THE REPUBLIC OF UGANDA

Busia 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 Ogwang Jimmy, Disaster Preparedness Officer and the team of consultants (GIS/DRR specialists); Dr. Bernard Barasa, and Mr. Nsiimire Peter, who provided technical support.

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

My appreciation also goes to Busia District Team;
1. Mr. Mayende Sam - Chief Administrative Officer
2. Ms. Sanyu Phiona
3. Mr. Erienyu Johnson - National Resources 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 Masafu, Dabani, Busitema, Lumino 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 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.

Multi-hazards experienced in Busia 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 Busia 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. Human disease outbreaks, dry spells and environmental degradation were identified as most serious problems in Busia 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 the district increase their vulnerability to hazard exposure necessitating urgent external support. To reduce vulnerability at community, local government and national levels should be a threefold effort hinged on:

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

The following were recommended policy actions targeting vulnerability reduction:

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

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

OVERVIEW OF BUSIA DISTRICT

2.1 Location

Busia District was originally part of Tororo District until Thursday, 20th March 1997, when Parliament passed the legislation creating six new Districts inclusive Busia to exist with effect from 1st July 1997.

The district is located in the south-eastern part of the Republic of Uganda, north of Lake Victoria and west of the Republic of Kenya. It is 196km from Kampala the capital city of the Republic of Uganda. The District lies approximately between longitudes 3305' East and 3401' East, and latitude 0010'North and 0035' North and it covers a total surface area of 743 sq. km. Land area is 648.95 sq. Km while open water and swamps cover about 36.88 sq. Km.

Busia District is a one County District (Samia-Bugwe County) and has One Municipal Council (Busia Municipal Council), 14 Sub-counties, two Divisions (Eastern and Western), 63 parishes and 534 (509 Rural & 25 Urban) villages.

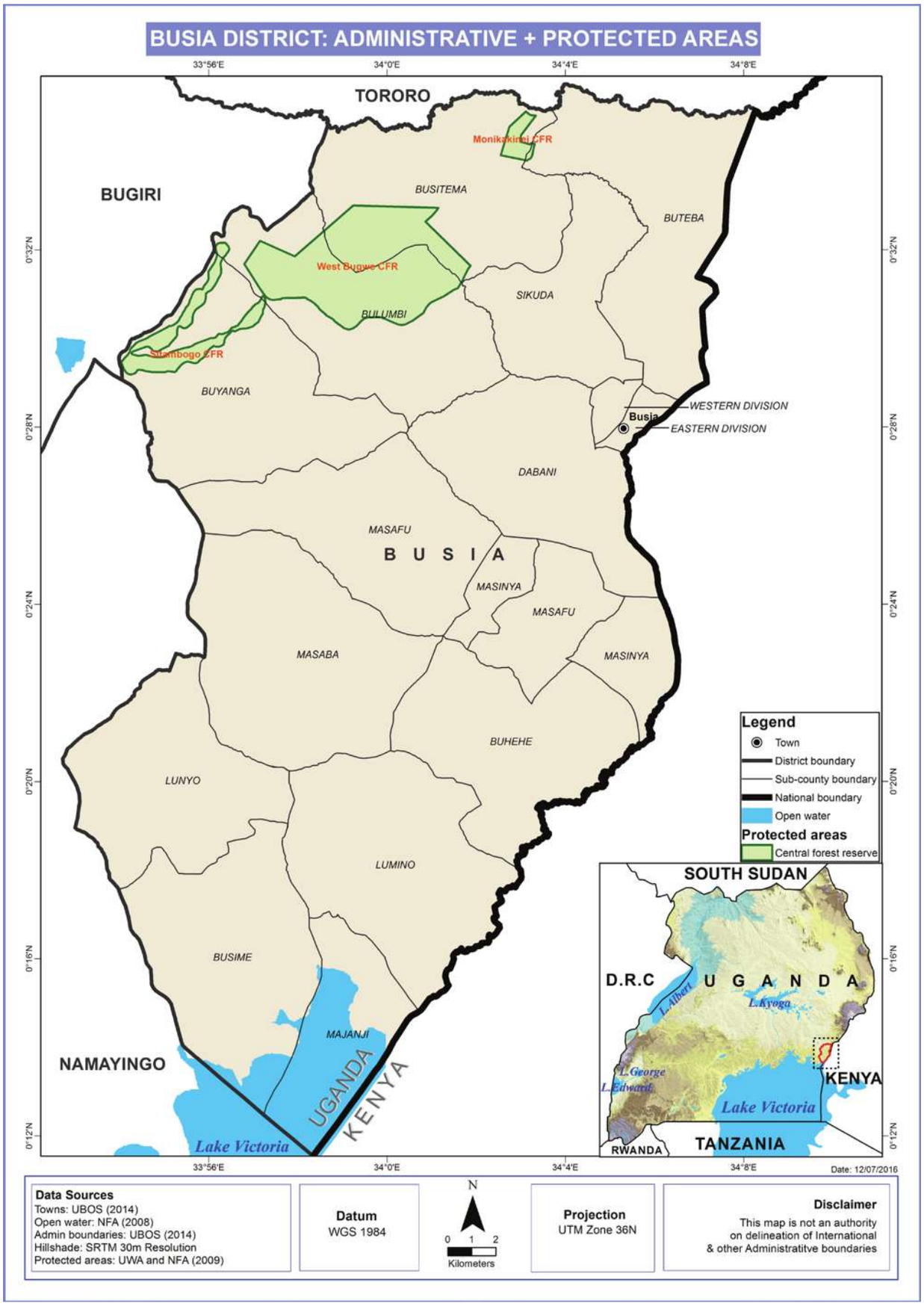


Figure 1: Administrative Boundaries and Gazetted areas, Busia District

2.1.1 Geomorphology

The District is dominated by undulating plain topography with an altitude of about 1,128 meters above sea level at Nebolola Hills in Lumino Sub-county. There are also low-lying areas, predominantly valleys with altitude of about 1,000meters above sea level. The most significant is River Malaba valley to the north and River Lumboka to the west. (Figure2).

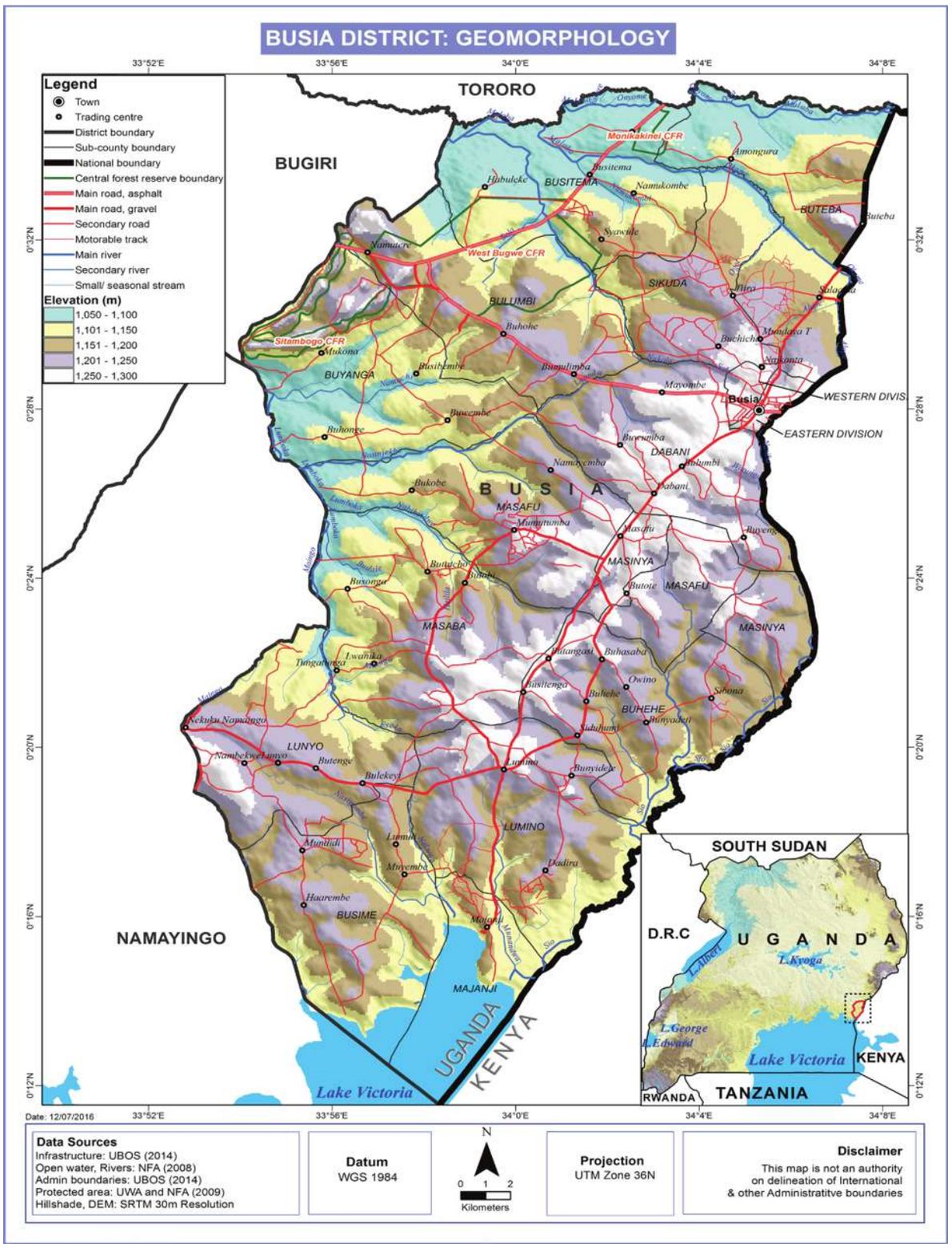


Figure 2: Geormophology, Busia District

2.1.2 Geology and soils

Most of the soils in the District are ferrallitic which characteristically represent almost the final stage in tropical weathering. They are mainly sandy loams and are usually with little differentiation into clearly defined horizons.

The other group of soils is ferrisols which closely resemble ferrallitic soils. They are distinguished because they represent an earlier stage in the development of ferrallitic soils. They appear on crystalline basic rocks and possess better agronomic qualities.

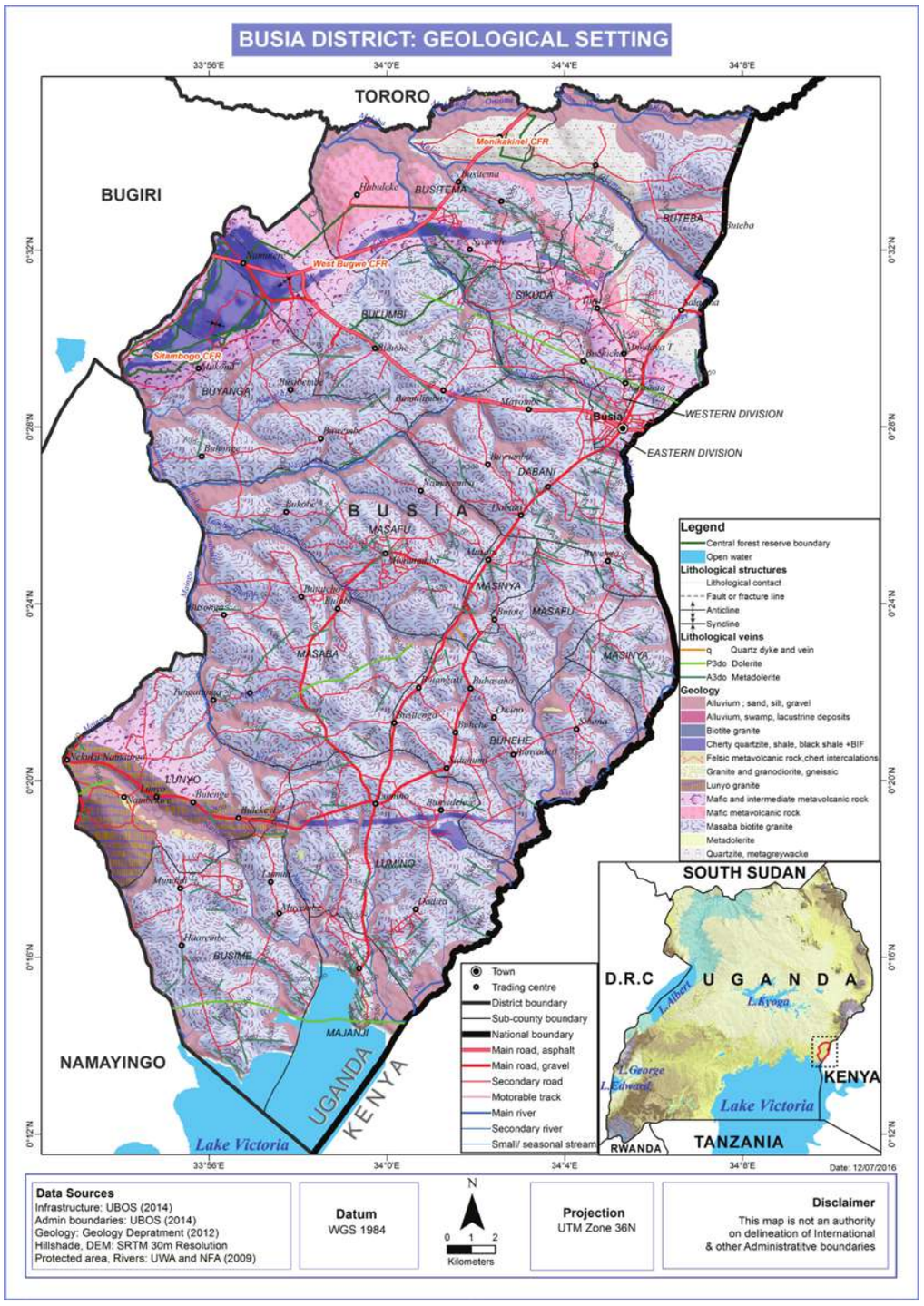


Figure 3: Geology and Lithological Structures, Busia District

2.1.3 Vegetation and Land use Stratification

The vegetation observed in the District has undergone considerable changes from that distinguished by Langdale Brown et al., (1964) as a result of continuous cultivation, burning or clearing for other purposes. What can be seen today can, therefore, be considered as remnants of the original vegetation types with some characteristics of the original one still seen in a few places. Taking the above observations into account, the following broad categories of vegetation types can be seen in the District:

- Medium Altitude Forest covering parts of Busitema Sub-county extending from the border with Bugiri District near Muwayo, and extending north-east along the Jinja-Tororo high way up to the border with Tororo District (along river Malaba),
- Moist Combretum Savanna,
- Wooded Savanna,
- Grass Savanna,
- Swamps.

