



THE REPUBLIC OF UGANDA

Buliisa 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.

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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. Onok

Minister for Relief, Disaster Preparedness and Refugees

EXECUTIVE SUMMARY

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

Preliminary spatial analysis

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

Stakeholder engagements

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

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

Participatory GIS

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

Geo-referencing and ground-truthing

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

Data analysis and integration

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

Data verification and validation

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

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

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

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

The following were recommended policy actions targeting vulnerability reduction:

- The government should improve enforcement of policies aimed at enhancing sustainable environmental health.
- The government through MAAIF should review the animal diseases control act because of low penalties given to defaulters.
- The government should establish systems to motivate support of political leaders 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 relevant ministries coordinated by OPM 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 provide staff with necessary logistics.

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LIST OF ACRONYMS

BBW	Banana Bacterial Wilt
DDMC	District Disaster Management Committee
DEAP	District Environment Action Plan
DEM	Digital Elevation Model
DLG	District Local Government
DRM	Disaster Risk Management
DWD	Directorate of Water Development
DWRM	Directorate of Water Resources Management
EIA	Environmental Impact Assessment
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
PEPD	Petroleum Exploration and Production Department
PGIS	Participatory GIS
SMCA	Spatial Multi-criteria Analysis
STRM	Shuttle Radar Topography Mission
UBOS	Uganda Bureau of Statistics
UNDP	United Nations Development Program
UNRA	Uganda National Roads Authority
UTM	Universal Transverse Mercator
WGS	World Geodetic System

DEFINITION OF KEY TERMS

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

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

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

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

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

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

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

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

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

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

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

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

INTRODUCTION

1.1 Background

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

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

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

This draft report details methodological approach for HRV profiling and mapping for Buliisa district in Mid-western 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 Buliisa District, Mid-western Uganda.

1.2.2 Specific Objectives

In fulfilling the above mentioned main objective the following specific objectives were 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 Buliisa 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 Buliisa district. Section 3 focuses on the methodology employed. Section 4 elaborates the Multi-hazard, Risks and Vulnerability profile and Coping strategies for Buliisa district. Section 5 describes Conclusions and policy related recommendations.

OVERVIEW OF BULIISA DISTRICT

2.1 Location

Buliisa District is located between coordinates: 2° 11' 0" N and 31° 24' 0" E in mid-western Uganda and was carved out of Masindi District on 1st July, 2006. It is one of the districts in the western Albertine rift valley where a lot of oil and gas deposits have been discovered. Buliisa District is bordered by Nebbi District to the Northwest, Nwoya District to the Northeast, Masindi District to the East, Hoima District to the South and the Democratic Republic of the Congo, across Lake Albert, to the West. The District has 6 Sub-counties and 1 Town Council. These include: Biiso and Kihungya in upper Buliisa and Butiaba, Buliisa, Kigwera, Ngwedo sub-counties and Buliisa town council in lower Buliisa. Figure 1 shows the Administrative boundaries and gazetted areas of Buliisa District.

