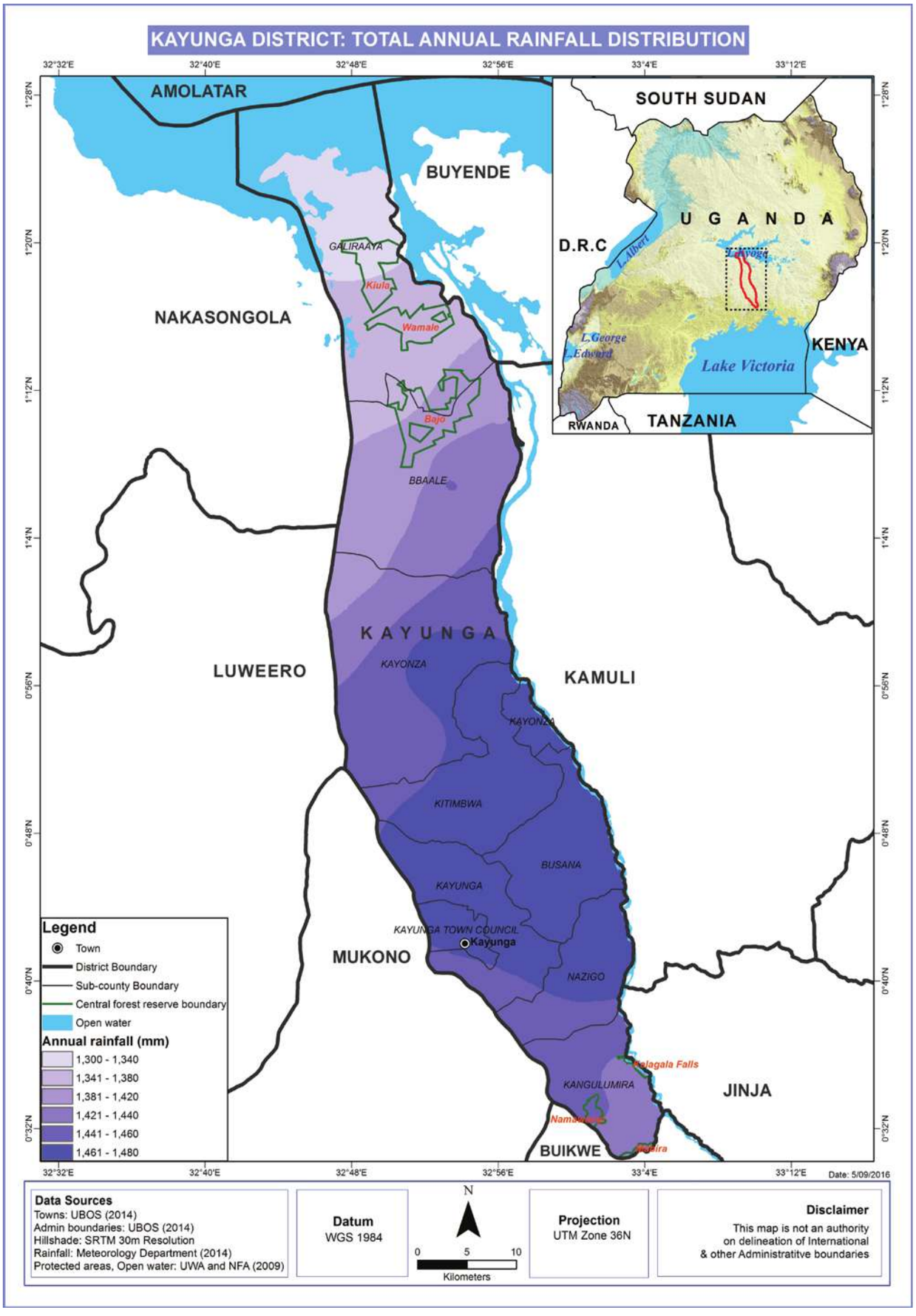



**Figure 5: Total Annual Rainfall Distribution, Kayunga District**

### *2.1.7 Hydrology*

The District has a total land area under water of 1,702.4sq Km representing 0.7% of the total National land cover (UBOS, 2012).

The Districts open waters covers 114.5 sq km representing 6.7% of the total area. It has a wide range of permanent and seasonal wetlands which represent 11.3% of the entire land cover. Total area coverage of open waters, permanent and seasonal wetlands is 1,395.1 representing 18% of the total area coverage. This District consists of two major permanent wetlands namely:

***1. Sezibwa wetland:*** Located along the western boarders of the District stretching from Mukono to Nakaseke draining to Lake Kyoga.

**2. Musamya wetland**: This wetland stretches from the Centre and drains into the great Ssezibwa wetland system. Most of the seasonal wetlands such as Kantenga, Unga, Wabunyonyi, and Balisaanga among others are compartments of this system. Kayunga District is mainly drained by two systems i.e., River Ssezibwa and River Nile.

***3. Nature of Rivers (Nile and other tributaries)***

Most of the rivers in Kayunga District flow northwards over a generally flat landscape, However, River Nile in the east flows through V and U shaped valleys in the southern part and northern part respectively. The valley is characterized by a series of waterfalls, rapids and cataracts at various stages. The major ones being Kalagala, Kiyange, Katayigwa, Nampanyi, Lusenke, Wampongo, Kasana, Kirindi, Katikanyonyi in Kangulumira, Bbaale, Busana and Nazigo Sub counties respectively.

### *2.1.8 Population*

According to the National Population and Housing Census (2014) results, Kayunga District had a total population of 370,210 people. Results also showed that most of the people in Kayunga District reside in rural areas (343,622 (92.8%) compared to (26,588 (7.2%) who reside in urban centers of Kayunga Town council, Kangulumira Town Board, Busaana Town Board and Kitwe in Kayonza Sub county. The gender distribution was reported to be males: 180,541 (48.8%) and females: 189,669 (51.2%). About 99% (366,471) of the population form the household population and only 1% (3,739) is Non-household. Kayonza sub-county had the highest population of 59,054 people while Bbaale sub-county had the least population of 16,661 people (Figure 6). Table 1 shows the population distribution per sub-county for the different gender.

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

| | HOUSEHOLDS | | POPULATION | | |
|---|---|---|---|---|---|
| ***Sub-County*** | ***Number*** | ***Average Size*** | ***Males*** | ***Females*** | ***Total*** |
| Bbaale | 3726 | 4.4 | 8660 | 8001 | 16661 |
| Galiraaya | 5716 | 4.7 | 13752 | 13068 | 26820 |
| Kayonza | 11664 | 5 | 29359 | 29695 | 59054 |
| Kitimbwa | 8938 | 5 | 21677 | 23366 | 45043 |
| Busana | 10635 | 5.3 | 27559 | 29029 | 56588 |
| Kangulumira | 11889 | 4.4 | 25449 | 27890 | 53339 |
| Kayunga | 8745 | 4.7 | 20092 | 21552 | 41644 |
| Kayunga Town Council | 6783 | 3.8 | 12409 | 14179 | 26588 |
| Nazigo | 9309 | 4.7 | 21584 | 22889 | 44473 |

*Source: UBOS Census 2014*

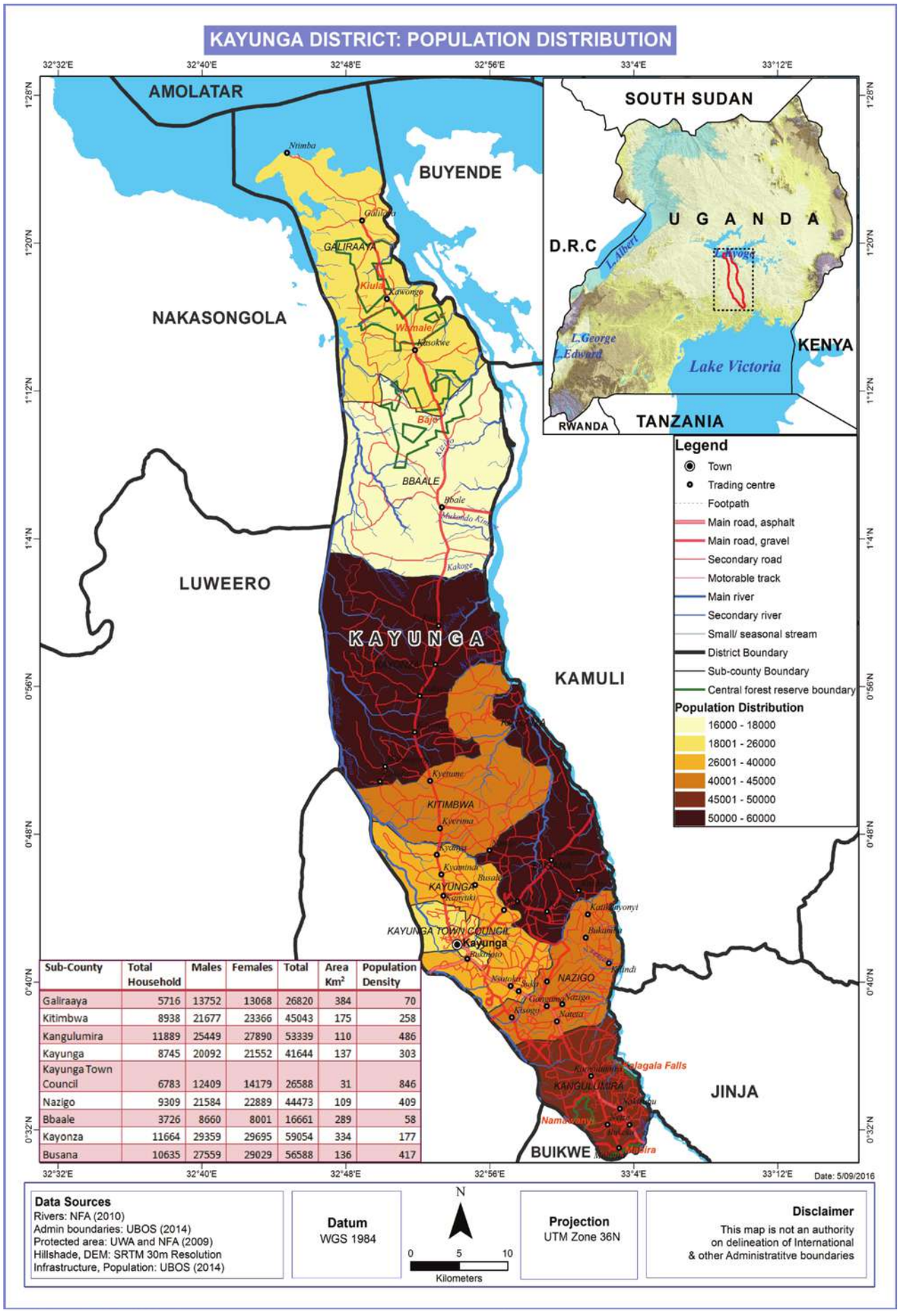



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**Figure 6: Population Distribution, Kayunga District**

### *2.1.9 Economic activities*

Subsistence agriculture like in most rural parts of the Country employs almost 96% of the population. Coffee is the main cash crop but due to coffee wilt, its production has decreased. The main food crops include bananas, sweet potatoes, yams, rice, cassava, maize, beans and groundnuts. In addition, fruits (pineapples, watermelon, mangoes and passion) are grown for commercial purposes. The sub counties mainly engaged in crop farming are: Kangulumira, Kitimbwa, Kayonza, Nazigo, Kayunga and Busaana. The rest are mainly involved in livestock farming :( Bbaale and Galiraya) majorly cattle, goats, pigs and poultry. In Kangulumira sub county, there are ecotourism activities taking place especially along Kalagala waterfalls, Adrift rafting, bird watching and Hotel facilities.