Forest Resources provide essential products for the predominantly rural population. Fire wood is the main source of energy supply and constitutes nearly 90% of the domestic energy requirement.

Charcoal is also used extensively in the urban areas and some is exported to Kenya to earn income for a few individuals. These are however, significant pressure on the resource currently since the demand evidently surpasses the supply stock. Most of the parts of the District are devoid of the vegetation, leaving extensive patches bare which are susceptible to degradation.

The total area under gazetted forest is 3.867 hectare (38.67sq.km).
High population densities and increased demand for forest products has led to encroachment on the forest reserve.

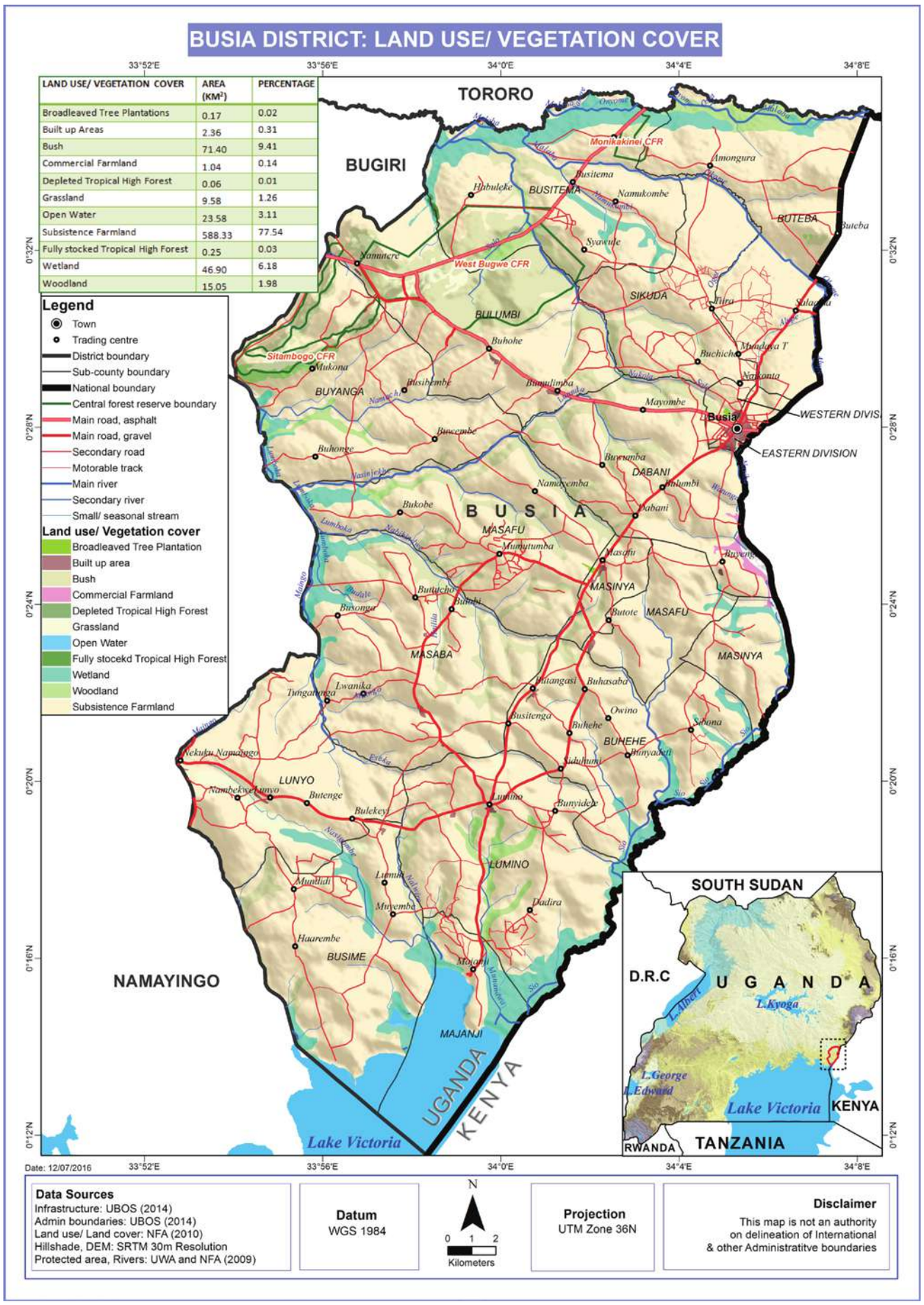


Figure 4: Land use stratification, Busia District

2.1.4 Climate

The District receives an annual rainfall of 1514mm varies from about 1940mm in the northern parts of the District to about 1080 mm towards the lake. The rainfall pattern is bimodal, with the first rainy season (short rains) extending from March to May and a longer rainy season extending from August to November.

While the mean annual maximum temperature is 28.7^{0}C and the mean annual minimum is 16.2^{0}C. The mean monthly maximum ranges from 27^{0}C to 31^{0}C, while the mean minimum sometimes falls to 16^{0}C especially at dawn (early morning).

The above climatic condition supports two cropping seasons mainly of cereals thereby reducing incidences of food shortage.

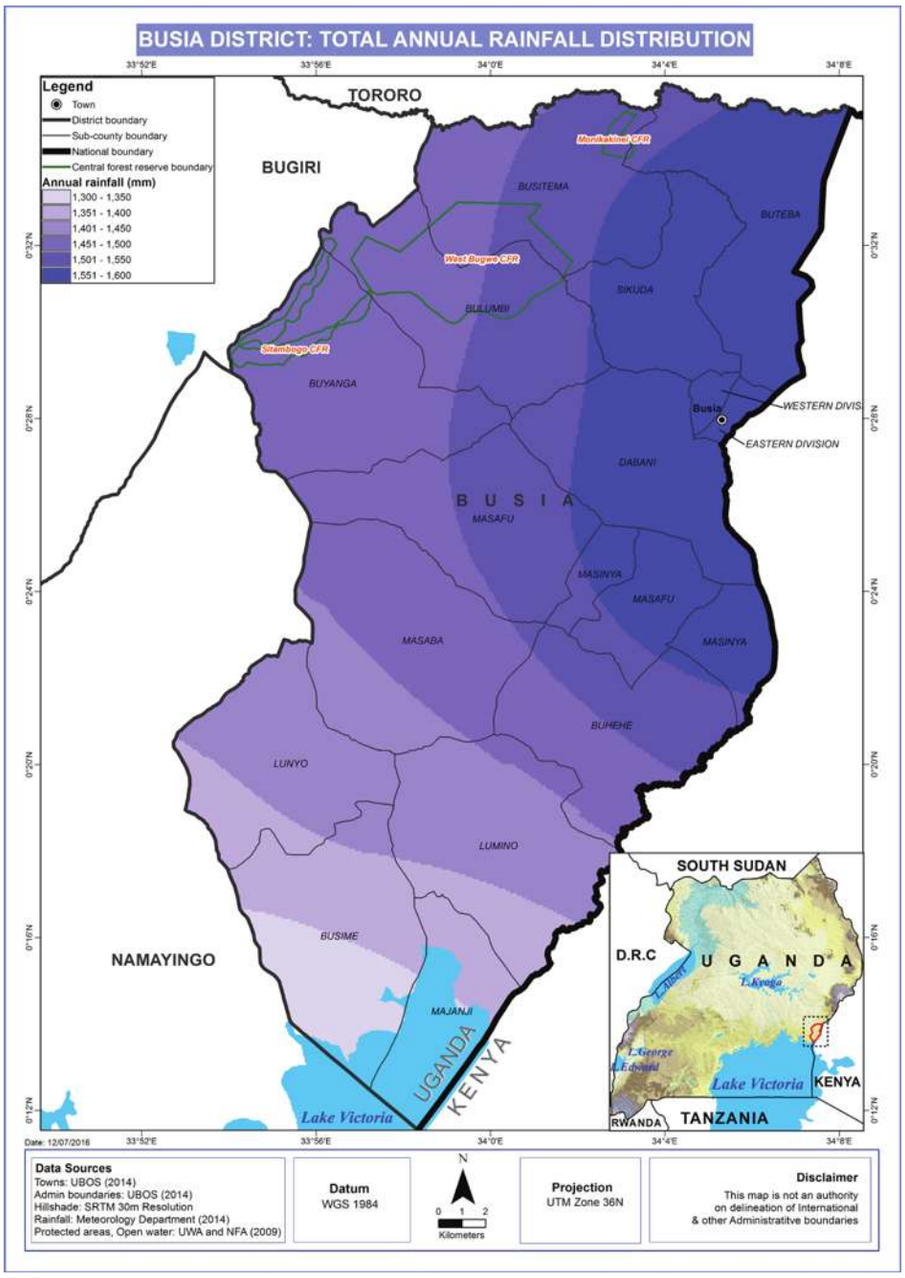


Figure 5: Total Annual Rainfall Distribution, Busia District

2.1.5 Wind

The long-term wind speed records from the Global Weather Data Website (1979 - 2014) indicate average annual wind speeds of 2 knots and 3 knots at 0600 hours and 1200 hours, for Busia. The wind speed values indicated, therefore, represent conditions of moderate to strong or turbulent conditions. The average number of calms experienced in the area, are indicated to be experienced for 99days at 0600 hours, and 27 days at 1200 hours, respectively, at Busia. The general conclusion from these climatic figures is that for most of the year, Busia experiences moderate to strong and gusty winds, increasing in the afternoon.

2.1.6 Hydrology

Busia District has both surface and underground water sources. Wetlands and rivers cover a total area of 57.173sq. km, while open water, Lake Victoria, cover 36.88sq. km. The most significant permanent swamp systems are along River Lumboka to the west, forming part of the boundary with Bugiri District, and River Malaba to the north bordering Tororo District. There are also some smaller swamp systems along River Sio bordering Kenya. Other significant rivers are Okame, Solo, Namachi, Nasinjekhe, Nabihidwe and Eseka.

The presence of numerous streams and swamps have enabled the District to have a high potential of protectable springs and easy to drill boreholes in major areas of the District especially in Busitema, Buteba, Masafu, Dabani and Bulumbi Sub-counties.

There is also a potential for manual borehole augur in some parts of the District i.e. Masaba and Busitema Sub-counties.

Otherwise the Sub-counties of Busime, Majanji, Lunyo, Lumino and Buhehe have no potentials for spring protection leaving the District with no option but to provide deep boreholes and rain water harvesting facilities.

The quality of water is very palatable with very low mineral content in most parts of the District except areas near Lake Victoria.

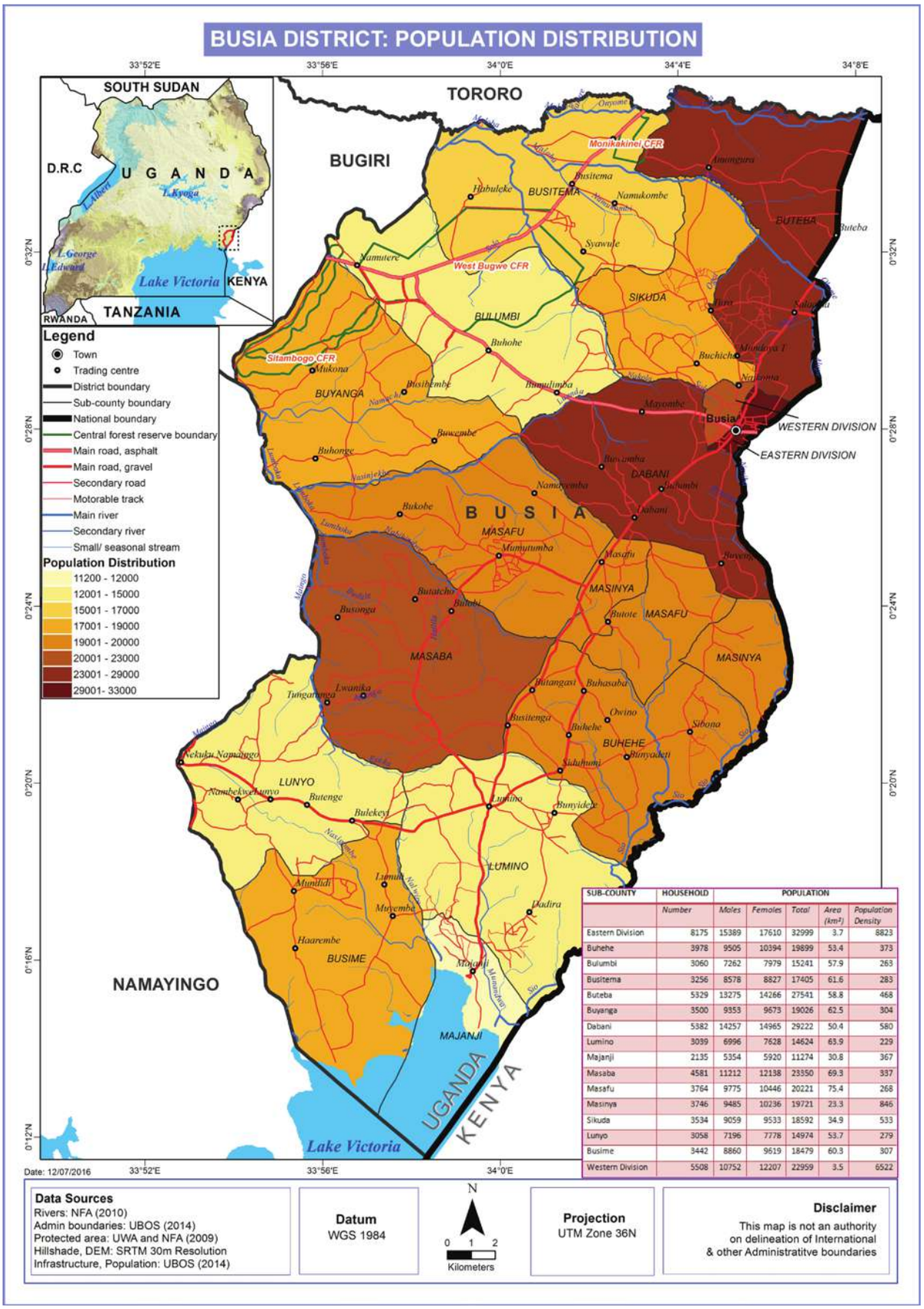
2.1.7 Population

According to the National Population and Housing Census (2014) results, Busia District had a total population of 325,400 people. The gender distribution was reported to be males: 155,929 (47.9%) and females: 169,471 (52.08%). (Figure6). Table 1 shows the population distribution per sub-county for the different gender.