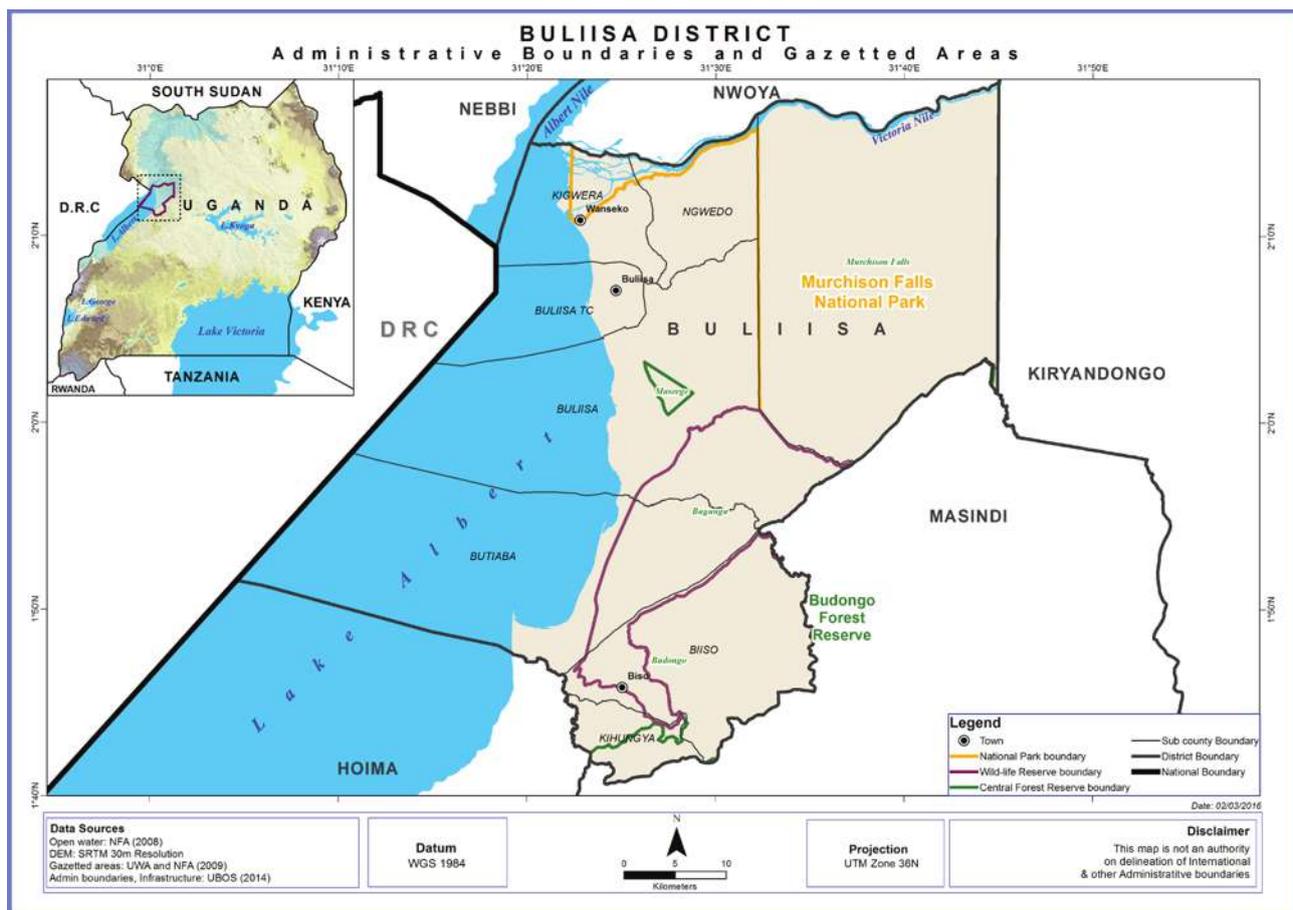


Figure 1: Administrative Boundaries and Gazetted Areas, Buliisa District

2.1.1 Geomorphology

Buliisa District is part of the Central plateau of Uganda with an altitude of about 680 – 1400 meters above sea level. The lowest point of the District is in Lake Albert at 682 meters. The slopes are generally steep with wide valleys. The western fringes of the district lie in the western rift valley a part largely covered by Lake Albert and the Escarpment. The south eastern part of the district is dominated by high areas ranging from 1000 – 1200m.a.s.l, particularly areas in Kihungya and Biiso sub-counties. Figure 2 presents the geomorphology of Buliisa district.