# METHODOLOGY

## 3.1 Collection and analysis of field data using GIS

### *3.1.1 Preliminary spatial analysis*

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

### *3.1.2 Stakeholder engagements*

Stakeholder engagements were carried out in close collaboration with OPM's DRM team and the district disaster management focal persons with the aim of identifying the various hazards ranging from drought, to floods, landslides, human and animal disease, pests, animal attacks, earthquakes, fires, conflicts etc. Stakeholder engagements were done through Focus Group Discussions (FGDs) and key informant interviews guided by checklist tools (Appendix I). At district level, One Key Informant Interview comprising of six respondents (Deputy Chief Administrative Officer, District Natural Resources Officer, Senior Production Officer, District Production Officer, District Environment Officer and District Health Officer) was held at Kayunga District Headquarters (). At sub-county level Key informants included: Sub-county and parish chiefs, community Development mobilizers and health workers.

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

Focus Group discussions and Key Informant Interviews were transcribed in the field for purposes of input into the NVIVO software for qualitative data analysis. Case stories and photographs were documented and captured 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.

### *3.1.3 Participatory GIS*

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

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

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

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

### *3.2.1 Data analysis and integration*

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

### *3.2.2 Data verification and validation*

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

## 3.3 Preserve the spatial data to enable future use of the maps

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

## RESULTS FROM MULTI-HAZARD RISK, VULNERABILITY MAPPING

### 4. Multi-hazards

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

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

i. Geomorphological or Geological hazards including; landslides, rock falls and soil erosion

ii. Climatological or Meteorological hazards including; floods, drought, hailstorms, strong winds and lightning

iii. Ecological or Biological hazards including; crop pests and diseases, livestock pests and diseases, human epidemic diseases, vermin attacks and wildlife animal attacks,

iv. Human induced or Technological hazards including; bush fires, road accidents and land conflicts.

### 4.1 Geomorphological and Geological Hazards

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

Results from the participatory assessments indicated that there weren't any incidences of landslides in Kayunga District. However, incidences of rock falls and soil erosion have increased in Nazigo and Kangulumira sub-counties due to stone quarrying and the lack of soil conservation practices. This information was integrated with the spatial modelling using socio-ecological spatial data i.e. Soil texture (data for National Agricultural Research Laboratories – Kawanda (NARL) 2014, Rainfall (Meteorology Department 2014), Digital Elevation Model (DEM), SLOPE, ASPECT (30m resolution data from SRTM Shuttle Radar Topography Mission (SRTM) to generate Land slide, rock falls and soil erosion vulnerability map (Figure 7).

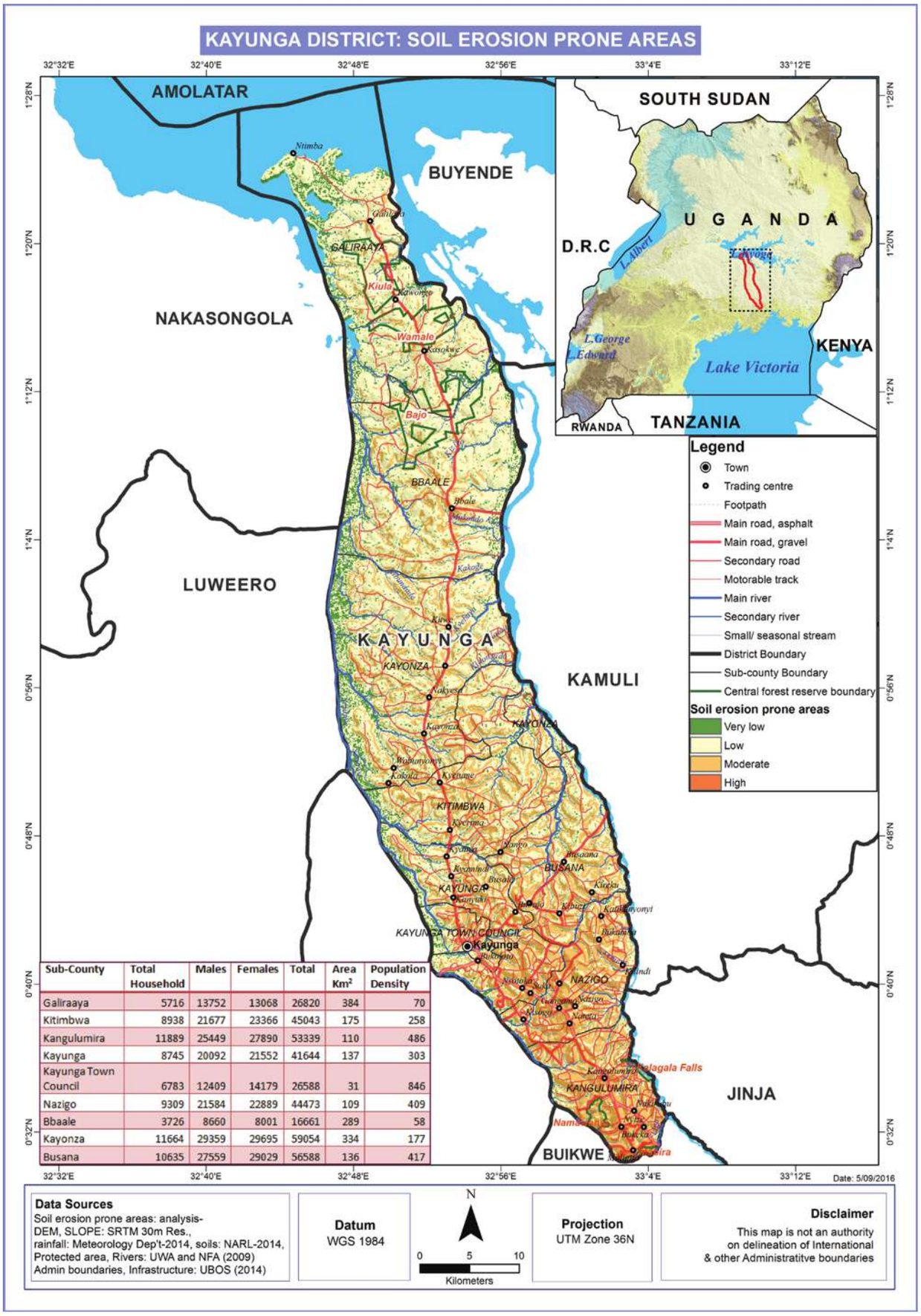


**Figure 7: Landslides, Rock fall and Soil erosion Prone Areas, Kayunga District**

### *4.1.2 Earthquakes and faults*

Participants of the focus group discussions reported that the district only experiences minor tremors occasionally. It was observed that cracks have developed along the stone quarries in Nazigo and Kangulumira sub-counties.

## 4.2 Climatological and Meteorological Hazards

### *4.2.1 Floods*

Participants in the focus group discussions indicated that floods mainly occur along rivers and in the low lying areas of Kayunga district during the rainy seasons. It was reported that in 2006, River Musaamya flooded and swept away culverts and blocked roads. The cattle corridor sub-counties of Galiraaya, Bbaale and Kayonza are the most affected however, incidences have also been reported in the other southern of the District in Kirindi, Bukamba, Nazigo Gombolola zone in Nazigo Sub county. Participants also noted that these floods have been intensified by swamp degradation and farming in the wetlands especially in Namataala, Kyampisi, Kantenga, Buttakoola in Kayunga sub county and Kedicho, Kiwula, Kassato along the banks of river Nile and lake Kyoga in Galilaya sub county . As a result people are displaced and crops submerged by these floods. This information was integrated with the spatial modelling using socio-ecological spatial data i.e. Soil texture (data for National Agricultural Research Laboratories – Kawanda (NARL) 2014, Rainfall (Meteorology Department 2014), Digital Elevation Model (DEM), SLOPE, ASPECT (30m resolution data from SRTM Shuttle Radar Topography Mission (SRTM) to generate flood susceptibility map (Figure 8).