Table 1: Population Distribution in Busia District Source:

SUB-COUNTY	HOUSEHOLDS		POPULATION				
	Number	Average	Males	Females	Total	Area	Population Density
Eastern Division	8175	4.0	15389	17610	32999	3.7	8823.3
Buhehe	3978	5.0	9505	10394	19899	53.4	372.9
Bulumbi	3060	5.0	7262	7979	15241	57.9	263.1
Busitema	3256	5.2	8578	8827	17405	61.6	282.6
Buteba	5329	5.2	13275	14266	27541	58.8	468.2
Buyanga	3500	5.4	9353	9673	19026	62.5	304.3
Dabani	5382	5.2	14257	14965	29222	50.4	580.2
Lumino	3039	4.8	6996	7628	14624	63.9	229.0
Majanji	2135	5.3	5354	5920	11274	30.8	366.5
Masaba	4581	5.1	11212	12138	23350	69.3	336.8
Masafu	3764	5.3	9775	10446	20221	75.4	268.1
Masinya	3746	5.2	9485	10236	19721	23.3	845.7
Sikuda	3534	5.3	9059	9533	18592	34.9	533.3
Lunyo	3058	4.9	7196	7778	14974	53.7	278.6
Busime	3442	5.4	8860	9619	18479	60.3	306.6
Western Division	5508	4.1	10752	12207	22959	3.5	6522.4
TOTAL	65487		156308	169219	325527	763	426

UBOS Census 2014



SUB-COUNTY	HOUSEHOLD	POPULATION				
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Lunyo	3058	7196	7778	14974	53.7	279
Busime	3442	8860	9619	18479	60.3	307
Western Division	5508	10752	12207	22959	3.5	6522

Figure 6: Population Distribution, Busia District

2.1.8 Economic activities

Majority of the population is mainly involved in agriculture (crop) production engaging over 85% of the population, hence provides the most important source of household income and livelihood. Production is mainly subsistence on small land holdings of about 2.2 hectares, Cotton is the traditional cash crop and cassava is the major staple food, while maize is grown on fairly large scale mainly for cash and food. The local population in Busia District is also engaged in rearing of local breeds of livestock, with over 90% of the animals found in rural areas. Other economic activities carried out in the district include; Fishing, Tourism, Mining and quarrying activities.

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 five respondents (District Agricultural Officer, District Fisheries Officer and 3 Sub-county Extension Officers) was held at Busia District Headquarters (620256E, 51042). 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 Masafu Sub county (), Dabani Sub-county (), Busitema Sub-county () and Lumino 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 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).

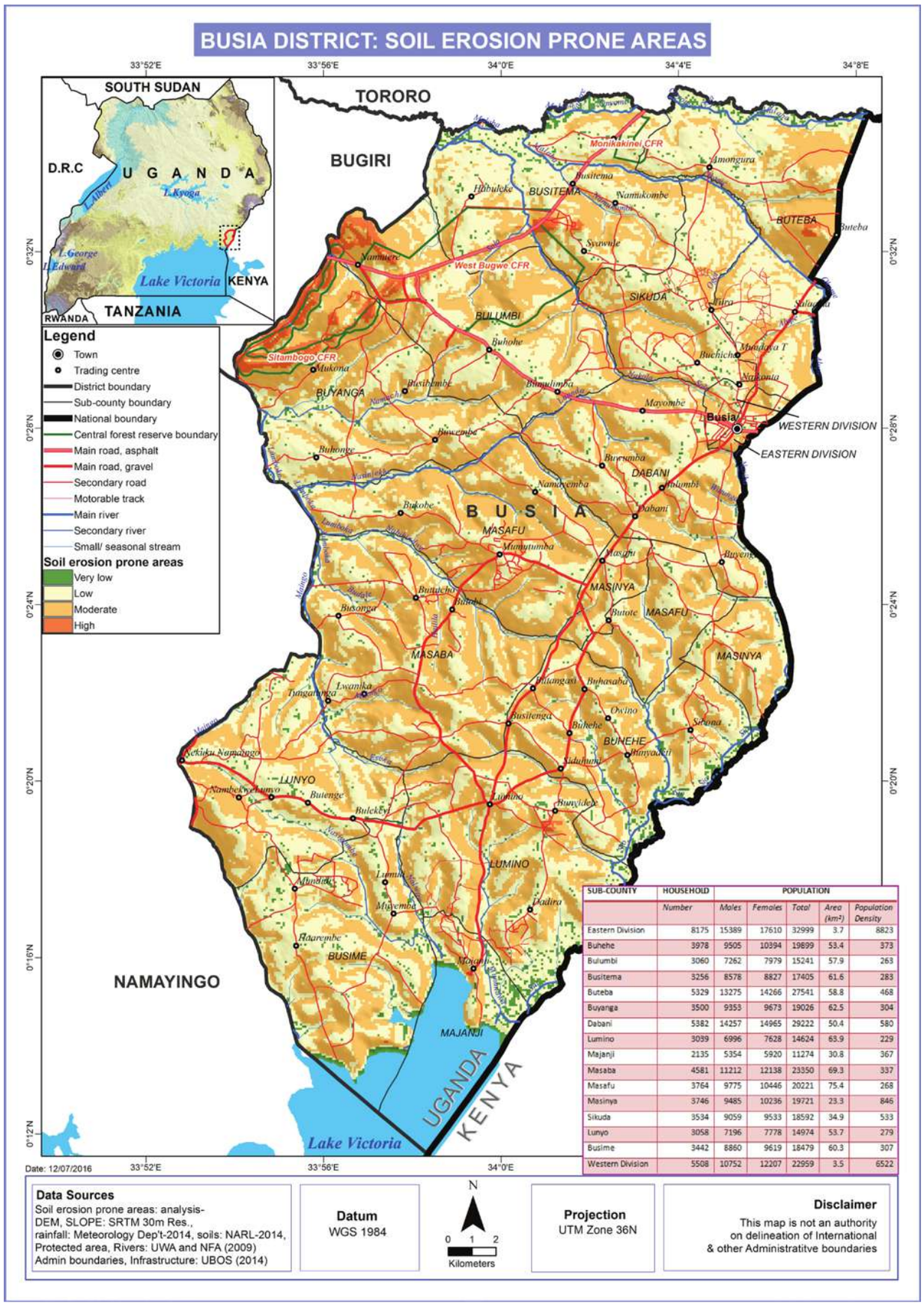
In the case of Busia district, hazards were classified following main controlling factors:

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

4.1 Geomorphological and Geological Hazards

4.1.1 Landslides, rock falls and soil erosion

Results from the participatory assessments indicated that soil erosion is a common occurrence in Busia district during the rainy seasons especially in the sub counties of Buhehe, Busitema, Dabani, Buteba and Sikuda. Crops such as maize, cassava and beans were listed as the major crops affected by soil erosions. They reported that there are a number of practices being put in place by farmers to mitigate soil erosion these include; strip grass planting and general water and soil conservation are some of the practices which have been embraced in the sub county of Buteba, Dabani, Bulumbi. 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)



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Buhehe	3978	9505	10394	19899	53.4	373
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Dabani	5382	14257	14965	29222	50.4	580
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Busime	3442	8860	9619	18479	60.3	307
Western Division	5508	10752	12207	22959	3.5	6522

Figure 7: Rock falls and soil erosion, Busia District

4.1.2 Earthquakes and faults

Participants in the focus group discussions indicated that Busia district experiences earth tremors but minor without significant damage. During the focus group discussion it was reported that some areas in the district have developed lines of weakness, a case to mention was Dabani, Sikuda, Busitema and Buteba Sub counties where there is gold mining activities. In 2014, it was reported that one of gold mining pits fell off (collapsed) and killed one person who was mining in Tira Parish Sikuda sub county. (Figure 8).