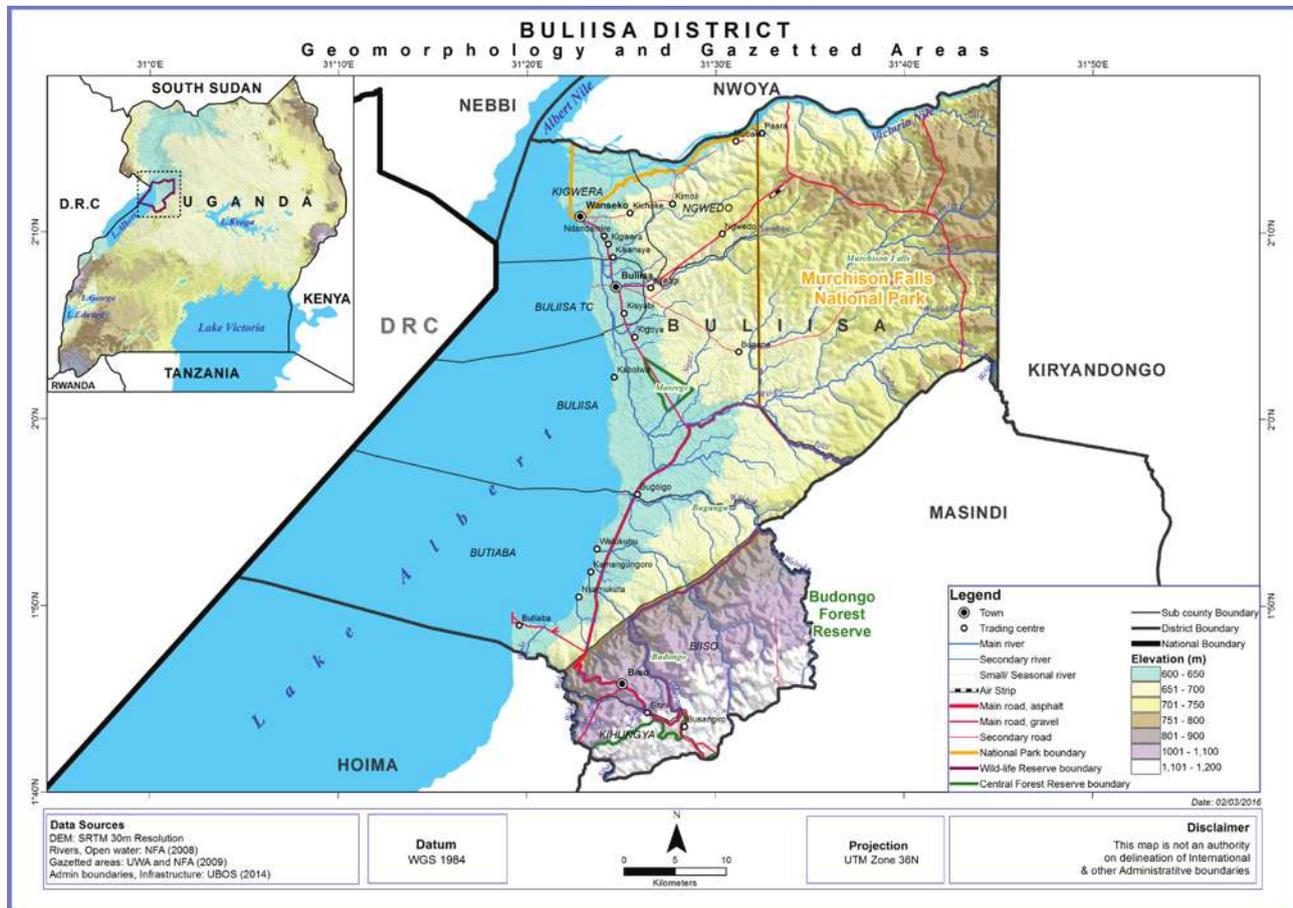


Figure 2: Geomorphology, Buliisa District

2.1.2 Geology and soils

Buliisa district lies in the Albertine Graben which is a Cenozoic sedimentary rift basin developed on the Precambrian orogenic belts of the African craton. Available geological and geophysical data suggest that the Albertine Graben has undergone substantial tectonic movements and sedimentary layers of approximately 6 km thickness have been deposited in fluvial deltaic and lacustrine environments. The rocks are mainly classified as Pre-Cambrian basement and sedimentary rock formations (PEPD, 2008).

Ferralitic soils cover a vast part of Buliisa District. The soils are mainly yellowish-red clay loams on sedimentary beds. There are also dark brown, black loams (Bugangari series) found along the axis of the warp. These two types of soil are of low to medium productivity. The soils of recent origin that consist of quartzite debris are found along the escarpment. Their depth depends on the vegetation cover and land use. They are suitable for coffee and maize (Harrop, 1960). Rivers and valley beds mainly have grayish-black sands, which are base deficient and acidic. These alluvial soils are of low productivity. Figure 3 presents the geological and lithological structures of Buliisa District according to the geological study done by the Geology Department of Uganda in 2012.