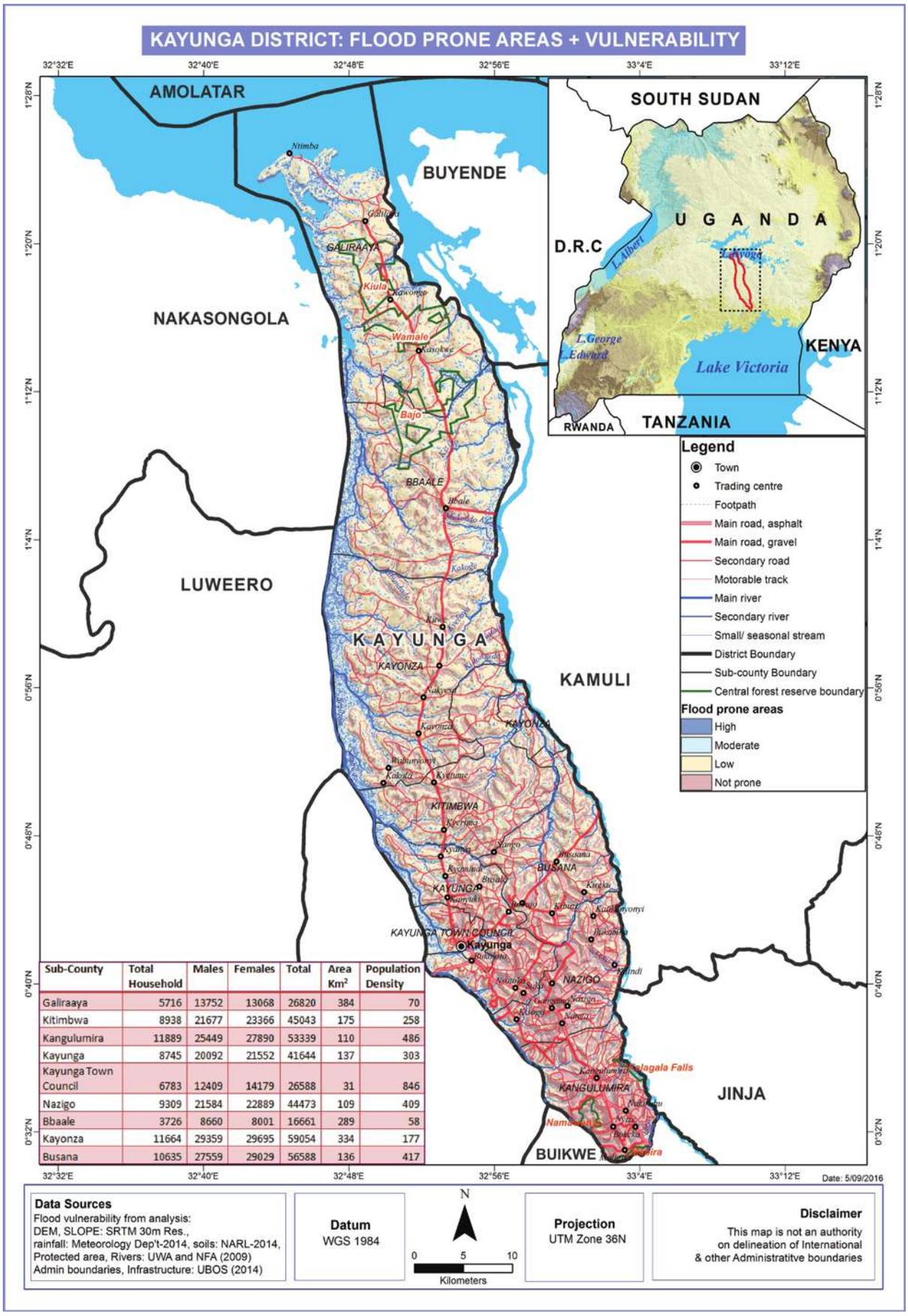


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**Figure 8: Flood Prone Areas and Vulnerability Ranking, Kayunga District**

### *4.2.2 Prolonged Dry Spells*

Participants in the focus group discussions observed that droughts were experienced in form of prolonged dry spells without any rainfall. It was reported that most of these dry spells occur from June to August and December to March. During this period there is scarcity of water, pastures, increased crop failures and high pests and disease incidences in livestock and crops. A number of animals have been reported dead as a result of dry spell related consequence's .The cattle corridor sub-counties of Galiraaya, Bbaale and Kayonza are the most affected. This information was integrated with spatial modelling using socio-ecological spatial data i.e. Rainfall and Temperature (Uganda National Meteorological Authority, 2014) using the Standardized Precipitation Index (SPI) to generate drought vulnerability map (Figure 9).

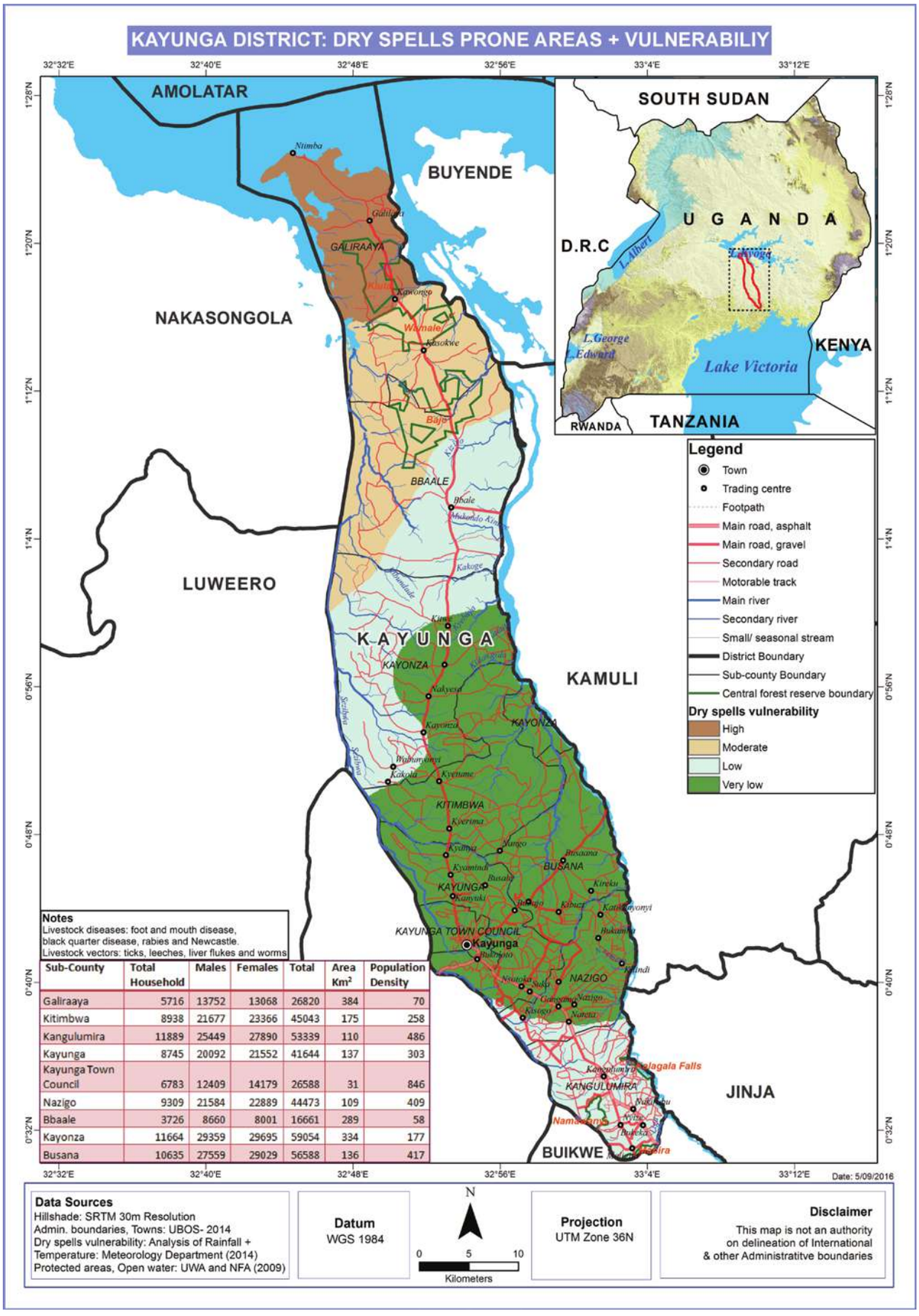


**Figure 9: Drought Prone Areas and Vulnerability Ranking, Kayunga District**

### *4.2.3 Hailstorms*

Participatory assessments through the focus group discussions indicated that hailstorms are experienced during heavy rains especially March-April. Participants observed that the effects of hailstorms are more predominant in Kayunga, Busaana, Nazigo and Kangulumira sub-counties. . Some of these effects include; crop loss such as banana plantations, maize, cassava, beans, and sweet potatoes. In 2013, house tops were washed away by heavy hail storms in Bukooloto Kayunga Town council destroying a number of business out lets. (Figure 11).

### *4.2.4 Strong winds*

In a series of focus group discussions, participants indicated that strong winds mainly occur at the onset and during rainy seasons. It was reported that strong winds cause tree falls, banana plantation logging and also blow off roof tops of houses and schools. The most affected sub-counties include: Busaana, Kayunga, Kayunga Town Council Nazigo and Kangulumira. Also Bbaale secondary school roof tops were washed off by heavy wind storm in 2014

### *4.2.5 Lightning*

Lightning is a sudden high-voltage discharge of electricity that occurs within a cloud, between clouds, or between a cloud and the ground. The distribution of lightning on Earth is far from uniform. The ideal conditions for producing lightning and associated thunderstorms occur where warm, moist air rises and mixes with cold air above. Results from the participatory assessments showed that there have been increased incidences of lightning in Kayunga district. Participants reported that lightning killed animals in Bbaale sub-county in 2014. The other most affected sub-counties include; Galiraaya, Bbaale, Kayonza, Kayunga Busaana and Nazigo. Kanjuki SSS in Kayunga Sub County, was hit by lightning in 2014 but were no reported death cases.

## 4.3 Ecological and Biological Hazards

### *4.3.1 Crop Pests and Diseases*

Participants in Kayunga district revealed that crop pests and diseases were prevalent throughout the year though their severity varied with season. The major crop diseases mentioned included; cassava brown streak, cassava mosaic, tomato blight, banana bacterial wilt, pineapple wilt, coffee wilt disease and pineapple root rot. While the major crop pests included; coffee black twig borer, Banana Nematodes, pineapple mealy bugs, Banana weevils and Fruit flies (especially mangoes). The entire district is affected by crop pests and diseases but extreme effects are observed in Kangulumira, Nazigo, Busaana, Kayunga, Kayunga Town council, Kitimbwa and Kayonza Sub counties. In May 2014, there was an outbreak of Giant loopers in the district in Kitimbwa, Busaana, Kayunga, Kangulumira, Nazigo, Kayunga town council and Kayonza sub counties.

### *4.3.2 Livestock Pests and Diseases*

The most reported livestock diseases in Kayunga district included; swine fever in pigs, foot and mouth disease, Nagana in cattle and Newcastle in poultry. While ticks and tsetse flies especially along the Nile were the most common pests in the entire district. Participants reported that in 2014, there was an outbreak of foot and mouth disease in the cattle corridor sub-counties of Galiraaya, Kayonza and Bbaale.