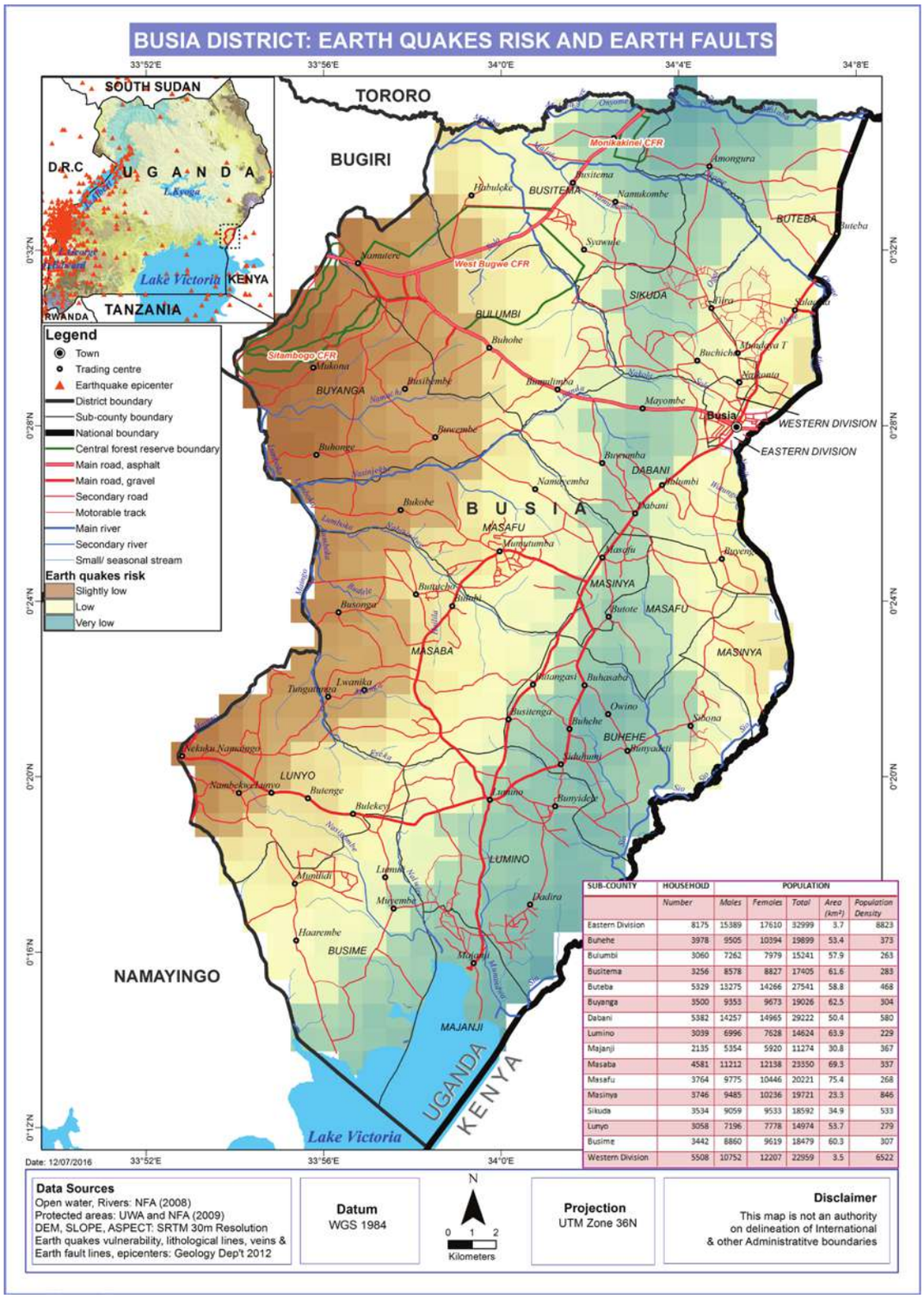

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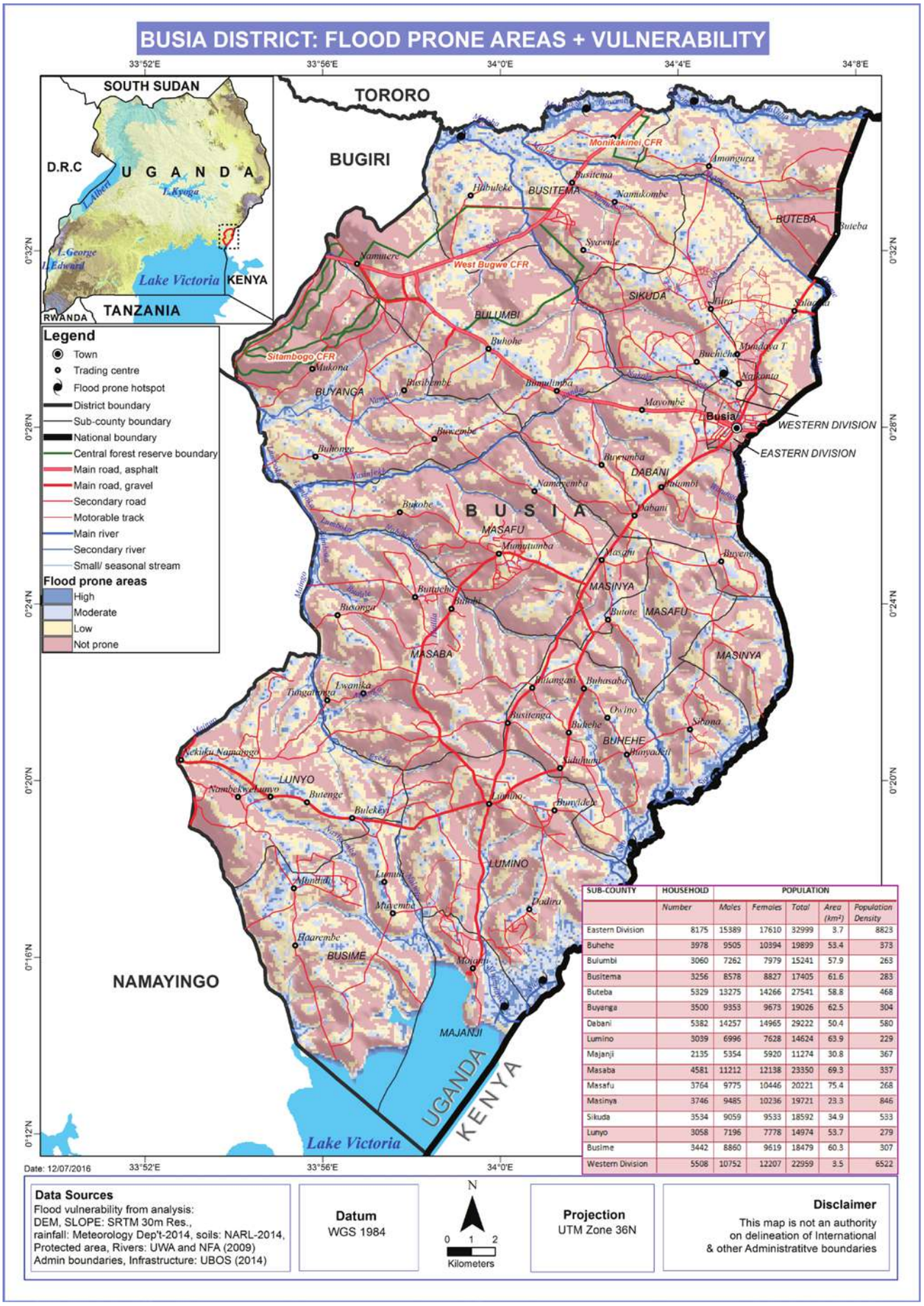
Figure 8: Earthquakes Vulnerability and Fault lines, Busia District

4.2 Climatological and Meteorological Hazards

4.2.1 Floods

Participants in the focus group discussions reported that flooding in Busia district mainly occur during rainy season and are mostly experienced in the sub counties of Busitema and Sikuda. They reported that in 2015 Chawo primary school in Chawo parish was affected by floods where a class room was water logged. Besides that, these floods also displaced people leave alone affecting livestock and crops. The participants also noted that floods always affect livestock pastures, impact on the water quality and logged areas create ambient conditions for tsetse flies infestation. 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 9).

Plate 1: flooding hot spot in wetland Majanje sub county



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Data Sources
Flood vulnerability from analysis:
DEM, SLOPE: SRTM 30m Res.,
rainfall: Meteorology Dep't-2014, soils: NARL-2014,
Protected area, Rivers: UWA and NFA (2009)
Admin boundaries, Infrastructure: UBOS (2014)

Datum
WGS 1984

N
0 1 2
Kilometers

Projection
UTM Zone 36N

Disclaimer
This map is not an authority on delineation of International & other Administrative boundaries

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

4.2.2 Dry spells

Results from participatory assessments indicated that droughts in form of dry spells are a serious problem in Busia district and mostly occur on sub counties along the lake which include; Majanji, Lumino, Busime, Lunyo and Buhehe. They reported that the farmers have managed to follow coping strategies which include; small scale irrigation, water harvesting in Buhehe and planting of short term maturing crops and resistant varieties. 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 10).

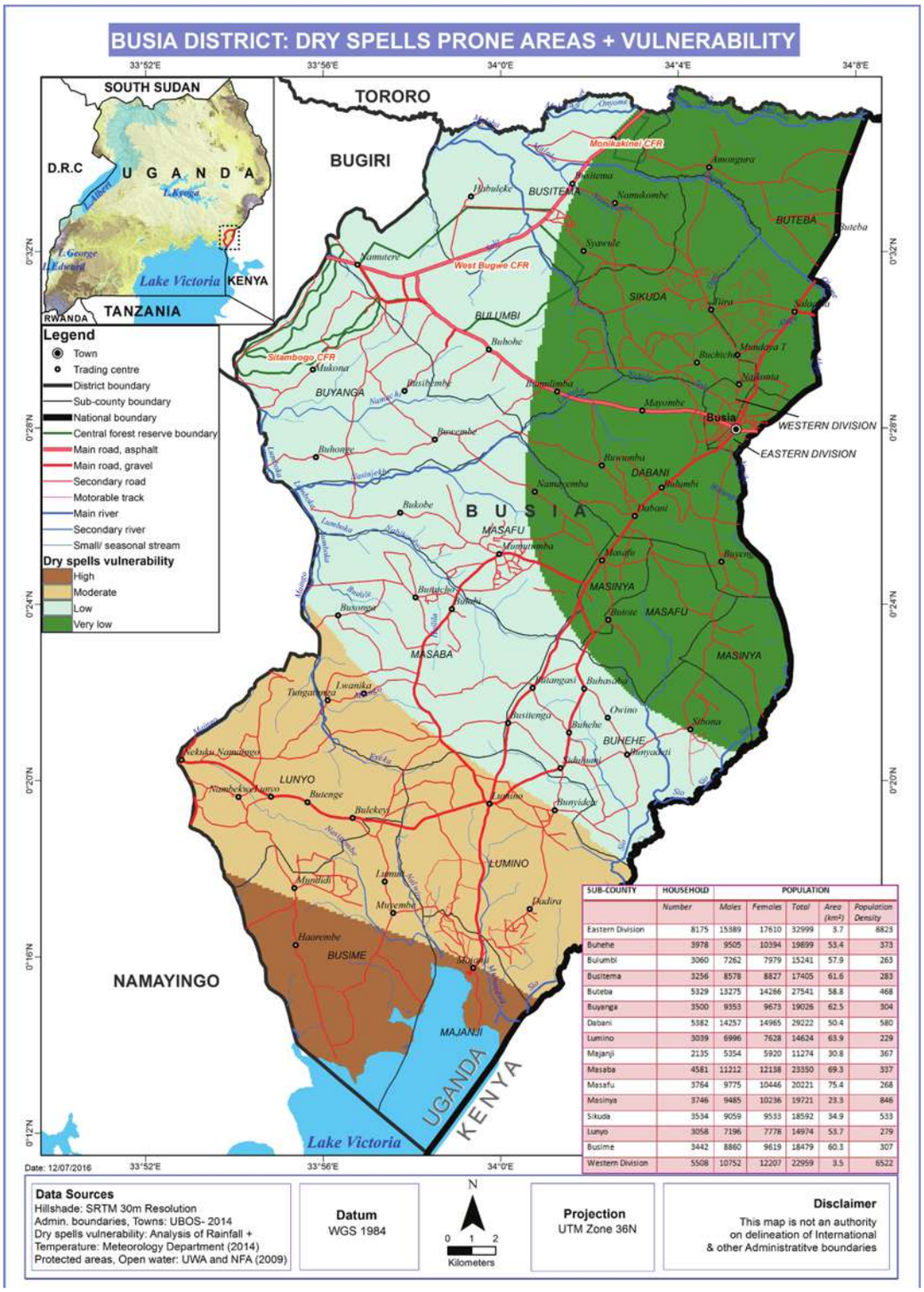

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Figure 10: Drought Vulnerability Ranking, Busia District

4.2.3 Hailstorms

Participatory assessments through the focus group discussions indicated that hailstorms are experienced on a few occasions during heavy rains in the whole district and no sub county in specific is most hit.

4.2.4 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. Participants indicated that lightning was a common occurrence in Busia district. It is reported that of recent in 2016, 3 people were struck by lightning in Masafu sub county, another incident happened in 2015 in Lumino market, however no death cases were reported.

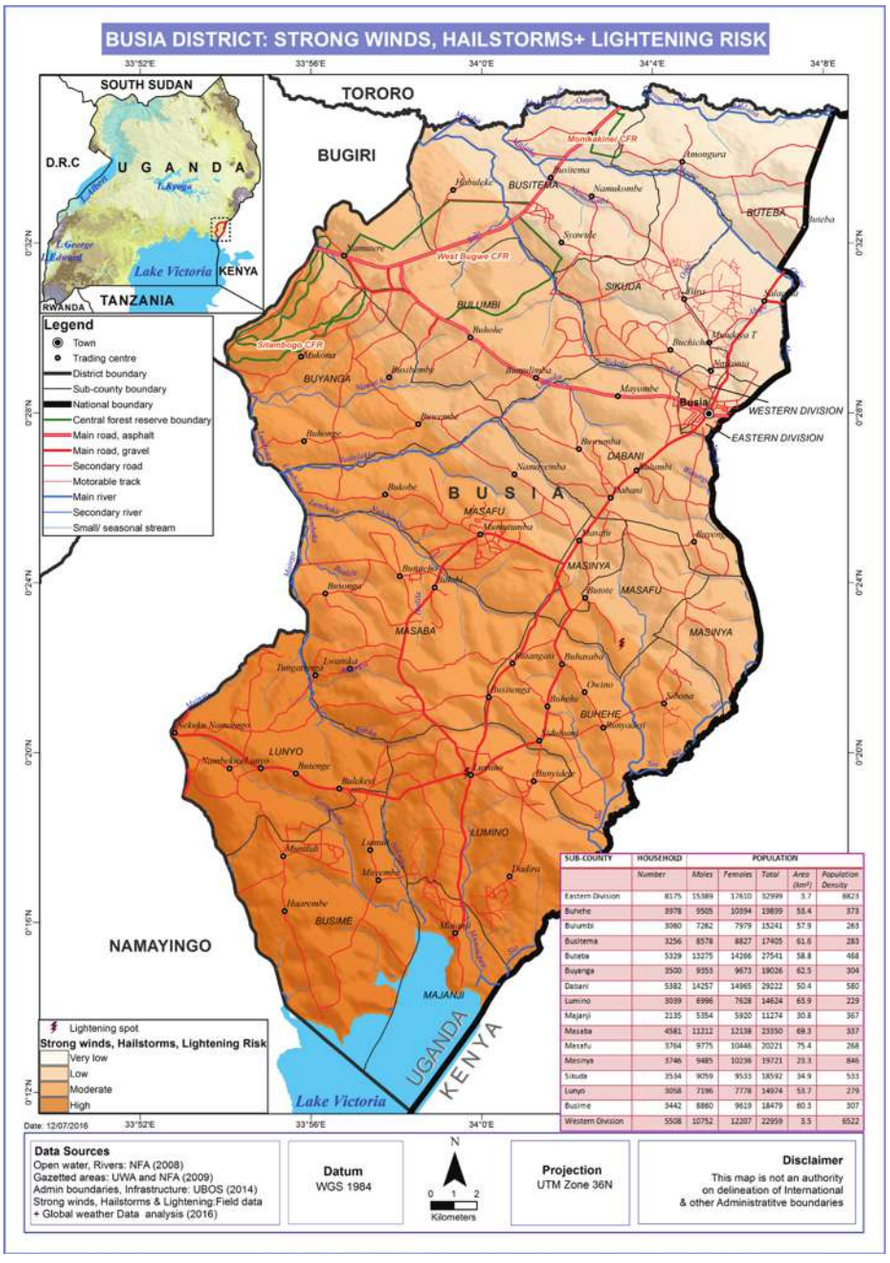

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Figure 11: Hailstorms and Lightning Hotspots and Vulnerability, Busia District

4.3 Ecological and Biological Hazards

4.3.1 Crop Pests and Diseases

Results from participatory assessments indicated that Busia district is vulnerable to crop pests and diseases. The most reported crop pests and diseases include; parasitic weed (yellow like net TO BE IDENTIFIED) commonly in the sub counties of Buyanga, Masafu and Masaba, mole rats, striga, maize stalk borer, maize lethal necrosis commonly in the sub counties along the Kenyan border, smuts in sorghum, cassava mosaic, bean root rot, leaf rust and anthracnose in beans. It was reported that these crop pest lead to poor formation of seeds, low yields and fewer tubers in cassava.
(Figure 12) shows crop pests and diseases vulnerability in Busia district.