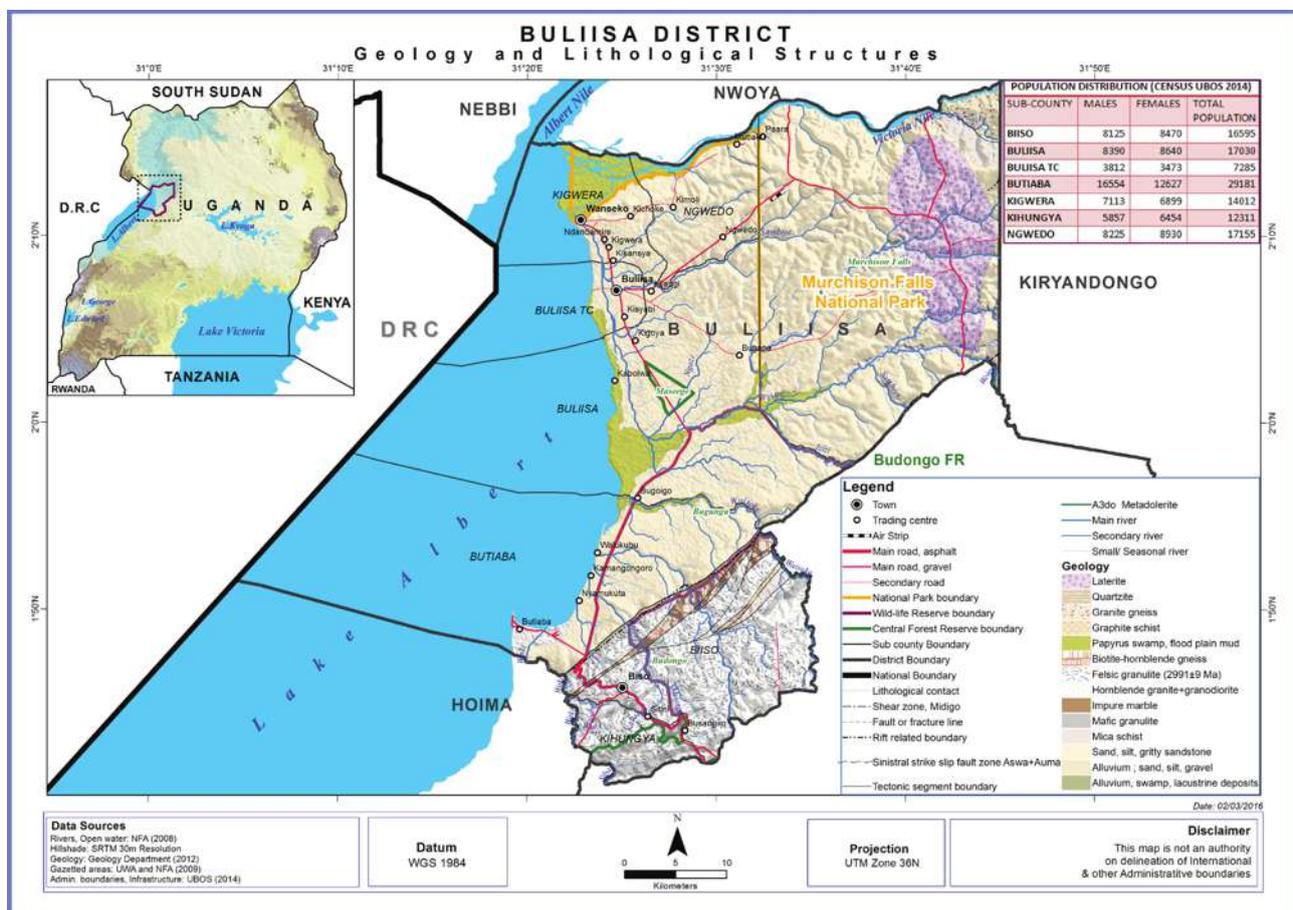


Figure 3: Geology and Lithological Structures, Buliisa District

2.1.3 Vegetation and Land use Stratification

The vegetation is classified into forest, savannah, grassland and swamp. Forest vegetation includes Budongo high tropical forest; while savannah vegetation consists of perennial grasses, scattered trees and shrubs. The dry savannah lies contiguous to Lake Albert, turning into wet savannah grassland up to the escarpment. Swamp vegetation fills most of the water logged valleys (Langdale-Brown et al., 1964). Murchison Falls National Park and Bugungu game reserve contribute to grassland and woodland cover. Figure 4 shows the Land use Stratification and Gazetted areas of Buliisa District.