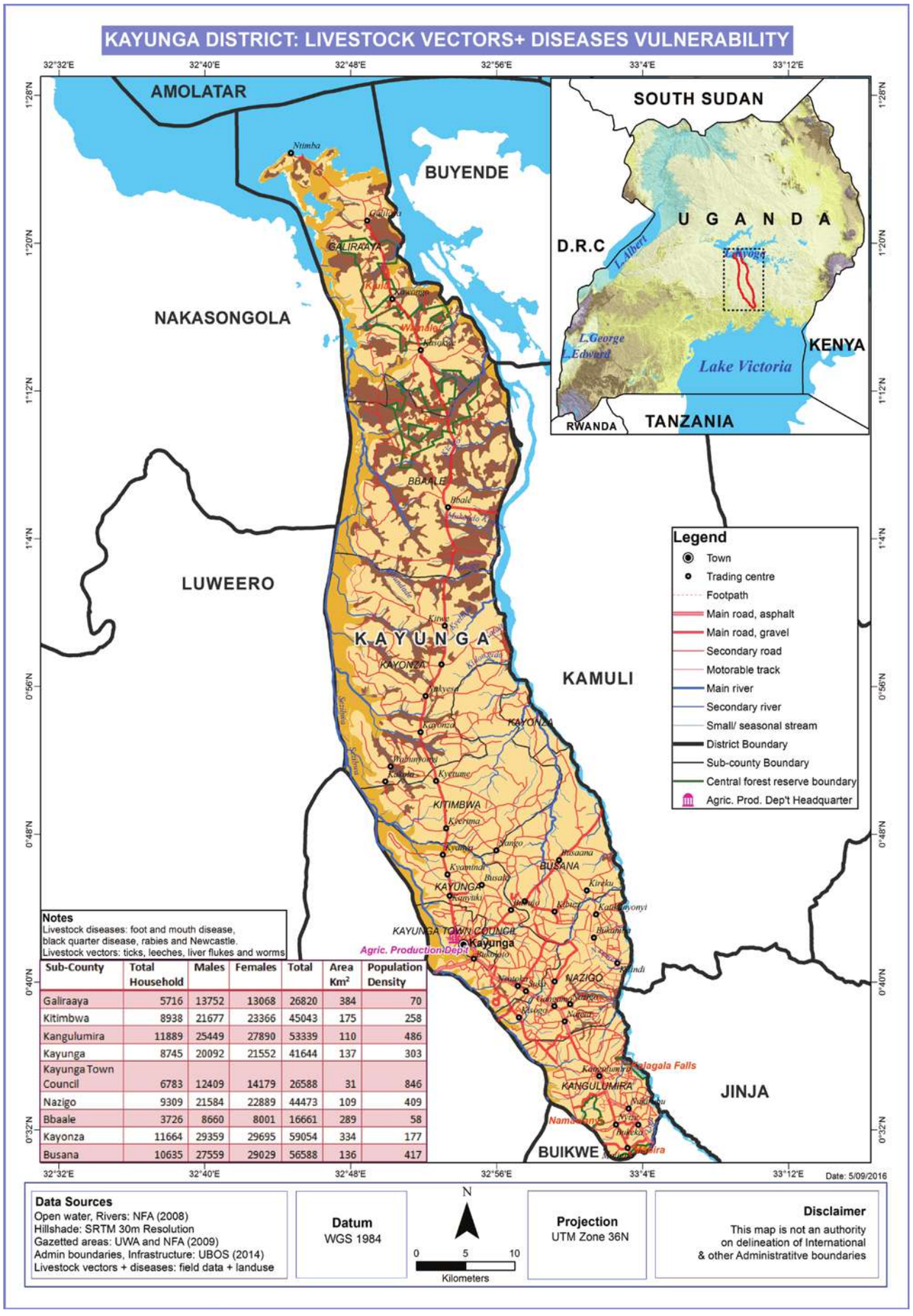


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**Figure 10: Livestock Pests and Diseases Vulnerability, Kayunga District**

### *4.3.3 Human Diseases outbreaks*

Participants indicated that malaria, cholera, pneumonia, respiratory tract infections and HIV/AIDS were the most common diseases in Kayunga district. Malaria was regarded to be prevalent in the entire district despite government efforts of providing every household with mosquito nets. It was reported that the prevalence rates of HIV/AIDS were high in Kayunga Town Council and at Kawoongo landing site on Lake Kyoga. Reports also indicated that in 2010, there was an outbreak of cholera in Kawoongo landing site and Galiraaya sub-county.

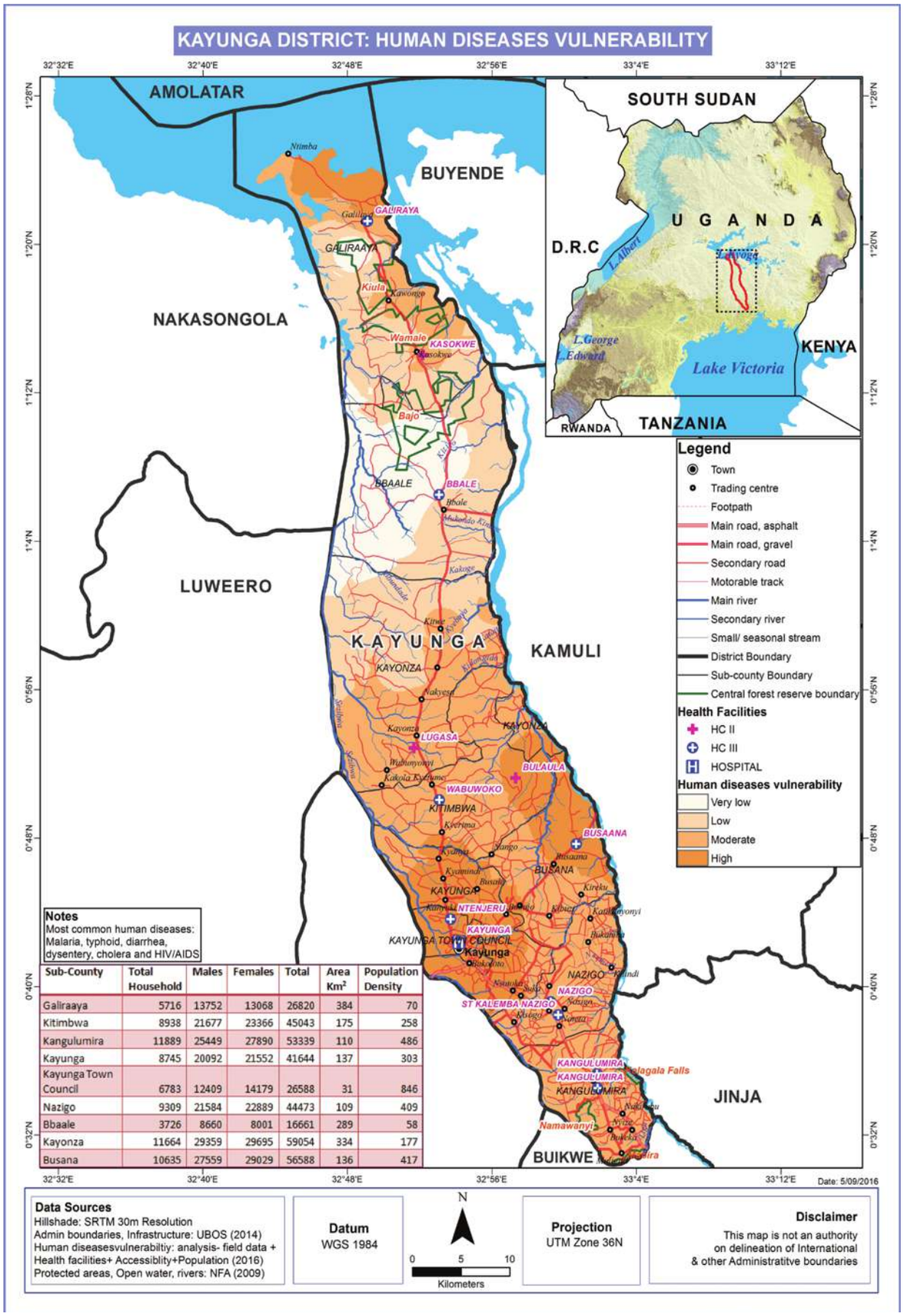


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**Figure 11: Human Disease Prevalence and Health Facilities, Kayunga District**

### *4.3.4 Vermin and Wild-life Animal Attacks*

Participatory assessments through focus group discussions indicated that incidences of vermin and wildlife animal attacks were not common in Kayunga district. Participants reported that monkeys attack communities in Galiraaya and Kalagala in Kangulumira sub-county and destroy crops.

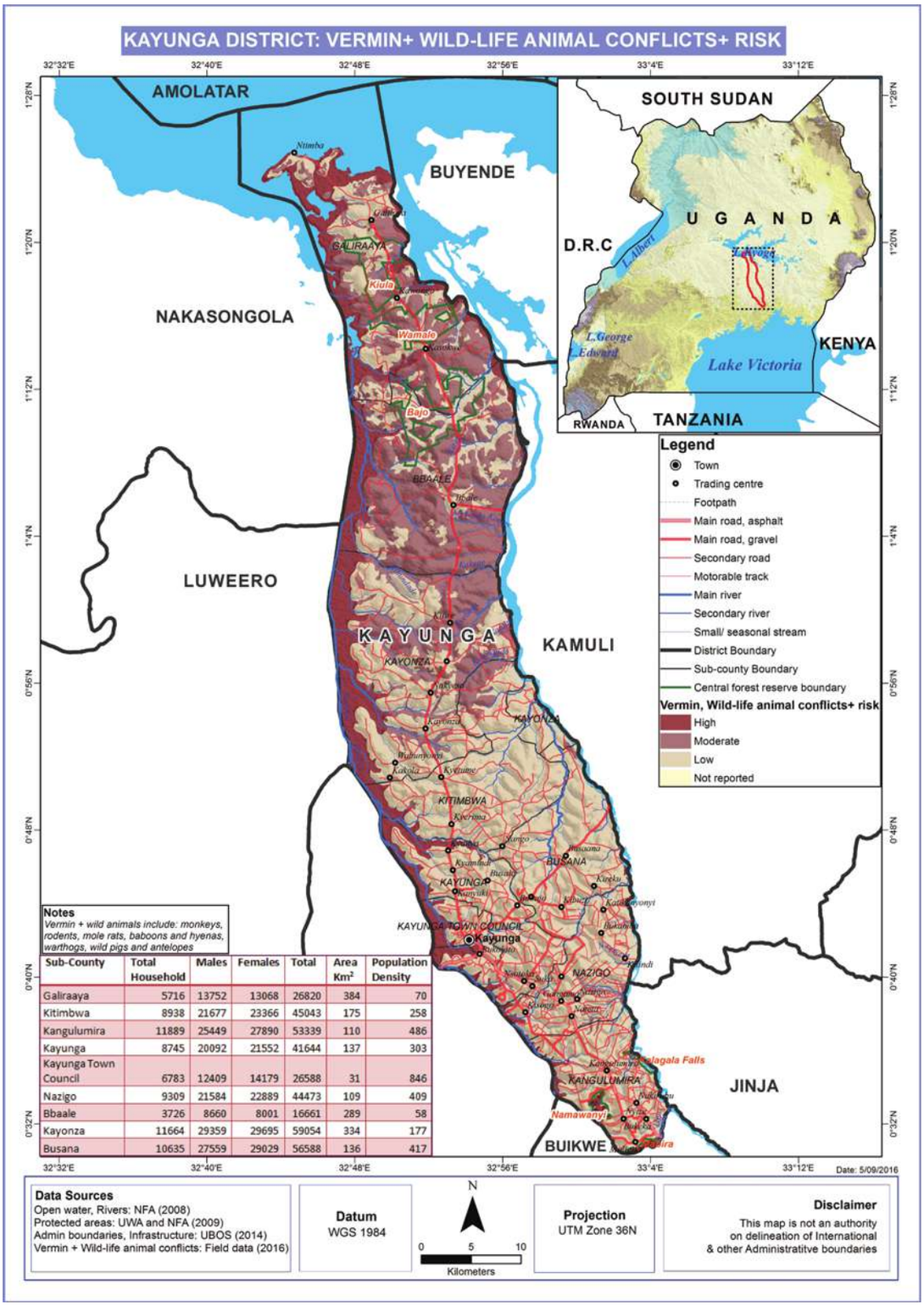


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**Figure 12: Vermin and Wildlife Animal Conflicts and Vulnerability, Kayunga District**

### *4.3.5 Invasive species*

Results from the discussions showed that *Water hyancith*, *Lantana spp.*, *Striga spp.* and paper mulberry were the most prominent invasive species in Kayunga district. Participants revealed that *Lantana spp.* suppresses the growth of pasture in grazing land. Reports indicated that *water hyancith* was dominant on Victoria Nile and Lake Kyoga. It was also reported that paper mulberry was a serious problem in Kangulumira sub-county. *Oxalis latifolia* ssp is also evident in banana plantations in Nazigo, Kangulumira, and Kayunga and Busaana sub counties.