Plate 2: *Banana plantation affected in Lumino Sub-county*

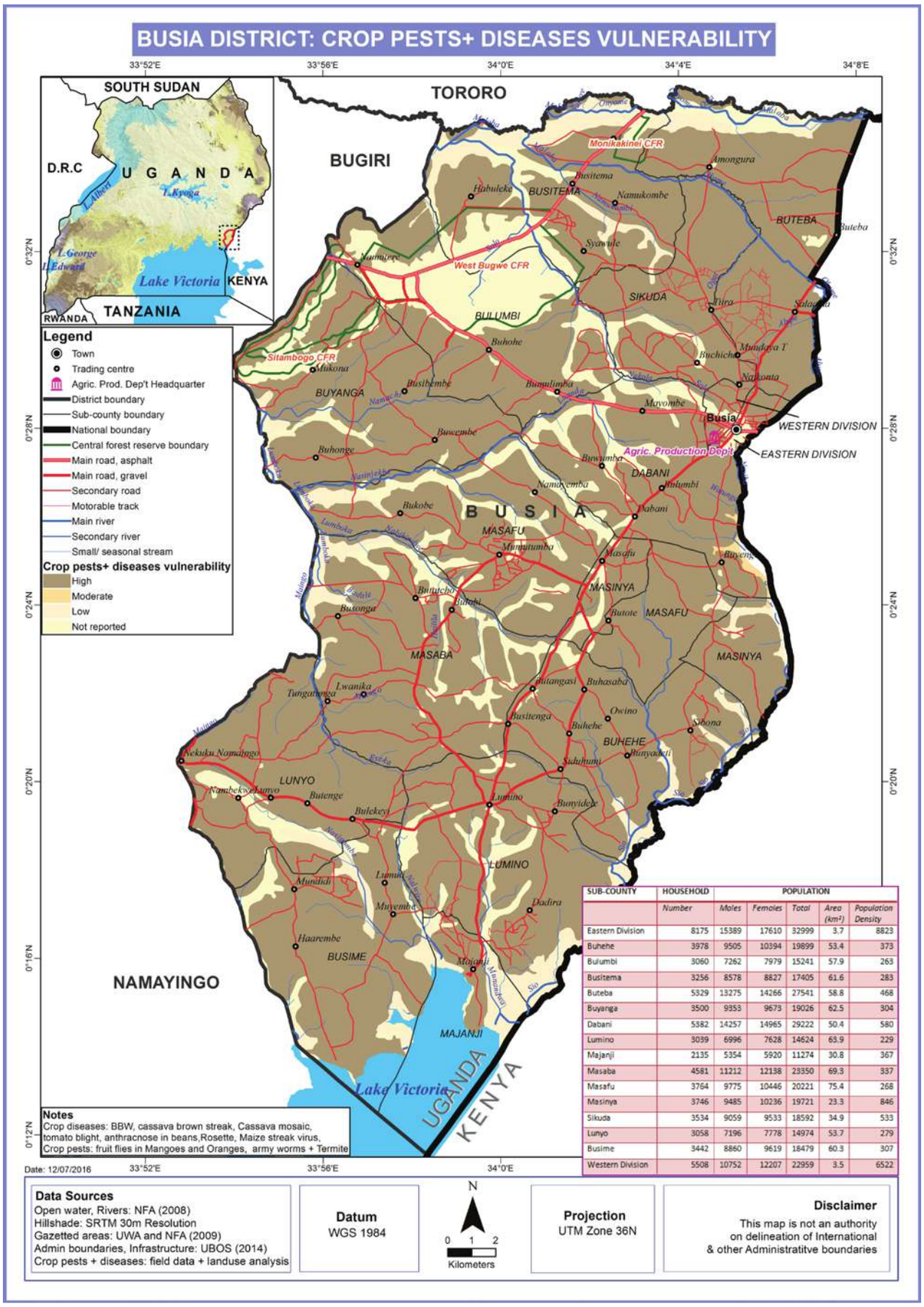

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Figure 12: Crop Pests and Diseases Vulnerability, Busia District

4.3.2 Livestock parasites and Diseases

The most common pests and diseases that affect livestock in Busia district include; tick borne diseases mainly east coast fever, cattle worm infections, bacterial and viral infections like black quarter, foot and mouth disease and brucellosis in cattle, worm infections in goats, Newcastle disease, coccidiosis and fowl typhoid in poultry and African swine fever in pigs. These livestock diseases are common in the entire district.

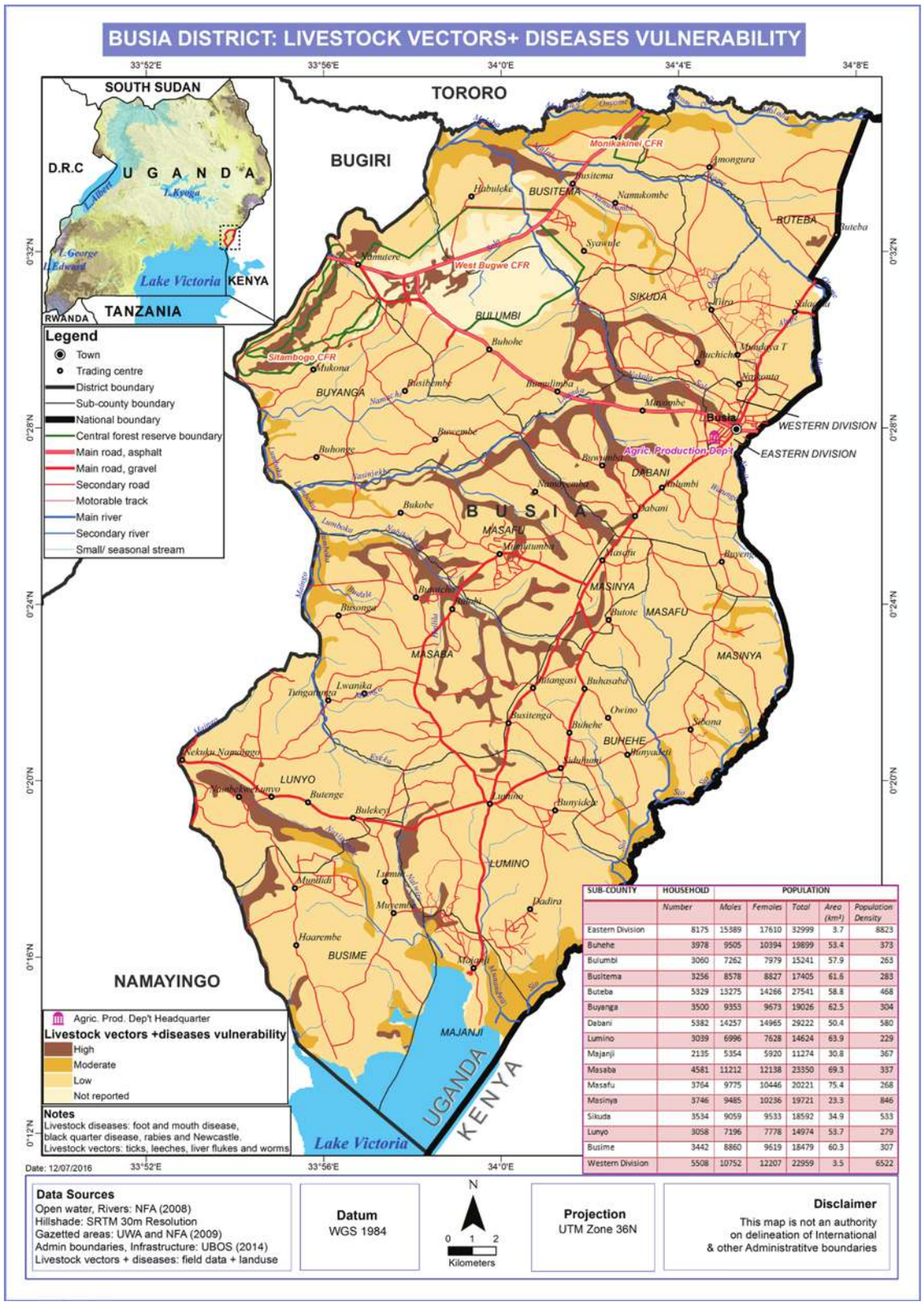

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Figure 13: shows livestock pests and diseases vulnerability in Busia district.

4.3.3 Human Diseases

Participatory assessments indicated that the most common disease epidemics experienced in Busia district are; malaria, dysentery, cholera, respiratory tract diseases, chicken pox in the municipality, polio epidemics and food poisoning. Other common diseases are malnutrition, ear infections, maternal health related conditions, skin diseases and HIV/AIDS (Figure 14). The prevalence rates of HIV/AIDS were reported to be highest on the border due to many immigrants, and sub counties listed include Majaji, Lumino, Busia Municipality and the lake shores. It was reported that these areas highlighted have active commercial sex, lesbianism and homosexuality. The prevalence rate for the entire district is (5.3%). The district health officer reported that a lot has been done different actors including; Busia district local government, different NGOs and the government of Uganda to help curb down the prevalence rate in HIV/AIDS among these include; distribution of condoms to the suspected hot sports, testing of HIV/AIDS , treatment and counseling, radio talk shows, and PEP provision to hospitals and clinics.

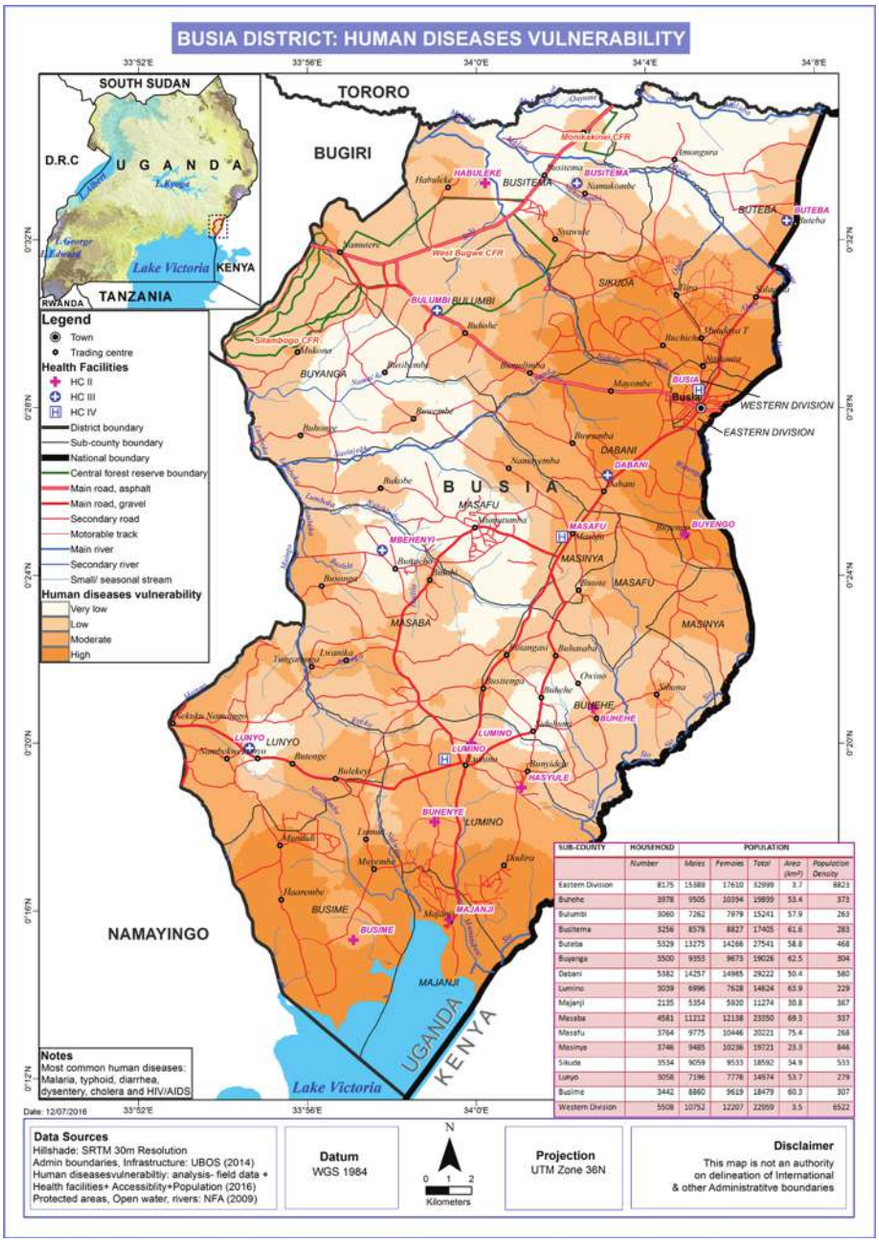

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Figure 14: Human Diseases Prevalence and Health Facilities, Busia District

4.3.4 Vermin and Wild-life Animal Attacks

In Busia district, human-wildlife conflicts are a pertinent issue for those communities surrounding the forests including Busitema, Bulumbi, Bubango, Chawo and Habuleke parishes. In 2015 it was reported that a hunter was attacked by a baboon in Syanyonja parish. Generally it was reported the cases of conflicts between the communities and wildlife/vermin are most prominent in the west Bugwe central reserve. The reports also revealed that these vermin have created significant negative impacts which include; injuring the humans, crop raiding causing total damage to the gardens, and cases of baboons attacking poultry. It was reported Busia district with UWA are collaborating together reduce on vermin attacks.