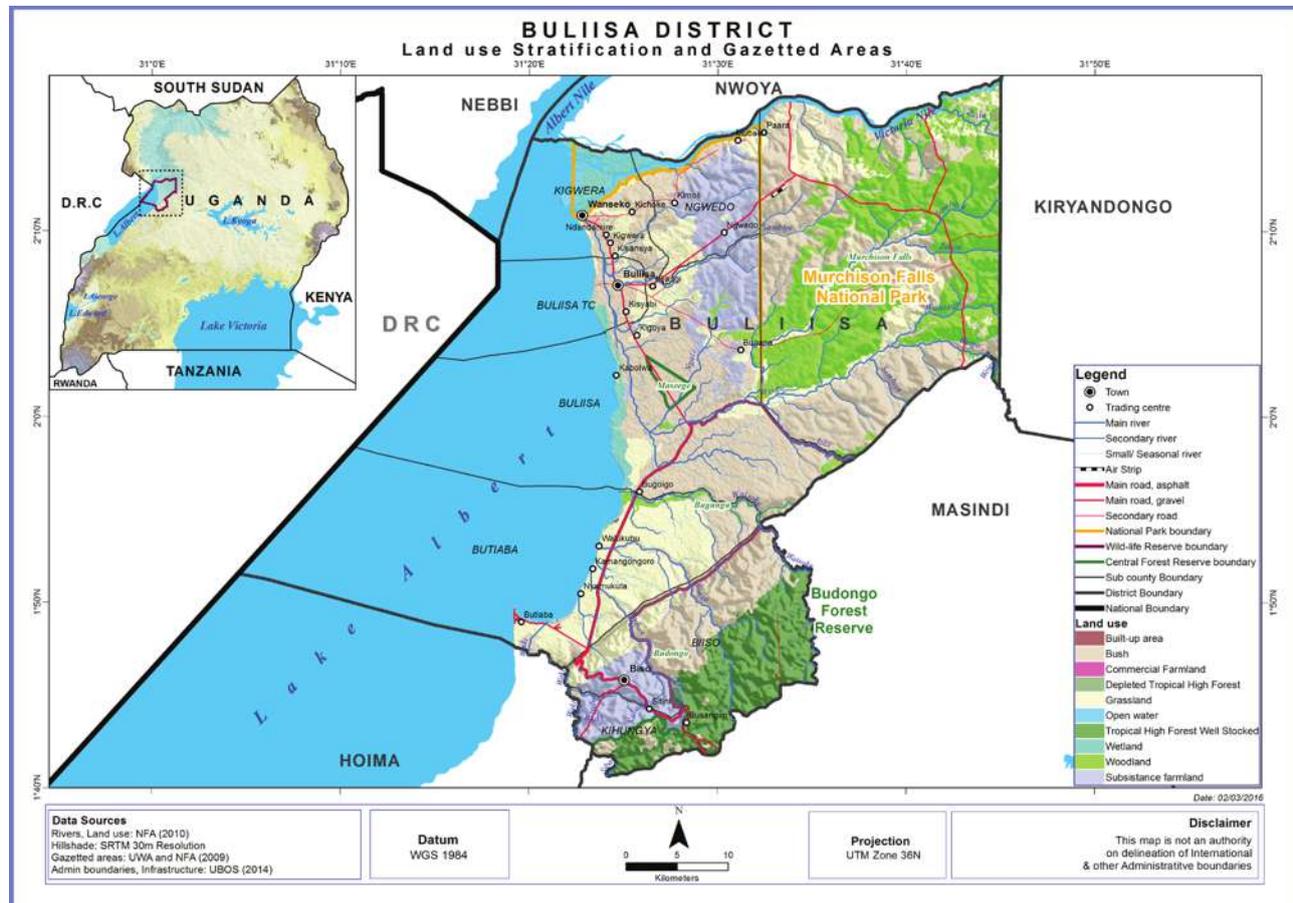


Figure 4: Land use Stratification, Buliisa District

2.1.4 Temperature and Humidity

The District is divided into two main altitudes. The high altitudes are in the Sub counties of Biiso and Kihungya, while the low altitudes are in the sub counties of Butiaba, Buliisa, Kigwera, Ngwedo, and Town Council. The altitude in the respective Sub-counties determines the temperature levels. This means that the two described altitudinal zones exhibit different climatic conditions, where one finds upper Buliisa cooler with higher rainfall and lower Buliisa hotter and drier. This phenomenon has resulted into the indignant people migrating from lower to upper Buliisa and as far as Kigoroby (Hoima) and Masindi for better and more appealing weather conditions.

2.1.5 Wind

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

2.1.6 Rainfall

Buliisa district receives a bimodal rainfall pattern with totals ranging from about 800 mm in the Lake Albert flat rising rapidly further away to the east above the escarpment to between 1250 - 1500 mm per annum before tapering off to 1000 mm in the eastern border areas of the District. The peak periods are between March - May and September to December (Buliisa district SoER, 2015) (Figure 5).