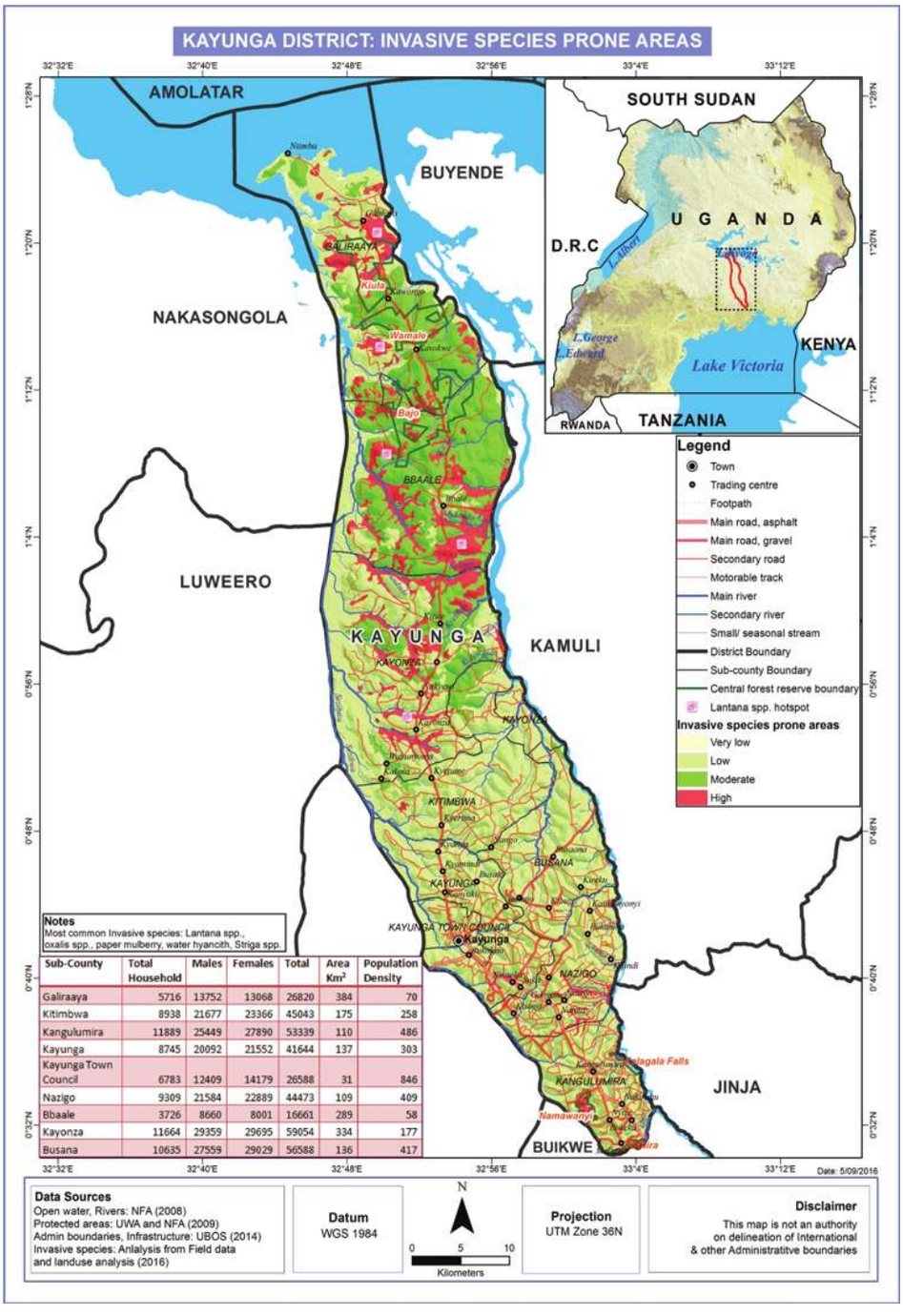


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**Figure 13: Invasive species vulnerability, Kayunga District**

## 4.4 Human Induced and Technological Hazards

### *4.4.1 Bush fires*

Participants indicated that most bush fires in Kayunga district occur during the dry season. It was reported that these bush fires are usually started by cattle keepers who believe that burning of old pastures allows for regeneration of fresh forage for livestock. Such fires started by cattle keepers were common in the cattle corridor sub-counties of Bbaale, Galiraaya and Kayonza. During the dry season, it has been observed that some wetlands burn naturally and this has evident in Kantenga wetland a compartment of great Ssezibwa system in Kayunga town council

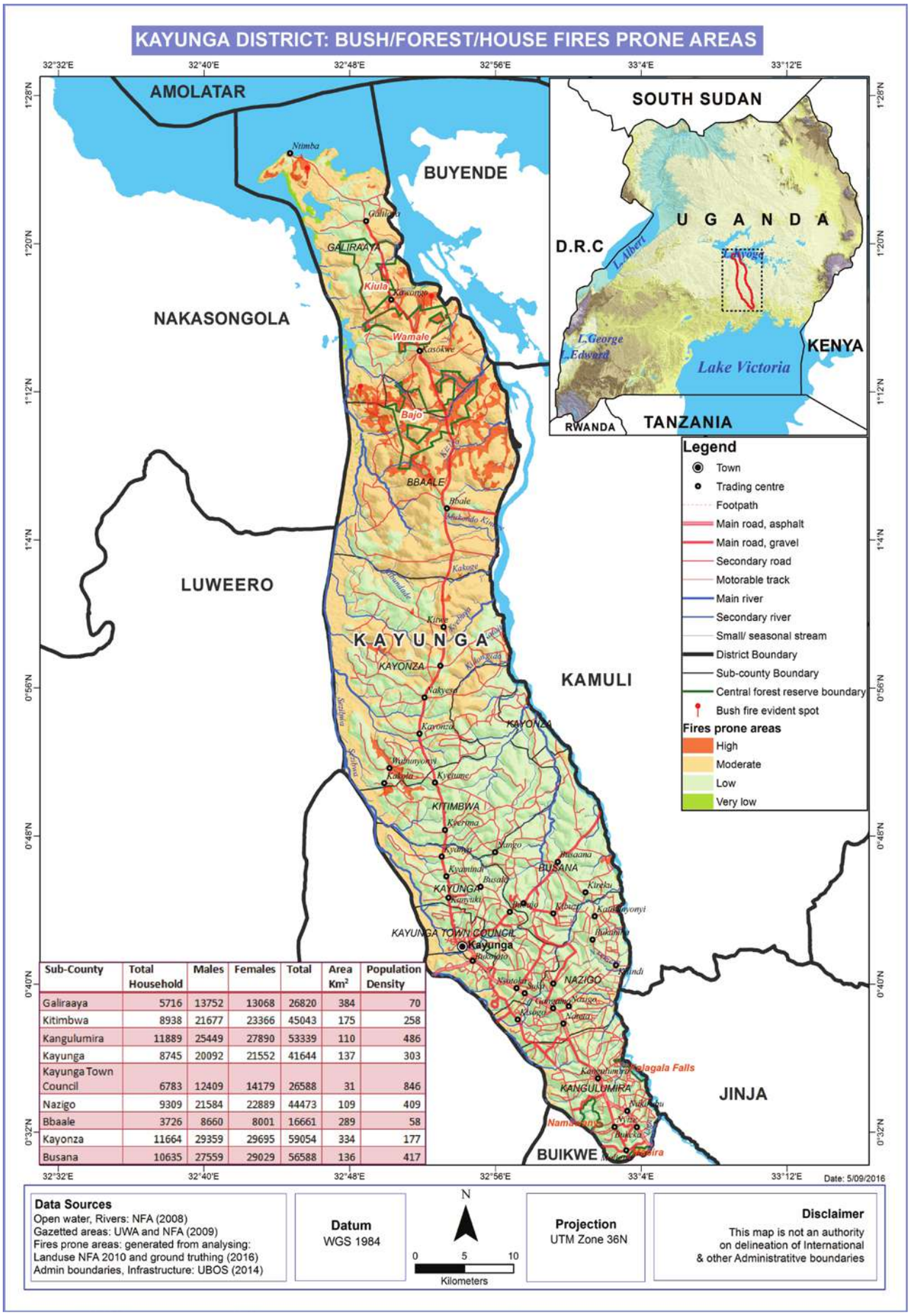


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**Figure 14: Bush/Forest fires Hotspot Areas and Vulnerability, Kayunga District**

### *4.4.2 Land conflicts*

Land conflicts were reported to be so common in Kayunga district. Participants reported that most of the land has been taken by land grabbers who take advantage of local people without land titles. Consequently, most local people have been evicted from their land by these land grabbers. The most affected sub-counties include; Nazigo, Kangulumira, Kayonza and Kayunga Town Council. Take and incidence that happened in Galiraya sub county where community members were evicted and killed over land wrangles which have not been completely settled( sept 2015).