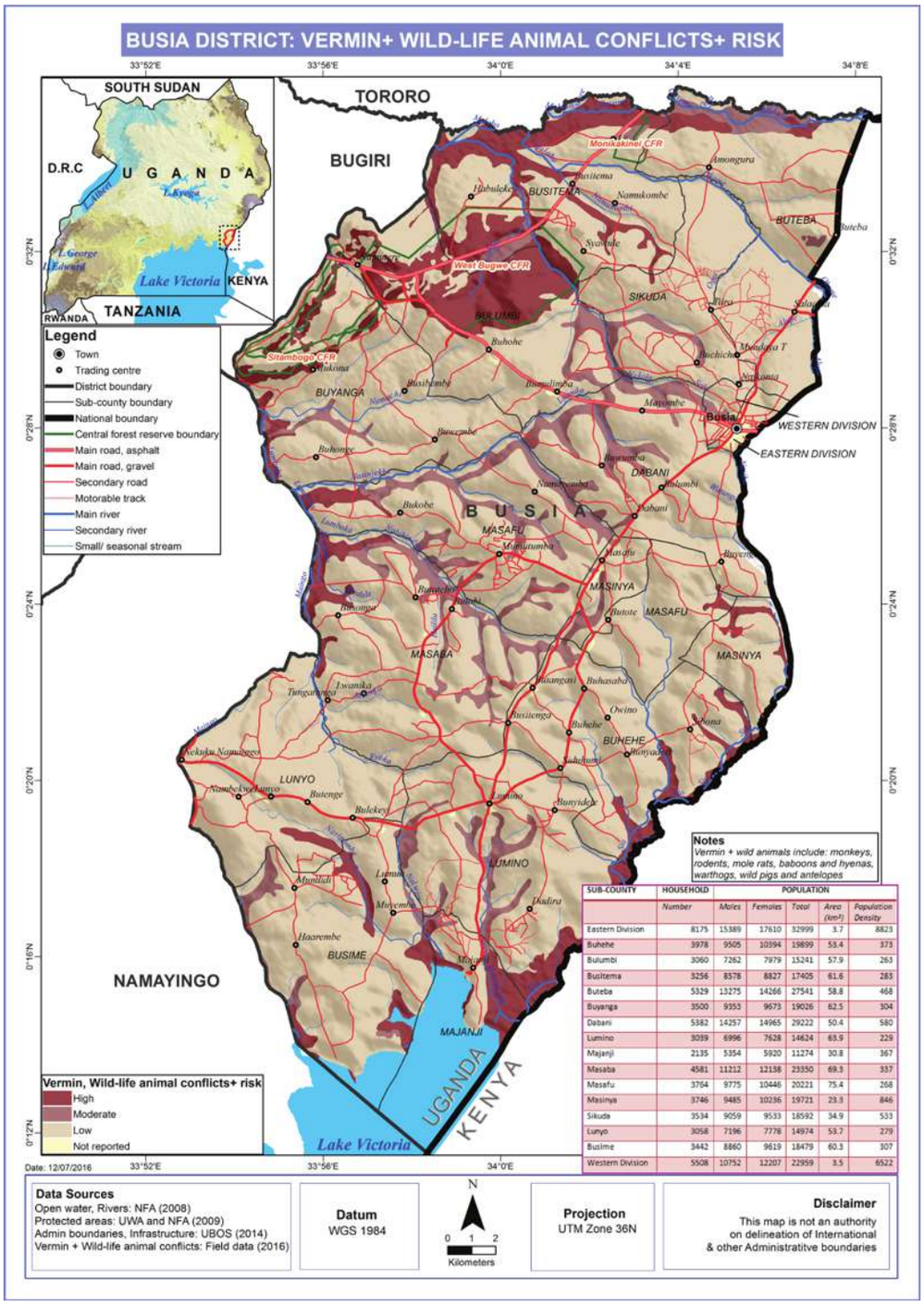

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Figure 15: shows vermin and wildlife animal conflicts and vulnerability in Busia district.

4.3.5 Invasive species

The most common invasive species in Busia district were *Lantana camara (* harbor flies*)*, Paper Mulberry, yellow flowered Tithonia, green herb (to be identified) and *Striga* .The above mentioned invasive species are common in the entire district. Figure 16 shows invasive species prone areas in Busia district.

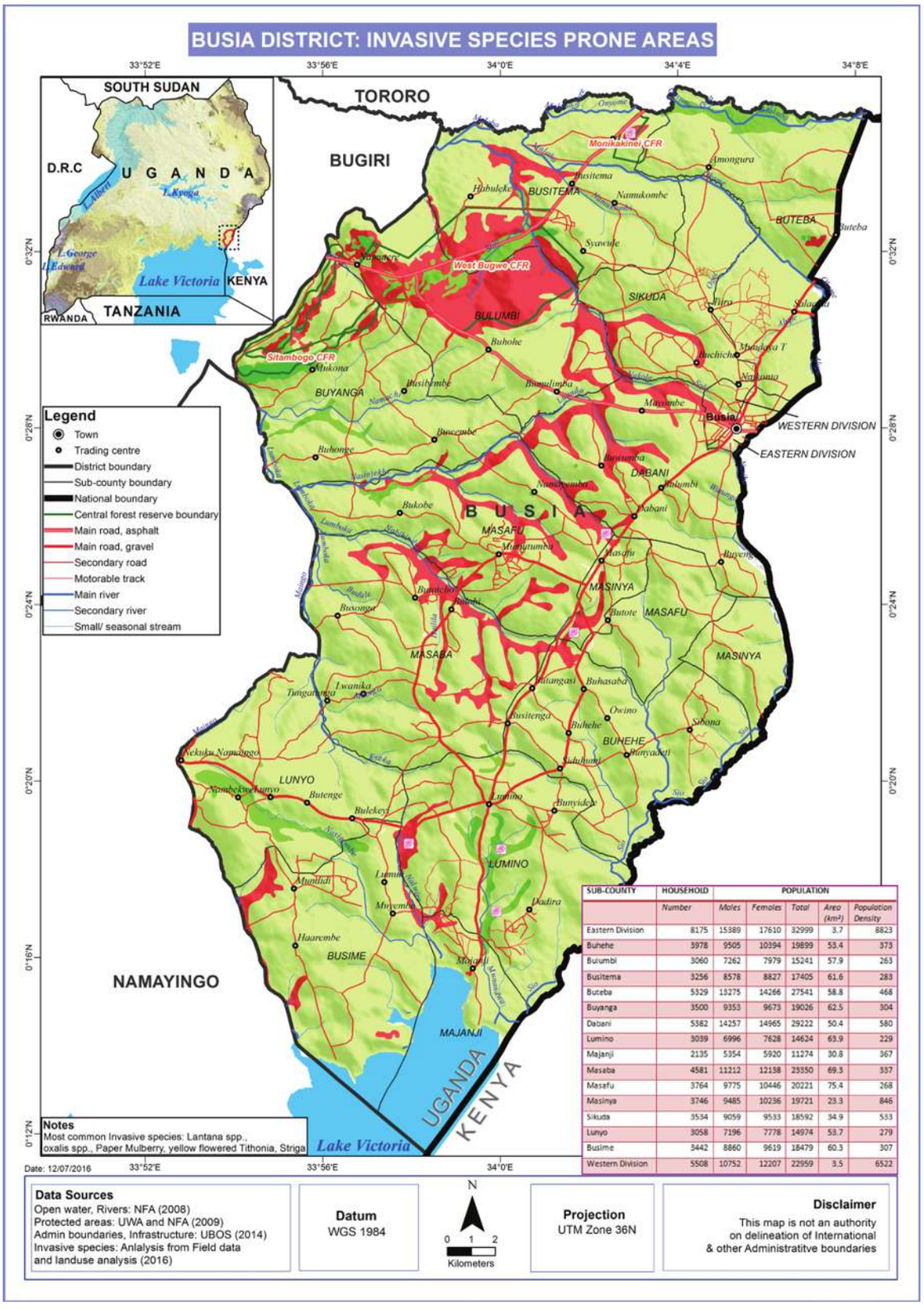
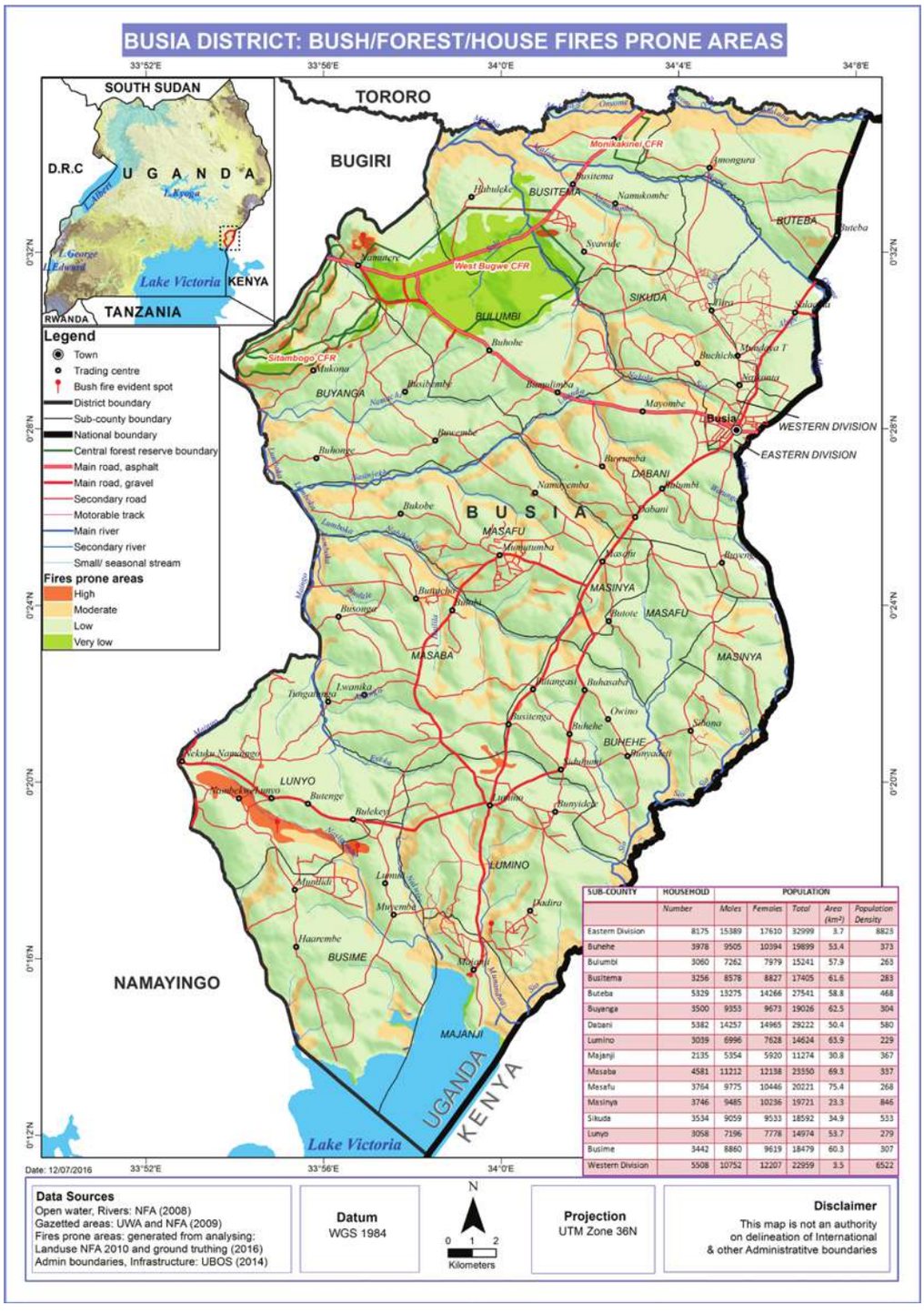


Figure 16: Invasive Species Vulnerability, Busia District

4.4 Human Induced and Technological Hazards

4.4.1 Fire outbreaks

Participants in the focus group discussions indicated that there have been cases of forest fires; a case was reported in March 2015 where west Bugwe central forest reverse was set on fires by the local communities who were suspected to be charcoal burners. These fires impacted negatively to the vegetation and animals especially the wildlife. There have been other cases of fire out breaks which include home fires and a case to mention was in Busia municipality where electricity burnt a house due electric short circuit.



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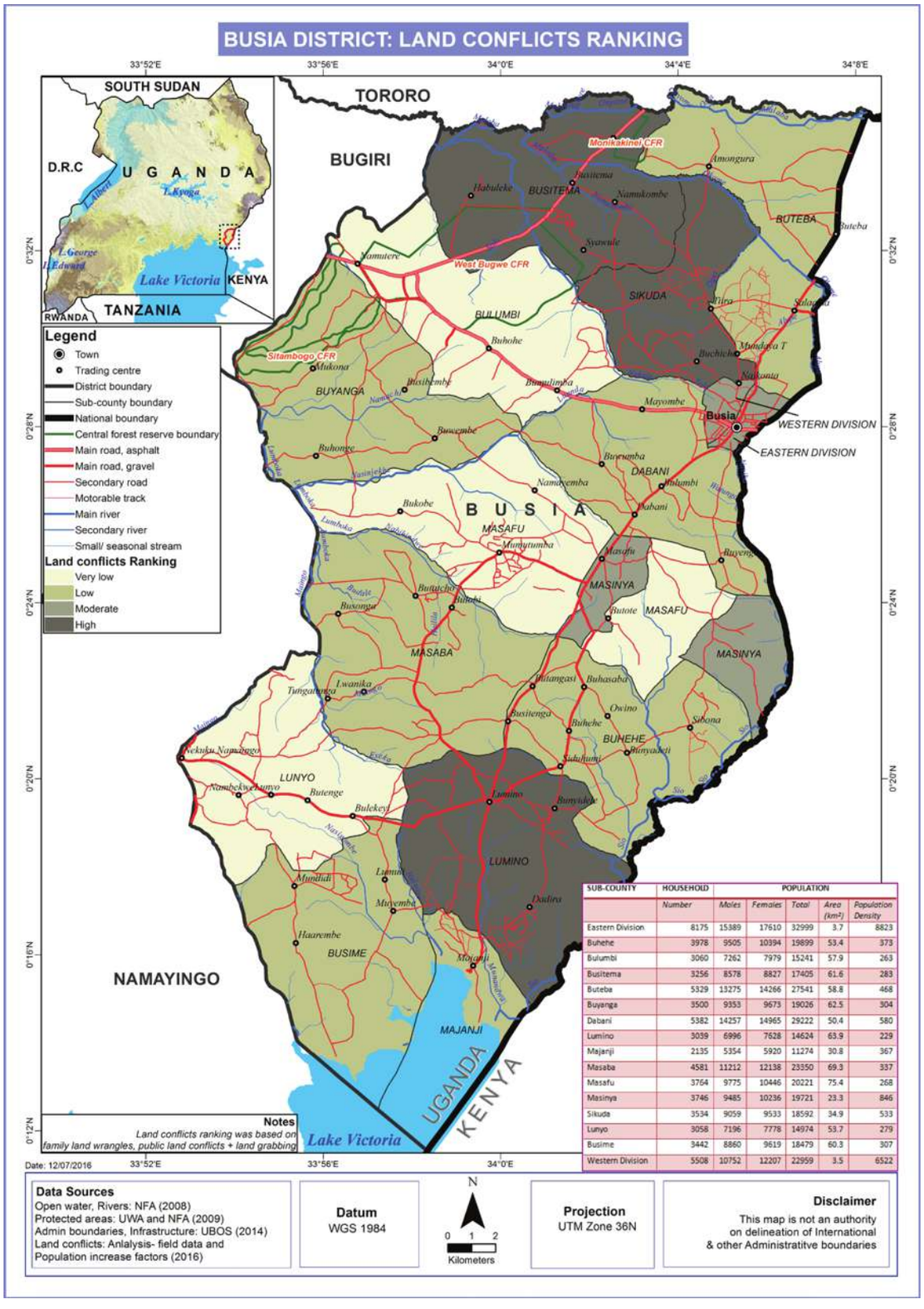
Majanji	2135	5354	5920	11274	30.8	367
Masaba	4581	11212	12138	23350	69.3	337
Masafu	3764	9775	10446	20221	75.4	268
Masinya	3746	9485	10236	19721	23.3	846
Sikuda	3534	9059	9533	18592	34.9	533
Lunyo	3058	7196	7778	14974	53.7	279
Busime	3442	8860	9619	18479	60.3	307
Western Division	5508	10752	12207	22959	3.5	6522

Figure 17: shows bush/forest fires hotspot areas in Busia District.