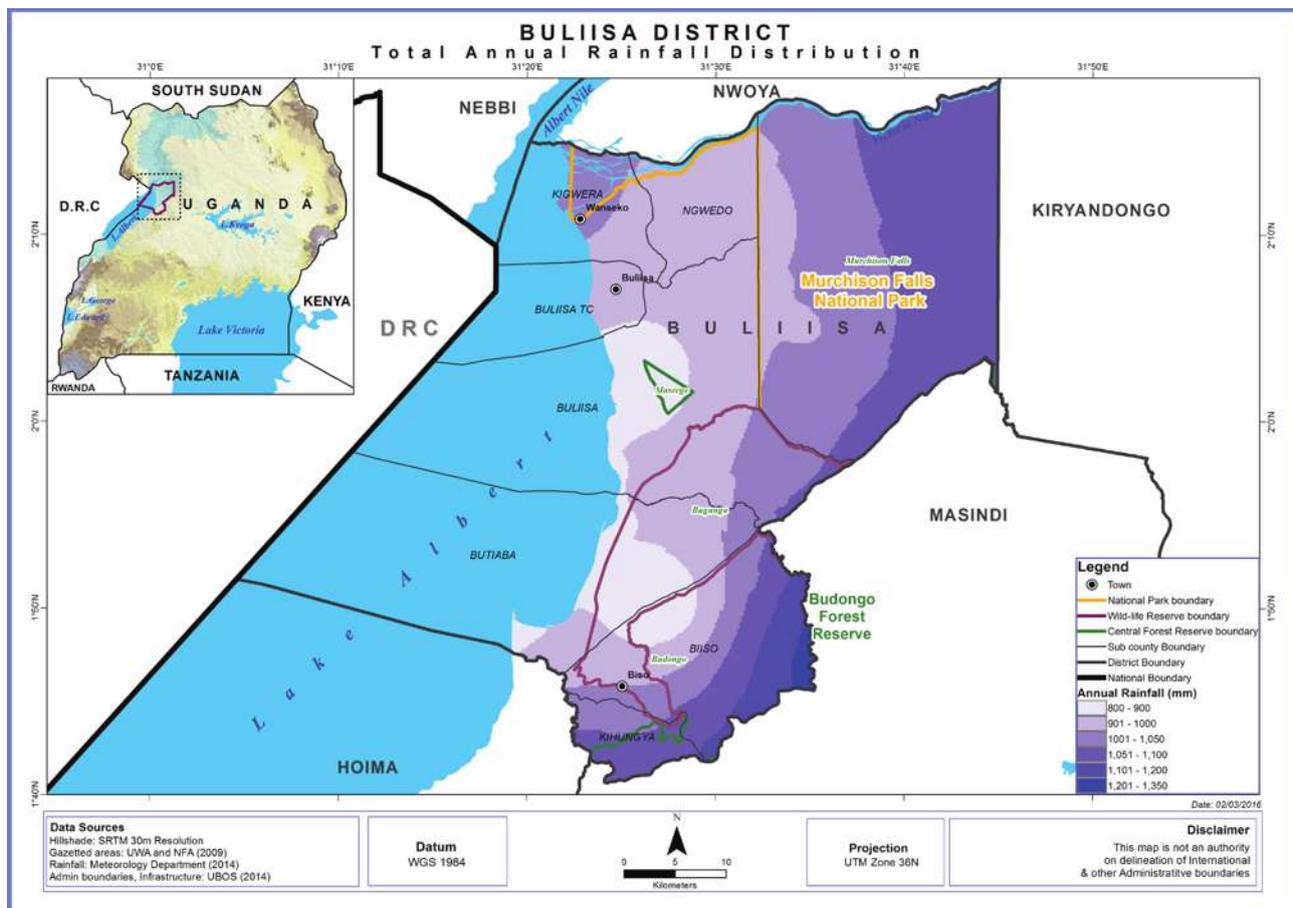


Figure 5: Annual Rainfall Distribution, Buliisa District

2.1.7 Hydrology

Buliisa District comprises of part of Lake Albert, which is associated with several small rivers and swamps, hence, the high water cover. The major rivers include Victoria Nile, Sambiye, Waisoke, Bubwe and Sonsio; and Boola wetland in Buliisa town council. Almost all of them have extensive floodplains within the rift valley. The seasonal streams and rivers are flooded by runoff from the catchment areas after a heavy rainfall event. The Nile deltas discharge into Lake Albert at the northern tip, across extensive shallow zones of the lake (<2 m deep) with a carpet of predominantly submerged aquatic flora. River Waisoke drains upper floodplains of permanent and semi-permanent wetland within the rift valley and have an extensive lower zone of swamp forest. A significant part of the Victoria Nile, right from the Murchison fall to the Nile Delta comprises of the Murchison falls/Nile Delta Ramsar site.

2.1.8 Population

According to the National Population and Housing Census (2014) results, Buliisa District had a total population of 113,569 people. Results also showed that most of the people in Buliisa District reside in rural areas (106,284 (93.6%) compared to (7,285 (6.4%) who reside in urban centers. The gender distribution was reported to be males: 58,076 (51.1%) and females: 55,493 (48.9%). About 95.1% (108,059) of the population form the household population and only 4.9% (5,510) is Non-household. Butiaba sub-county had the highest population of 29,181 people while Buliisa town council had the least population of 7,285 people (Figure 6). Table 1 shows the population distribution per sub-county for the different gender.

Table 1: Population Distribution in Buliisa District

<i>Sub-County</i>	HOUSEHOLDS		POPULATION		
	<i>Number</i>	<i>Average Size</i>	<i>Males</i>	<i>Females</i>	<i>Total</i>
Biiso	3294	5	8125	8470	16595
Buliisa	3216	5.2	8390	8640	17030
Buliisa Town Council	1441	4.8	3812	3473	7285
Butiaba	5533	4.5	16554	12627	29181
Kigwera	2643	5.3	7113	6899	14012
Kihungya	2173	5.7	5857	6454	12311
Ngwedo	3217	5.3	8225	8930	17155

Source: UBOS Census 2014

2.1.9 Economic activities

Buliisa district is primarily rural and most people are either engaged in agricultural activities. Crop husbandry is the leading agricultural activity followed by livestock keeping. Most commonly grown crops include cassava (staple food), maize, beans, Pineapples, Citrius (Oranges), cotton, tobacco Mangoes, ground nuts, banana (Busingiro and Akimi), in Biiso and Kihungya sub-counties respectively. Animals reared include cattle, goats, sheep, pigs (Small scale), chicken, and ducks. Animals in most parts of the district are communally grazed and their movements are rarely controlled.