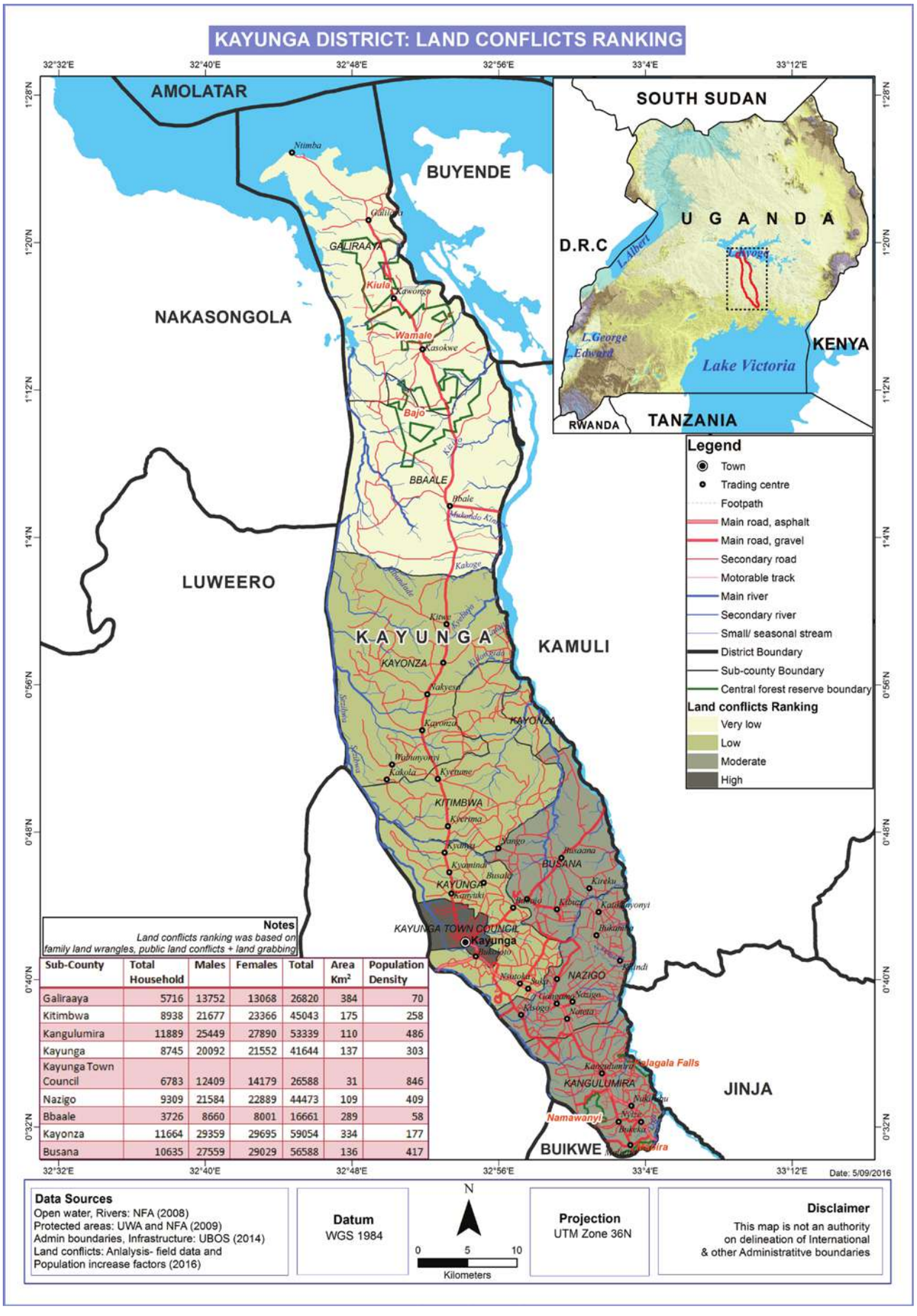


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**Figure 15: Land Conflicts Ranking, Kayunga District**

### *4.4.3 Environmental Degradation*

Results from the participatory assessments indicated that the most reported forms of environmental degradation in Kayunga district were; charcoal burning, stone quarrying, river bank degradation, swamp reclamation, deforestation and overgrazing. Participants reported indiscriminate charcoal production in Bbaale and Galiraaya sub-counties. It was also reported that Musamya wetland system had been encroached on for cultivation.

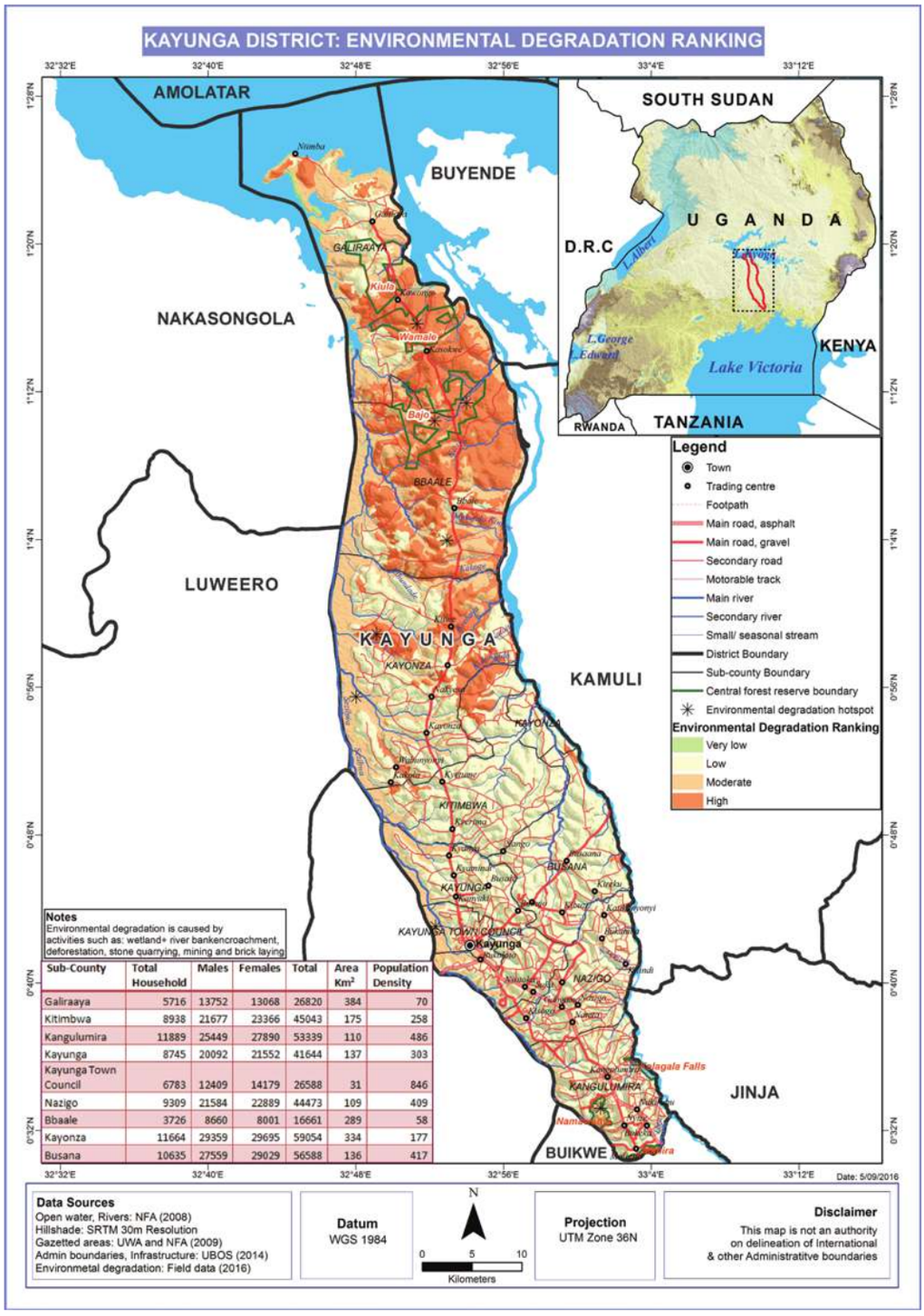


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**Figure 16: Environmental Degradation Ranking, Kayunga District**

### *4.4.4 Road Accidents*

Participants reported that road accidents usually occur on the Galiraaya – Bbaale – Kayunga road. It was also observed that sugar cane trucks are most times involved in accidents along this road due to overloading. Figure 20