4.4.2 Land conflicts

Results from the participatory assessments indicated that land conflicts were common in the entire district. Participants reported that land for Lumino sub county headquarters has failed to be surveyed due to land wrangles. It was reported that other land disputes are usually between family members. Figure 18 shows land conflict prone areas in Busia district.



SUB-COUNTY	HOUSEHOLD	POPULATION				
	Number	Males	Females	Total	Area (km²)	Population Density
Eastern Division	8175	15389	17610	32999	3.7	8823
Buhehe	3978	9505	10394	19899	53.4	373
Bulumbi	3060	7262	7979	15241	57.9	263
Busitema	3256	8578	8827	17405	61.6	283
Buteba	5329	13275	14266	27541	58.8	468
Buyanga	3500	9353	9673	19026	62.5	304
Dabani	5382	14257	14965	29222	50.4	580
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Western Division	5508	10752	12207	22959	3.5	6522

Figure 18: Land Conflicts Ranking, Busia District

4.4.3 Environmental Degradation

The reports revealed that there is serious land degradation in the District through continuous cultivation /over cultivation, bush burning and deforestation among other factors. The local farmers use poor farming methods such as those mentioned above due to population pressure leading to negative consequences of soil erosion and loss of soil fertility and the problem of reduction in agricultural production. Fragile ecosystems such as wetlands and Forest Reserves have been degraded through deforestation and wetland drainage. Some of the wetland under threats include Chawo in Busitema sub county and Busunba wetland in Dabani. Other forms of environment degradation in the district include; sand mining from the lake in Majanji Sub County, gold mining in Buteba, Sikuda and Busitema and encroachment into west Bugwe central forest reserve majorly for charcoal, firewood and timber. (Figure 19).

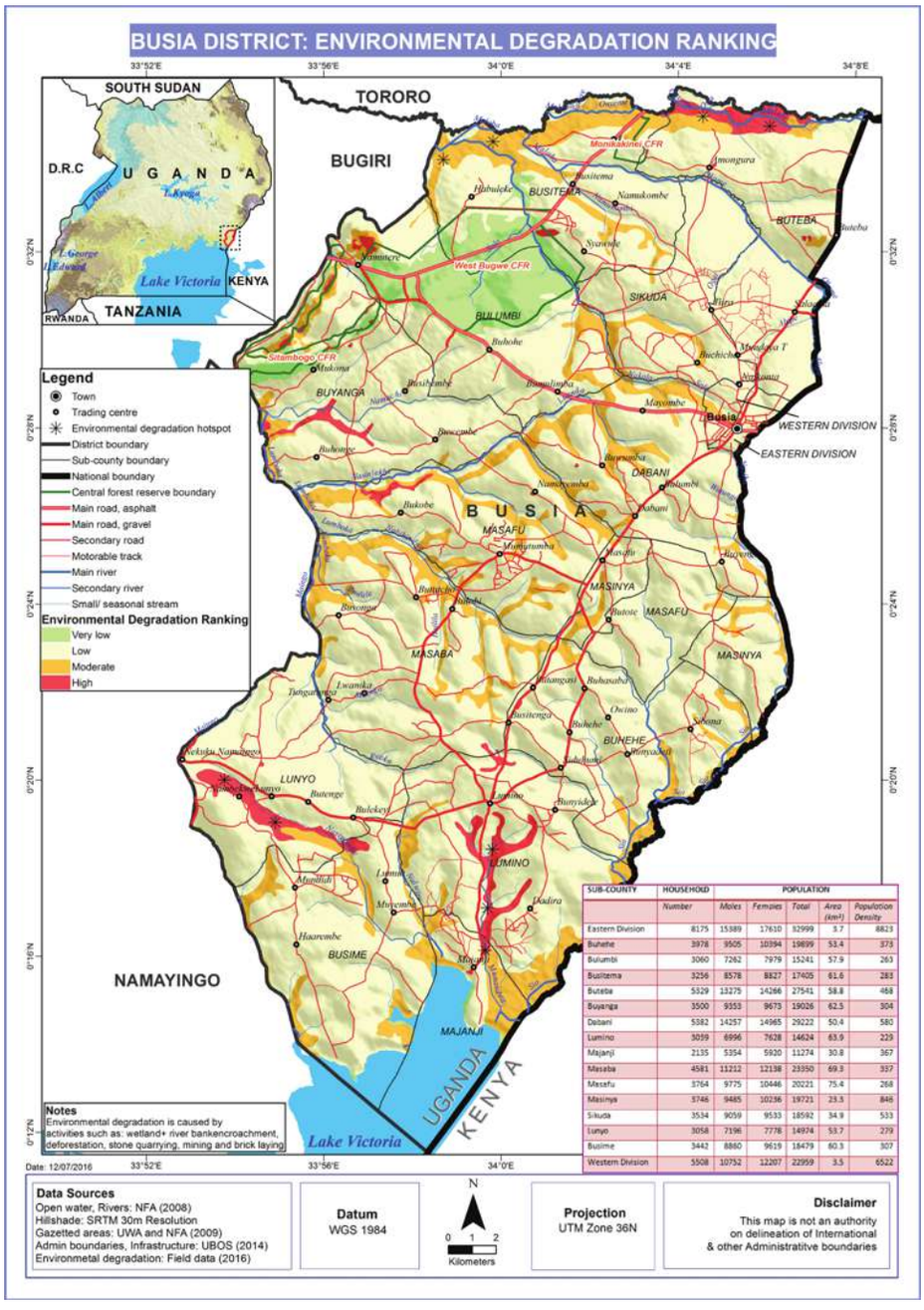
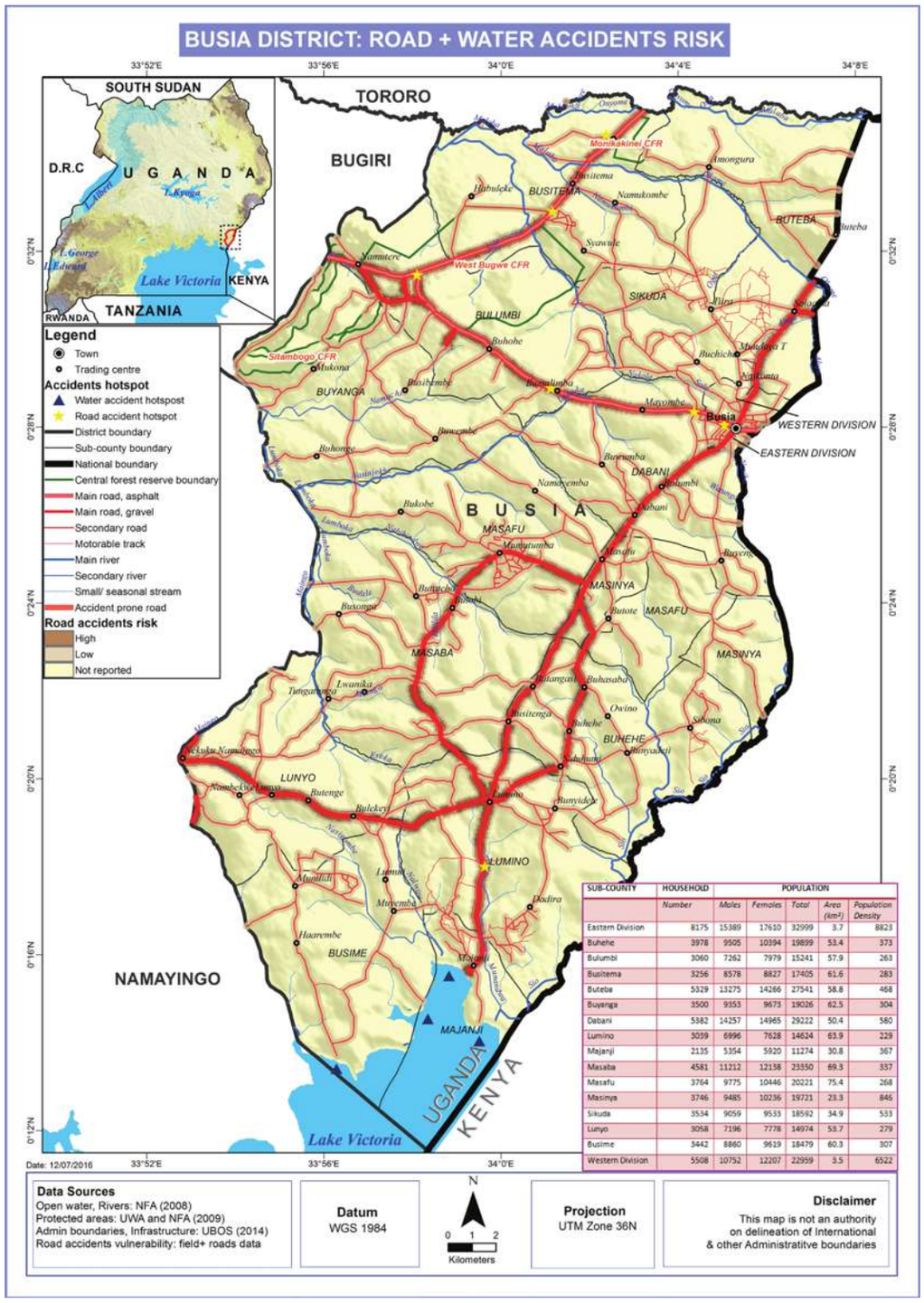


Figure 19: Environmental Degradation Ranking, Busia District

4.4.4 Road Accidents and Water Accidents

Participants in the focus group discussions reported that accidents mainly occur on the Busia- Jinja highway, Busia- Tororo road and Busia main market. Some of these accidents are caused by over speeding and reckless driving, it was reported that Busia being at border a lot smuggling activities are common, these is also said to have increased on the cases of accidents due to over spending. Water accidents were also reported in the sub counties near Lake Victoria where boats usually capsize due to over loading and strong wave in Majaji and Busime.



SUB-COUNTY	HOUSEHOLD	POPULATION				
	Number	Males	Females	Total	Area (km²)	Population Density
Eastern Division	8175	15389	17610	32999	3.7	8823
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Busime	3442	8860	9619	18479	60.3	307
Western Division	5508	10752	12207	22959	3.5	6522

Figure 20: shows road and water accidents hotspots in Busia 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 Busia 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 Busia District.

Table 2: Components of Vulnerability in Busia District

Vulnerability	Exposure			Susceptibility			Resilience
	Hazards	**Elements at Risk**	Geographical Scale	**Susceptibility**	Geographical Scale	**Coping strategies**	Geographical Scale
Socio-economic component	Soil erosion	- Crops near rivers and wetlands.	Parish	- Complete crop failure	Parish	-Sensitization by both government and non-governmental agencies	Parish
	Tremors	- Infrastructure e.g. houses, schools	District	- Loss of lives - Destruction of Infrastructure e.g. houses, schools	District	-No much measure so far Sensitisation	District
	Floods	- Livestock adjacent to flood plain - Crops on flood plain - Infrastructure e.g. houses, schools, roads adjacent to flood plain	Parish	- Livestock loss - Destruction of crops - Destruction of infrastructure e.g. houses, schools, roads adjacent to flood plain	Parish	-Migration -Sensitization on wetland conservation -Dig trenches	Parish
	Dry spells	- Livestock - Crops - Human population	Village	- Food insecurity & poverty - Livestock loss - Crop failure - Shortage of pasture - Shortage of water	Village	-Migration -Sensitization on tree planting -Buy food from elsewhere	Village
	Hailstorms, strong winds and Lightning	- Human and livestock populations - Crops - Infrastructure e.g. houses, schools, health centres	Parish	- Loss of lives - Destruction of crops - 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 - Cut and burry affected crops -Sensitization on crop disease management	District
	Livestock Pests and Diseases	-Livestock (cattle, goats etc.)	District	- Loss of livestock - Reduced livestock productivity	District	- Vaccination - Burry and burn animals that have died from infection - Quarantine	District
	Human Disease outbreaks	- Human Population	District	- Loss of lives	District	- Mass Immunization - Use of mosquito nets	District
	Invasive species	-indigenous species -Animals	District	- Outcompete the indigenous spp., suppress growth of indigenous spp - Loss of indigenous spp. - Complete crop Failure - suppress growth of pasture	District	- Cut and burn -Sensitization on Invasive species management	District
	Bush fires	- Livestock - Crops - Infrastructure e.g. houses, schools	Sub-county	- Loss of livestock - Shortage of pasture - Destruction of crops - Destruction of infrastructure e.g. houses, schools	Sub-county	-Sensitization	Sub-county