Fishing is widely done in the district and the major source being Lake Albert which has economically viable fish species such as *Bracynus nus* (Ragogi), *Neobola bredoi* (Muziri), *Lates abertianus* (nile perch) and *Oreochromis niloticus* (Tilapia) (SoER, 2015).

Buliisa District has wildlife both in Protected Areas and outside Protected Areas. The Protected Areas in Buliisa with wild are Bugungu wildlife reserve, Part of Murchison Falls National Park, part of Budongo Central Forest Reserve and a number of wetlands. Sub counties of Ngwedo, Kigwera, Buliisa, Butiaba and Biiso that border the protected areas share 20% annual revenues accrued from park gate collection.

The recent discovery of oil and gas in Albertine graben, of which Buliisa District is part, has led to rapid growth and development of the area. This has been mainly through infrastructural developments such as settlement camps, oil related access roads, waste consolidation sites, as well employment and housing opportunities for both the locals and external workers. Example of local employment opportunities include driving, casual laboring, and community liaison work. Whereas oil and gas is a blessing to Buliisa district a number of shortcomings has been registered at exploration, appraisal and development stages.

METHODOLOGY

3.1 Collection and analysis of field data using GIS

3.1.1 Preliminary spatial analysis

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

3.1.2 Stakeholder engagements

Stakeholder engagements were carried out in close collaboration with OPM's DRM team and the District Disaster Management focal persons with the aim of identifying the various hazards ranging from drought, floods, landslides, human, animal and crop diseases, pests, wildlife animal attacks, earthquakes, fires and conflicts among others. Stakeholder engagements were done through Focus Group Discussions (FGDs) and Key Informant Interviews guided by checklist tools (Appendix I). At District level, one Key Informant Interview comprising of three respondents (District Environment Officer, District Production Officer and District Fisheries Officer) was held at Buliisa District Headquarters (UTM Zone 36N: 324061E; 232708N). At Sub-county level key informants included: Sub-county and parish chiefs and Community Development Officers.

FGDs were carried out in four purposively selected sub-counties that were ranked with the highest vulnerability. FGDs comprising of an average of 12 respondents (crop farmers, local leaders, fishermen and cattle keepers) were conducted at Kigwera Sub-county (UTM Zone 36N: 322557E; 238664N), Ngwedo Sub-county (UTM Zone 36N: 332209E; 238230N), Butiaba Sub-county (UTM Zone 36N: 313834E; 201212N) and Kihungya Sub-county (UTM Zone 36N: 321571E; 1908540N). 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 Mbarara Municipality as a central place within the region. This involved key district DDMC focal persons for the purpose of creating local/district ownership of the profiles.

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

HRV 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 Buliisa 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, environmental degradation, oil and gas hazards.

4.1 Geomorphological and Geological Hazards

4.1.1 Landslides, rock falls and soil erosion

Results from the participatory assessments indicated that areas near the escarpment experience rock falls and soil erosion especially during the rainy season. Participants in the discussion reported that the run-off from the escarpment comes along with rocks which in most cases block the Biiso - Buliisa road. Reports indicated that Butiaba, Kihungya and Biiso sub-counties were prone to soil erosion and rock. 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 6). The map also shows hot spot areas where landslides, rock falls and soil erosion have occurred in the past 20 years.