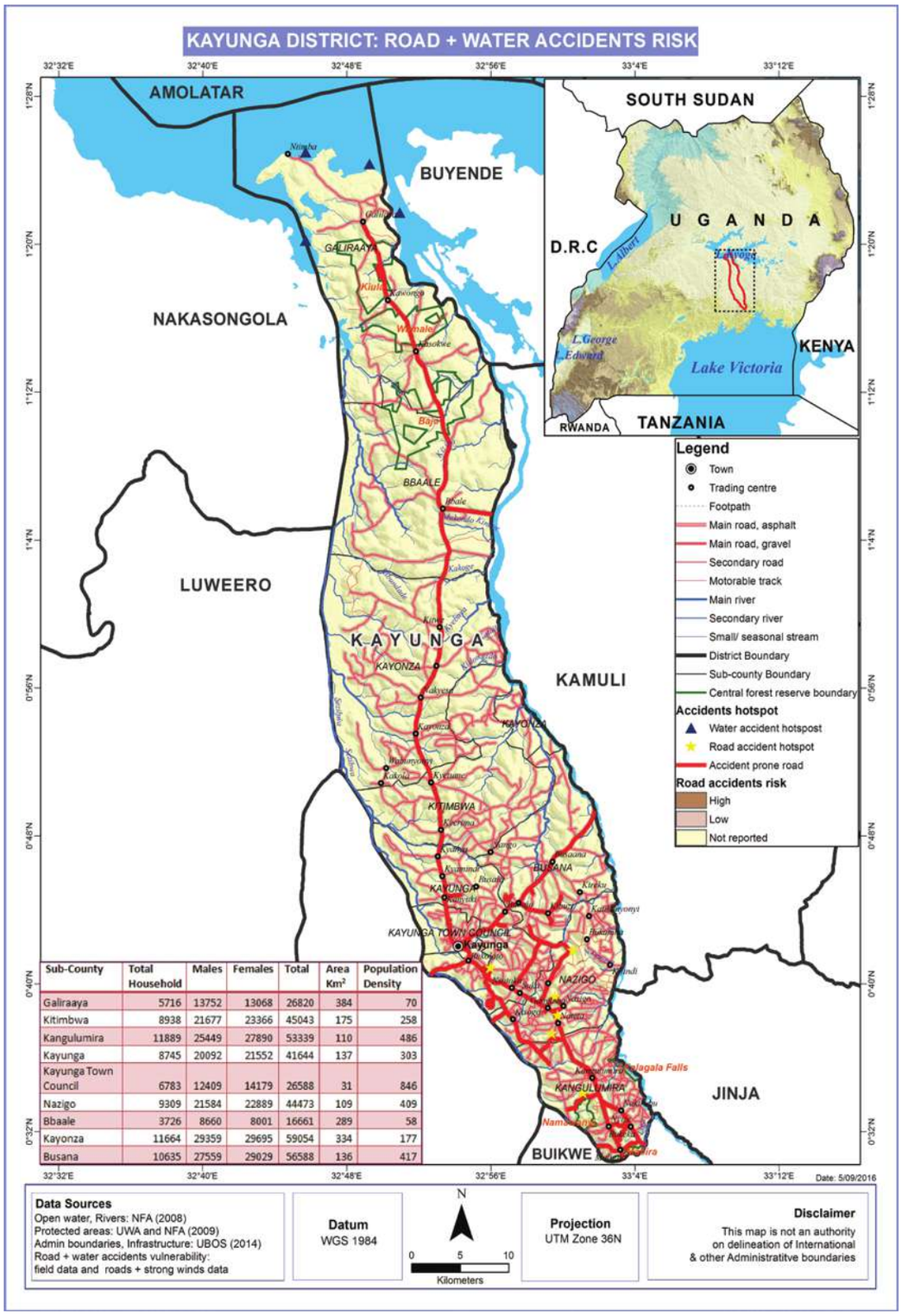


**Figure 17 Road accidents racking in Kayunga district**

## 4.5 VULNERABILITY PROFILE

Vulnerability depends on low capacity to anticipate, cope with and/or recover from a disaster and is unequally distributed in a society. The vulnerability profile of Kayunga district were assessed based on exposure, susceptibility and adaptive capacity at community (village), parish, sub-county and district levels highlighting their sensitivity to a certain risk or phenomena. Indeed, vulnerability was divided into biophysical (or natural including environmental and physical components) and social (including social and economic components) vulnerability. Whereas the biophysical vulnerability is dependent upon the characteristics of the natural system itself, the socio-economic vulnerability is affected by economic resources, power relationships, institutions or cultural aspects of a social system. Differences in socio-economic vulnerability can often be linked to differences in socio-economic status, where a low status generally means that you are more vulnerable.

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

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

## Table 2: Components of Vulnerability in Kayunga 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 Lightning | - 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 |
| | Vermin 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 |
| **Environmental 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 | |
| | 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 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 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 | |
| | 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 | |
| | Hailstorms, strong winds and Lightning | - 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 | | |
| | Crop Pests and Diseases | -Crops | District | - Complete crop failure | District | - Spraying<br>- Cut and burry affected crops<br>-Sensitization on crop disease management | |
| | 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 | |
| | Human Disease outbreaks | - Human Population | District | - Loss of lives | District | - Mass Immunization<br>- Use of mosquito nets | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 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 | |
| | 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 | |
| | 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 | |
| | 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 | |
| | Vermin 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 | |
| | 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 | |

## Table 3: Vulnerability Profile for Kayunga 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 2 = Doubtful 3 = Possible 4 = Probable 5 = Inevitable* | *1 = No impact 2= Low 3=medium 4 = High* | *0-1= Not Occur 2-10= Low 11-15=Medium 16-20= High* | |
| Floods | 4 | 3 | 12 | Galiraya Kangulumira ,Nazigo, Busaana , Kayonza and Kitimbwa |
| Dry spells | 3 | 4 | 12 | Galiraya , Bbaale, Kayonza, Kitimbwa |
| Soil erosion, rock falls and landslides | 4 | 3 | 12 | Galiraya , Bbaale, Kayonza, Kitimbwa, Nazigo, Kangulumira, Busaana, Kayunga |
| Hail storms, lightning and strong winds | 4 | 4 | 16 | Kangulumira, Nazigo, Kayunga, Kayunga Tc, Busaana, Kitimbwa |
| Bush fires and Forest fires | 3 | 3 | 9 | Galiraya , Bbaale, Kayonza, Kitimbwa, Kayunga |
| Crop pests and diseases | 4 | 4 | 16 | Galiraya , Bbaale, Kayonza, Kitimbwa, Nazigo, Kangulumira, Busaana, Kayunga, Kayunga TC, |
| Livestock pests and diseases | 4 | 4 | 16 | Galiraya , Bbaale, Kayonza, Kitimbwa |
| Human Diseases outbreaks | 4 | 4 | 16 | Galiraya , Bbaale, Kayonza, Kitimbwa, Nazigo, Kangulumira, Busaana, Kayunga, Kayunga TC |
| Land conflicts | 4 | 4 | 16 | Galiraya , Bbaale, Kayonza, Kitimbwa |
| Vermin and Wild-life animal attacks | 2 | 2 | 4 | Galiraya , Bbaale, Kayonza, Kitimbwa and Kangulumira |
| Earthquakes and faults | 3 | 3 | 9 | Nazigo and Kangulumira |
| Road accidents and Water accidents | 4 | 4 | 16 | Galiraya , Bbaale, Kayonza, Kitimbwa, Kangulumira , Nazigo |
| Environmental degradation | 5 | 4 | 20 | Entire District |
| Invasive species | 4 | 3 | 13 | Entire District |

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

Key for Relative Risk

| | |
|---|---|
| | High |
| | Medium |
| | Low |
| | Not reported/ Not prone |

## Table 4: Hazard Risk Assessment

| Hazard | Galiraaya | BBAALE | KAYONZA | KITIMBWA | KAYUNGA | KAYUNGA TC | BUSAANA | NAZIGO | KANGULUMIRA |
|---|---|---|---|---|---|---|---|---|---|
| Floods | H | H | M | | | | | M | M |
| Dry spells | H | H | H | H | M | M | M | M | M |
| Landslides, Rock falls and Erosion | M | M | M | M | M | M | M | H | H |
| Strong winds, Hailstorms and Lightning | L | L | L | M | M | M | M | M | M |
| MCrop pests and Diseases | H | H | H | H | H | H | H | H | H |
| Livestock pests and Diseases | H | H | H | H | H | H | H | H | H |
| Human disease outbreaks | H | H | H | H | H | H | H | H | H |
| Vermin and Wildlife animal attacks | L | L | L | | | | | | |
| Land conflicts | H | H | H | H | | | | L | L |
| Bush fires and Forest fires | H | H | | | | L | | | |
| Environmental degradation | H | H | H | H | H | H | H | H | H |
| Earthquakes and faults | | | | | | | M | M | M |
| Road accidents | H | H | H | H | H | H | M | M | M |
| Invasive species | M | M | M | M | M | M | M | M | M |

Key

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

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

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

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

### *4.5.2 Coping Strategies*

In response to the various hazards, participants identified a range of coping strategies that the community employs to adjust to, and build resilience towards the challenges. The range of coping strategies are broad and interactive often tackling more than one hazard at a time and the focus of the communities leans towards adaptation actions and processes including social and economic frameworks within which livelihood and mitigation strategies take place; ensuring extremes are buffered irrespective of the direction of climate change and better positioning themselves to better face the adverse impacts and associated effects of climate induced and technological hazards (Table 5).

## Table 6: Coping strategies to the Multi-hazards in Kayunga 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 | • Designs of houses (pillars)<br>• Early warning system<br>• Vigilance<br>• Sensitization<br>• Emergency response mechanisms |
| 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 Lightning | • 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 lightning 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 lightning 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<br>• Hugo group<br>• Mauritius thorns<br>• Plant tea as buffer<br>• Dig trenches<br>• Chain link<br>• Plant red pepper as buffer<br>• Recommend vermin guards |

| No | Multi-Hazards | | Coping strategies |
|---|---|---|---|
| 10 | | Invasive species | • Uproot<br>• Spray with herbicides (e.g 2-4-D)<br>• Biological control (e.g beetles)<br>• Cut and burn<br>• Sensitization on Invasive species management<br>• Blacklisting exotic species |
| 11 | Human induced or technological | Land conflicts | • Community dialogues<br>• Report to court<br>• Migration<br>• Resettlement<br>• Surveying and titling<br>• Strengthen Land management structures<br>• Sensitization on land ownership<br>• Proper demarcation (live fencing) |
| 12 | | Bush fires/ Forest 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<br>• Bye-laws<br>• Sensitization on dangers of fires |
| 13 | | Road accidents | • Construction of humps<br>• Road Signage including speed limits<br>• Separate lanes on sharp corners<br>• Sensitisation<br>• Widen narrow roads<br>• Plant trees on road reserve, as road guards<br>• Deployment of Traffic officers |
| 14 | | Environmental degradation | • Leave wetlands as water catchments<br>• Plant appropriate tree species as climate modifiers<br>• Sensitization<br>• Bye-laws<br>• Enforcement<br>• Gazatte and demarcate wetlands<br>• Restore wetlands and other fragile ecosystems<br>• EIA for new developments<br>• No land titles for wetland areas<br>• Cancellation of existing wetland land titles<br>• Developing land use plans and enforce them |

## GENERAL CONCLUSIONS AND RECOMMENDATIONS

### 5.1 Conclusions

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

Results from the participatory assessment indicated that Kayunga district has over the past two decades increasingly experienced hazards including rock falls, soil erosion, floods, drought, hailstorms, strong winds, lightning, crop pests and diseases, livestock pests and diseases, human disease outbreaks, vermin, wildlife animal attacks, invasive species, bush fires and land conflicts putting livelihoods at increased risk. Generally drought and flooding were identified as most serious problem in Kayunga 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 Kayunga district increase their vulnerability to hazard exposure necessitating urgent external support.

Hazards experienced in Kayunga district can be classified as:

i. Geomorphological or Geological hazards including landslides, rock falls, soil erosion and earth quakes.

ii. Climatological or Meteorological hazards including floods, drought, hailstorms, strong winds and lightning.

iii. Ecological or Biological hazards including crop pests and diseases, livestock pests and diseases, human disease outbreaks, vermin and wildlife animal attacks and invasive species.

iv. Human induced or Technological hazards including bush fires, road accidents land conflicts.

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

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

ii. Building capacities to withstand and cope with the hazards and risks.

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

### 5.2 Policy-related Recommendations

The following recommended policy actions targeting vulnerability reduction include:

i. The government should improve enforcement of policies aimed at enhancing sustainable environmental health.

ii. The government through MAAIF should review the animal diseases control act because of low penalties given to defaulters.

iii. The government should establish systems to motivate support of political leaders toward government initiatives and programmes aimed at disaster risk reduction.

iv. The government should increase awareness campaigns aimed at sensitizing farmers/ communities on disaster risk reduction initiatives and practices.

v. The government should revive disaster management committees at district level and ensure funding of disaster and environmental related activities.

vi. The government through UNRA and the District Authority should fund periodic maintenance of feeder roads to reduce on traffic accidents.

vii. The government through MAAIF and the District Production Office should promote drought and disease resistant crop seeds.

viii. The government through OPM and Meteorology Authority should increase importation of lightning conductors and also reduce taxes on their importation.

ix. The government through OPM and Meteorology Authority should support establishment of disaster early warning systems.

x. The government through MWE increase funding and staff to monitor wetland degradation and non-genuine agro-inputs.

xi. The government through OPM should strengthening communication between the disaster department and local communities.

xii. The government through MWE should promote Tree planting along road reserves.

xiii. The government through MAAIF should fund and recruit extension workers at sub-county level and also facilitate them.