Road accidents	- Human population - Infrastructure adjacent to accident black spots e.g. houses, schools etc.	Sub-county	- Loss of lives - Destruction of vehicles - Destruction of Infrastructure adjacent to accident black spots e.g. houses, schools etc.	Sub-county	-Humps on roads -Signage on speed limits -Sensitization on traffic rules	Sub-county
Land conflicts	- Human population	Village	-Loss of lives -Family violence and break outs	Village	- Community dialogue - District court in charge of land issues	Village
Vermin and Wildlife animal attacks	- Human population - Livestock - Crops	Parish	-Loss of lives -Livestock loss -Crop destruction	Parish	- Report to UWA - Guard gardens -Poison -Hunt and kill -Fence water collection points with Wildlife animals	Village
Environmental degradation	- Human and livestock populations - Crops - Natural vegetation	Sub-county	-Crop failure -Shortage of pasture -Shortage of water -Decline of water quality	Sub-county	-Sensitization on wetland conservation -Sensitization on tree plating -Setting bi-laws	Sub-county
Soil erosion	- Crops near river banks and wetlands	Parish	- Loss of lives - Complete crop failure - Destruction of infrastructure e.g. homes, and schools	Parish	-Migration -Sensitization by both government and non-governmental agencies	
Earth quakes	- Infrastructure e.g. houses, schools	District	- Loss of lives - Destruction of Infrastructure e.g. houses, schools	District	-No much measure so far	
Floods	- Livestock adjacent to flood plain - Crops on flood plain - Infrastructure e.g. houses, schools, roads adjacent to flood plain	Parish	- Livestock loss - Destruction of crops - Destruction of infrastructure e.g. houses, schools, roads adjacent to flood plain	Parish	-Migration -Sensitization on wetland conservation -Dig trenches	
Drought	- Livestock - Crops - Human population	Village	- Hunger & poverty - Livestock loss - Crop failure - Shortage of pasture - Shortage of water	Village	-Migration -Sensitization on tree planting -Buy food from elsewhere	
Hailstorms, strong winds and Lightning	- Human and livestock populations - Crops - Infrastructure e.g. houses, schools, health centres	Parish	- Loss of lives - Destruction of crops - Destruction of infrastructure e.g. houses, schools, roads adjacent to flood plain	Parish		
Crop Pests and Diseases	-Crops	District	- Complete crop failure	District	- Spraying - Cut and burry affected crops -Sensitization on crop disease management	

Environmental component	Livestock Pests and Diseases	-Livestock (cattle, goats etc.)	District	- Loss of livestock - Reduced livestock productivity	District	- Vaccination - Burry and burn animals that have died from infection - Quarantine	
	Human Disease outbreaks	- Human Population	District	- Loss of lives	District	- Mass Immunization - Use of mosquito nets	
	Invasive species	-indigenous species -Animals	District	- Outcompete the indigenous spp., suppress growth of indigenous spp - Loss of indigenous spp. - Complete crop Failure - suppress growth of pasture	District	- Cut and burn -Sensitization on Invasive species management	
	Bush fires	- Livestock - Crops - Infrastructure e.g. houses, schools	Sub-county	- Loss of livestock - Shortage of pasture - Destruction of crops - Destruction of infrastructure e.g. houses, schools	Sub-county	-Sensitization	
	Road accidents	- Human population - Infrastructure adjacent to accident black spots e.g. houses, schools etc.	Sub-county	- Loss of lives - Destruction of vehicles - Destruction of Infrastructure adjacent to accident black spots e.g. houses, schools etc.	Sub-county	-Humps on roads -Signage on speed limits -Sensitization on traffic rules	
	Land conflicts	- Human population	Village	-Loss of lives -Family violence and break outs	Village	- Community dialogue - District court in charge of land issues	
	Vermin and Wildlife animal attacks	- Human population - Livestock - Crops	Parish	-Loss of lives -Livestock loss -Crop destruction	Parish	- Report to UWA - Guard gardens -Poison -Hunt and kill -Fence water collection points with Wildlife animals	
	Environmental degradation	- Human and livestock populations - Crops - Natural vegetation	Sub-county	-Crop failure -Shortage of pasture -Shortage of water -Decline of water quality	Sub-county	-Sensitization on wetland conservation -Sensitization on tree plating -Setting bi-laws	

Table 3: Vulnerability Profile for Busia 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	5	3	15	Busitema, Sikuda
Dry spells	5	3	15	Lumiono, Buhehe, Majanji, Busime, Lunyo
Soil erosion,	5	2	10	Buhehe, Busitema, Dabani, Buteba, Sikuda
Hail storms, and strong winds	3	2	6	Whole District
Lightning	3	2	6	Masafu, Lumino
Bush fires and Forest fires	3	4	12	Busitema, Bulumbi
Crop pests and diseases	4	2	8	Whole District
Livestock pests and diseases	4	2	8	Whole District
Human Diseases outbreaks	5	3	15	Whole district
Cholera	3	4	12	Municipality
Land conflicts	3	2	6	
Vermin and Wild-life animal attacks	5	4	20	Busitema, Bulumbi
Tremors and faults	3	3	9	Dabani, Buteba, Busitema, Sikuda
Road accidents and Water accidents	5	2	10	Busia Municipality, Bulumbi.
Environmental degradation	5	4	20	District
Invasive species	3	2	5	Whole 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	Lumino	Buhehe	Majanji	Busime	Lunyo	Masaba	Masafu	Dabani	Masinya	Buyanga	Bulumbi	Sikuda	Busitema	Buteba	Eastern Division	Western Division
Floods												H	H			
Dry Spells	H	H	H	H	H	M	L	L	M	L	L	L	L	M	L	L
Soil Erosion	M	H	M	M	M	M	M	H	M	M	M	H	H	H	M	M
Strong winds, Hailstorms	L	M	M	M	M	L	L	L	L	L	L	L	L	L	L	L
Lightning	H	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L
Crop pests and Diseases	L	M	M	M	M	L	L	L	L	L	L	L	L	L	L	L
Livestock pests and Diseases	M	H	H	H	H	M	M	M	M	M	M	M	M	M	M	M
Human disease outbreaks	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
Cholera	M	M	M	M	M		M	M	M	M	M	M		M	H	H
Vermin and Wildlife animal attacks	L	L	L	L	L	L	L	L	L	L	VH	L	VH	L	L	L
Land conflicts	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Bush fires and Forest fires	L	L	L	L	L	L	L	L	L	L	H	L	H	L	H	H
Environmental degradation	VH	VH	VH	VH	VH	VH	VH	VH	VH	VH	VH	VH	VH	VH	VH	VH
Tremors and faults	L	L	L	L	L	L	L	M	L	L	L	M	M	M	L	L
Road accidents	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H
Invasive species	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L

Key

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

4.5.1 Gender and Age groups mostly affected by Hazards

Table 5: Gender and age groups mostly affected by hazards

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

4.5.2 Coping Strategies

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

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

No	Multi-Hazards		Coping strategies
1	Geomorphological or Geological	Soil Erosion	• contour farming • Plant trees to control water movement on hill slopes • Mulching in banana plantations • Plant grass in banana plantations on hill slopes • Removal of stones from banana farmlands
2		Earth tremors and faults	• No action, communities think the tremors are minor • Designs of houses (pillars) • Early warning system • Vigilance • Sensitization • Standard gold mining practices • Emergency response mechanisms
3	Climatological or Meteorological	Floods	• Digging up of trenches in the flood plains • Planting trees to control water movement to flood plains • Migration to other areas • Seek for government food aid
4		Dry spells	• Leave wetlands as water catchments • Plant trees as climate modifiers • Buy food elsewhere in case of shortage • Buy water from the nearby areas • Food Storage especially dry grains
5		Strong winds, Hailstorms and Lightning	• Plant trees as wind breakers • Use of stakes against wind in banana plantations • Use of ropes to tire banana against wind • Installation of lightning conductors • Stay indoors during rains • Changing building designs and roof types • Removal of destroyed crops • Request for aid from the Office of the Prime Minister • Installation of lightning conductors on newly constructed schools • To put on rubber shoes or sandles

6	Ecological or Biological	Crop pests and Diseases	• Spraying pests • Cutting and burying BBW affected crops • Burning of affected crops • Vigilance
7		Livestock pests and Diseases	• Spraying pests • Vaccinations • Burying animals that have died from infection • Quarantine
8		Human epidemic Diseases	• Mass immunisation • Visiting health centres • Use of mosquito nets
9		Vermin and Wild-life animal attacks	• Guarding the gardens • Poisoning • Hunt and kill • Report to UWA • Hugo group • Mauritius thorns • Plant tea as buffer • Dig trenches • Chain link • Plant red pepper as buffer • Recommend vermin guards
10		Invasive species	• Uproot • Spray with herbicides (e.g 2-4-D) • Cut and burn • Sensitization on Invasive species management • Blacklisting exotic species
11	Human induced or technological	Land conflicts	• Community dialogues • Report to court • Migration • Resettlement • Surveying and titling • Strengthen Land management structures • Sensitization on land ownership • Proper demarcation (live fencing)
12		Bush fires/ Forest fires	• Stop the fires in case of fire outbreak • Fire lines (may be constructed, cleared grass) • Fire breaks planted along gardens e.g. euphorbia spp. • Vigilance especially in dry seasons where most burning is done • Bye-laws • Sensitization on dangers of fires
13		Road accidents	• Construction of humps • Road Signage including speed limits • Separate lanes on sharp corners • Sensitisation • Widen narrow roads • Plant trees on road reserve, as road guards • Deployment of Traffic officers
14		Environmental degradation	• Leave wetlands as water catchments • Plant appropriate tree species as climate modifiers • Sensitization • Bye-laws • Enforcement • Gazatte and demarcate wetlands • Restore wetlands and other fragile ecosystems • EIA for new developments • No land titles for wetland areas • Cancellation of existing wetland land titles • Developing land use plans and enforce them • No approval of applications for developments in wetlands by Physical Planning Committees

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 Busia 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 soil erosion, crop pest and diseases and environmental degradation were identified as most serious problems in Busia 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 Busia district increase their vulnerability to hazard exposure necessitating urgent external support.

Hazards experienced in Busia district can be classified as:

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

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

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

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

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

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

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

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

5.2 Policy-related Recommendations

The following recommended policy actions targeting vulnerability reduction include:

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

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

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

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

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

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

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

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

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

x. The government through OPM should improve communication between the disaster department and local communities.

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

xii. 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

Key Informant Interview at Busia district headquarters

FOCUS GROUP DISCUSSION GUIDE FOR DISTRICT DISASTER RISK MANAGEMENT FOCAL PERSONS

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

No.	Name of Participants	Designation	Contact	Signature

Introduction

i. You have all been requested to this session because we are interested in learning from you. We appreciate your rich experiences and hope to use them to strengthen service delivery across the district and the country as whole in a bid to improve access to information on Hazards and early warning.

ii. There is no “right” or “wrong” answers to any of the questions. As a Focus Group Discussion leader, I will try to ask all people here today to take turns speaking. If you have already spoken several times, I may call upon someone who has not said as much. I will also ask people to share their remarks with the group and not just with the person beside them, as we anxious to hear what you have to say.

iii. This session will be tape recorded so we can keep track of what is said, write it up later for our report. We are not attaching names to what you have to what is said, so whatever you say here will be anonymous and we will not quote you by name.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

17. What impacts have been caused by earth quakes?

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

of jurisdiction?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

34. In which way are crops affected by drought?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

of jurisdiction?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

71. What impacts have been caused by wildlife attacks?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

87. What impacts have been caused by environmental degradation?

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

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

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

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

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

93. What impacts have been caused by land conflicts?

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

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

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

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

98. Which roads have experienced Road accidents?

99. What impacts have been caused by Road accidents?

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

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

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

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

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

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

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

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

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

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

FOCUS GROUP DISCUSSION GUIDE FOR LOCAL COMMUNITIES

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

No.	Name of Participants	Village/ Parish	Contact	Signature

Introduction

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. Which crops are majorly grown in your community?

2. Which domestic animals are dominant in your community?

3. What challenges are faced by farmers in your community?

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

5. Which villages and parishes have been most affected by landslide and rock falls?

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

7. Which crops are majorly affected by landslides and rock falls in your community?

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

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?

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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?

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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?

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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?

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

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

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

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

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

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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?

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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?

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

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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
_____	_____	_____

SPATIAL DATA COLLECTION SHEET FOR HAZARD VULNERABILITY AND RISK MAPPING

<table>
<tr><td colspan="2">Observer Name:

Date:</td><td colspan="2">District:
Sub- county:
Parish:
Village:</td><td colspan="3">Coordinates</td></tr>
<tr><td colspan="2" rowspan="6"></td><td colspan="2" rowspan="6"></td><td>X:</td><td colspan="2"></td></tr>
<tr><td>Y:</td><td colspan="2"></td></tr>
<tr><td>Altitude</td><td colspan="2"></td></tr>
<tr><td colspan="2">Slope characterization</td><td colspan="2">Bio-physical characterization</td><td colspan="2">Vegetation characterization</td><td rowspan="7">Land use type (tick)
Bush
Grassland
Wetland
Tree plantation
Natural forest
Cropland
Built-up area
Grazing land
Others</td></tr>
<tr><td>Slope degree (e.g 10, 20, …)</td><td></td><td>Soil Texture</td><td></td><td>Veg. cover (%)</td><td></td></tr>
<tr><td>Slope length (m) (e.g 5, 10, …)</td><td></td><td>Soil Moisture</td><td></td><td>Tree cover (%)</td><td></td></tr>
<tr><td>Aspect (e.g N, NE…)</td><td></td><td>Rainfall</td><td></td><td>Shrubs cover (%)</td><td></td></tr>
<tr><td>Elevation (e.g high, low…)</td><td></td><td>Drainage</td><td></td><td>Grass / Herbs cover (%)</td><td></td></tr>
<tr><td>Slope curvature (e.g concave, covex…)</td><td></td><td>Temperature</td><td></td><td>Bare land cover</td><td></td></tr>
<tr><td colspan="7">Area Description (Susceptibility ranking: landslide, mudslide, erosion, flooding, drought, hailstorms, lightning, cattle disease outbreaks, human disease outbreaks, land conflicts, wildlife conflicts, bush fires, earthquakes, faults/ cracks, pictures, any other sensitive features)</td></tr>
</table>

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Office of the Prime Minister
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