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## APPENDIX I: DATA COLLECTION TOOLS

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

**1.** Which crops are majorly grown in your area of jurisdiction?

**2.** Which domestic animals are dominant in your area of jurisdiction?

3. What challenges are faced by farmers in your area of jurisdiction?

4. Have you experienced landslides and rock falls in the past 10 years in your area of jurisdiction?

5. Which villages, parishes or sub-counties have been most affected by landslide and rock falls?

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

7. Which crops are majorly affected by landslides and rock falls in your area of jurisdiction?

8. In which way are the crops affected by landslides and rock falls?

9. Which domestic animals are majorly affected by landslides and rock falls in your area of jurisdiction?

10. In which way are the domestic animals affected by landslides and rock falls?

11. Which agricultural practices are being adopted by farmers in a bid to mitigate the above challenges?

12. What are the relevant government's interventions focusing at helping farmers mitigate the challenges mentioned?

13. Do you have any earth faults or earth cracks as lines of weakness in your area of jurisdiction?

14. Have you experienced any earth quakes in the past 10 years in your area of jurisdiction?

15. Which particular villages, parishes or sub-counties have been majorly affected by earth quakes in your area of jurisdiction?

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

17. What impacts have been caused by earth quakes?

18. To what extent have the earth quakes affected livelihoods of the local communities in your area of jurisdiction?

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

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

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

**21.** Have you experienced floods in the past 10 years in your area of jurisdiction?

**22.** Which villages, parishes or sub-counties have been most affected by floods?

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

**24.** Which crops are majorly affected by floods in your area of jurisdiction?

**25.** In which way are the crops affected by floods?

**26.** Which domestic animals are majorly affected by floods in your area of jurisdiction?

**27.** In which way are the domestic animals affected by floods?

**28.** Which agricultural practices are being adopted by farmers in a bid to mitigate the above challenges?

**29.** What are the relevant government's interventions focusing at helping farmers mitigate the challenges mentioned?

**30.** Have you experienced drought in the past 10 years in your area of jurisdiction?

**31.** Which villages, parishes or sub-counties have been most affected by drought?

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

**33.** Which crops are majorly affected by drought in your area of jurisdiction?

**34.** In which way are crops affected by drought?

**35.** Which domestic animals are majorly affected by drought in your area of jurisdiction?

**36.** In which way are the domestic animals affected by drought?

**37.** Which agricultural practices are being adopted by farmers in a bid to mitigate the above challenges?

**38.** What are the relevant government's interventions focusing at helping farmers mitigate the challenges mentioned?

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

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

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

42. What impacts have been caused by hailstorms or lightning?

43. To what extent have the hailstorms or lightning affected livelihoods of the local communities in your area of jurisdiction?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**62.** Have you experienced any epidemic human disease outbreaks in the past 10 years in your area of jurisdiction?

**63.** Specify the epidemic human disease outbreaks that have majorly affected animals in your area of jurisdiction?

**64.** In which way are the humans affected by epidemic human disease outbreaks?

**65.** Which mitigation measures have been adopted by local communities in a bid to mitigate the above epidemic human disease outbreaks?

**66.** What are the relevant government's interventions focusing at helping local communities mitigate the epidemic human disease outbreaks mentioned?

**67.** Do you have any national park or wildlife reserve in your area of jurisdiction?

**68.** Have you experienced wildlife attacks in the past 10 years in your area of jurisdiction?

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

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

**71.** What impacts have been caused by wildlife attacks?

**72.** To what extent have the wildlife attacks affected livelihoods of the local communities in your area of jurisdiction?

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

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

**75.** Are there invasive species in your area of jurisdiction?

**76.** Specify the invasive species in your area of jurisdiction?

**77.** Which villages, parishes or sub-counties have been most affected by invasive species in your area of jurisdiction?

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

**79.** Which crops or animals are majorly affected by invasive species in your area of jurisdiction?

**80.** In which way are the crops or animals affected by invasive species?

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

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

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

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

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

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

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

**87.** What impacts have been caused by environmental degradation?

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

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

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

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

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

**93.** What impacts have been caused by land conflicts?

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

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

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

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

**98.** Which roads have experienced Road accidents?

**99.** What impacts have been caused by Road accidents?

**100.** To what extent have the Road accidents affected livelihoods of the local communities in your area of jurisdiction?

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

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

**103.** Have you experienced any serious bush and or forest fires in the past 10 years in your area of jurisdiction?

**104.** Which particular villages, parishes or sub-counties have been majorly affected by bush and or forest fires in your area of jurisdiction?

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

**106.** What impacts have been caused by serious bush and or forest fires?

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

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

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

## FOCUS GROUP DISCUSSION GUIDE FOR LOCAL COMMUNITIES

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

| No. | Name of Participants | Village/ Parish | Contact | Signature |
|---|---|---|---|---|
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### Introduction

v. 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 information on Hazards and early warning.

vi. 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.

vii. 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.

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

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

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

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

**21.** Have you experienced floods in the past 10 years in your community?

**22.** Which villages and parishes have been most affected by floods?

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

**24.** Which crops are majorly affected by floods in your community?

**25.** In which way are the crops affected by floods?

**26.** Which domestic animals are majorly affected by floods in your community?

**27.** In which way are the domestic animals affected by floods?

**28.** Which agricultural practices are being adopted by farmers in a bid to mitigate the above challenges?

**29.** What are the relevant government's interventions focusing at helping farmers mitigate the challenges mentioned?

**30.** Have you experienced drought in the past 10 years in your community?

**31.** Which villages and parishes have been most affected by drought?

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

**33.** Which crops are majorly affected by drought in your community?

**34.** In which way are crops affected by drought?

**35.** Which domestic animals are majorly affected by drought in your community?

**36.** In which way are the domestic animals affected by drought?

**37.** Which agricultural practices are being adopted by farmers in a bid to mitigate the above challenges?

**38.** What are the relevant government's interventions focusing at helping farmers mitigate the challenges mentioned?

**39.** Have you experienced hailstorms or lightning in the past 10 years in your community?

**40.** Which villages and parishes have been most affected by hailstorms or lightning?

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

**42.** What impacts have been caused by hailstorms or lightning?

**43.** To what extent have the hailstorms or lightning affected livelihoods of the local communities in your community?

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

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

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

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

**47.** Which villages and parishes have been most affected by epidemic animal disease outbreaks?

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

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

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

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

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

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

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

**55.** Which villages and parishes have been most affected by epidemic animal disease outbreaks?

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

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

**58.** Which crops are majorly affected by crop pests and disease outbreaks in your community?

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

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

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

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

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

**64.** In which way are the humans affected by epidemic human disease outbreaks?

**65.** Which mitigation measures have been adopted by local communities in a bid to mitigate the above epidemic human disease outbreaks?

**66.** What are the relevant government's interventions focusing at helping local communities mitigate the epidemic human disease outbreaks mentioned?

**67.** Do you have any national park or wildlife reserve in your area of jurisdiction?

**68.** Have you experienced wildlife attacks in the past 10 years in your community?

**69.** Which particular villages and parishes have been majorly affected by wildlife attacks in your community?

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

**71.** What impacts have been caused by wildlife attacks?

**72.** To what extent have the wildlife attacks affected livelihoods of the local communities in your community?

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

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

**75.** Are there invasive species in your community?

**76.** Specify the invasive species in your community?

**77.** Which villages and parishes have been most affected by invasive species in your community?

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

**79.** Which crops or animals are majorly affected by invasive species in your community?

**80.** In which way are the crops or animals affected by invasive species?

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

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

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

**83.** Have you experienced environmental degradation in your community?

**84.** What forms of environmental degradation have been experienced in your community?

**85.** Which villages and parishes have been most affected by environmental degradation?

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

**87.** What impacts have been caused by environmental degradation?

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

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

**90.** Have you experienced land conflicts in the past 10 years in your community?

**91.** Which particular villages and parishes have been majorly affected by land conflicts in your community?

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

**93.** What impacts have been caused by land conflicts?

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

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

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

**97.** Have you experienced Road accidents in the past 20 years in your community?

**98.** Which roads have experienced Road accidents?

**99.** What impacts have been caused by Road accidents?

**100.** To what extent have the Road accidents affected livelihoods of the local communities in your community?

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

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

**103.** Have you experienced any serious bush and or forest fires in the past 10 years in your community?

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

**105.** What impacts have been caused by serious bush and or forest fires?

**106.** To what extent have the serious bush and or forest fires affected livelihoods of the local communities in your community?

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

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

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

| Name of Participant | Designation | Contact |
|---|---|---|
| ..... | ..... | ..... |
| ..... | ..... | ..... |
| ..... | ..... | ..... |

## FOCUS GROUP DISCUSSION ATTENDANCE LIST FOR LOCAL COMMUNITIES

| Name of Participant | Village/Parish | Contact |
|---|---|---|
| ..... | ..... | ..... |
| ..... | ..... | ..... |
| ..... | ..... | ..... |

| Name of Participant | Village/Parish | Contact |
|---|---|---|
| ..... | ..... | ..... |
| ..... | ..... | ..... |
| ..... | ..... | ..... |

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

<table>
<tr><td rowspan="4">Observer Name:<br><br>Date:</td><td rowspan="4">District:<br>Sub- county:<br>Parish:<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>
</table>

| Slope characterization | | Bio-physical characterization | | Vegetation characterization | | |
|---|---|---|---|---|---|---|
| Slope degree (e.g 10, 20, …) | | Soil Texture | | Veg. cover (%) | | **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 |
| Slope length (m) (e.g 5, 10, …) | | Soil Moisture | | Tree cover (%) | | |
| Aspect (e.g N, NE…) | | Rainfall | | Shrubs cover (%) | | |
| Elevation (e.g high, low…) | | Drainage | | Grass / Herbs cover (%) | | |
| Slope curvature (e.g concave, covex…) | | Temperature | | Bare land cover | | |
| **Area Description (Susceptibility ranking: landslide, mudslide, erosion, flooding, drought, hailstorms, lightning, cattle disease outbreaks, human disease outbreaks, land conflicts, wildlife conflicts, bush fires, earthquakes, faults/ cracks, pictures, any other sensitive features)** | | | | | | |

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Department of Relief, Disaster
Preparedness and Management
Office of the Prime Minister
P.O.Box 371, Kampala, Uganda

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Plot 11 Yusuf Lule, Road, Nakasero
P. O. Box 7184, Kampala, Uganda
Tel: (+256) 417 112 100
Fax: (+256) 414 344 801
www.undp.org