Plate 1: Soils exposed to erosion on the escarpment in Biiso Sub-county

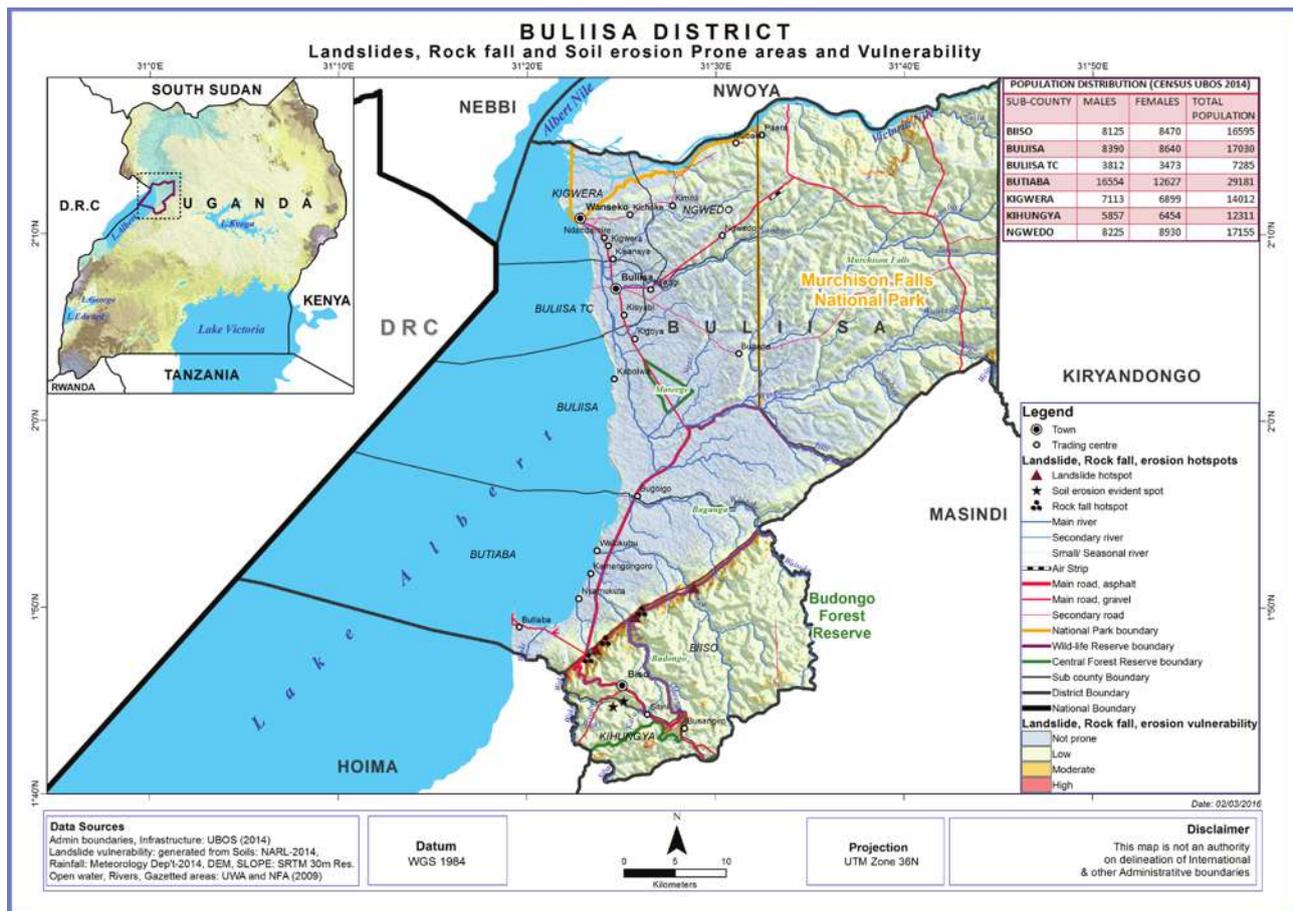


Figure 7: Landslides, Rock falls, Soil erosion prone areas, Buliisa District

4.1.2 Earthquakes and faults

Earth quakes in Uganda were first mapped by the World Health Organization and the US Geological Survey's Earthquake Program which indicated that the seismicity of Uganda is dominated by the East Africa rift system. Table 2 indicates major earthquake occurrences in Uganda in the recent past 21 years. The earth quake hazard study shows that western Uganda where Buliisa district is located is subject to a medium hazard, with a horizontal acceleration between 0.8g and 2.4g.

Table 2: Major earthquake events occurred in Uganda in the recent past

Date of occurrence	Epicenter	Magnitude	Socio-economic losses
09 July 1912	Kitgum, close to Aswa Shear zone	6.7	Partial destruction of buildings in northern Uganda
02 October 1929	Toro, Western Rift	5.9	Landslides
18 March 1945	Sembabule (40 km north of Masaka town)	6.0	Five persons died and destruction of some buildings
20 March 1966	Toro, Western rift	6.6	150 people died & over 1300 persons injured; loss of properties worth \$ 1 million
07 September 1990	Lake Victoria, near Kampala	5.0	Destroyed semi-permanent buildings
09 October 1991	Butiaba Port, Lake Albert, Western Rift	5.3	Destroyed semi-permanent buildings
05 February 1994	Kisomoro, Toro, Western Rift	6.2	Eight people died, destruction of property worth \$ 61

Source: World Health Organization and US Geological Survey's Earthquake Program

Participants of the focus group discussions indicated that earthquakes weren't a serious problem in Buliisa district. However, it was reported that the sub-counties of Butiaba, Buliisa, Kigwera and Buliisa town council in lower Buliisa experience minor earth quakes every year. According to the World Health Organization and US Geological Survey's Earthquake Program report, Butiaba Port was hit by an earthquake of magnitude 5.3 on Richter scale in October 1991 and caused severe damage to semi-permanent buildings. Figure 8 indicates areas where faults exist as vulnerable areas where earthquakes have more impact and the ranking is dependent on the distance from the faults and lithological veins.

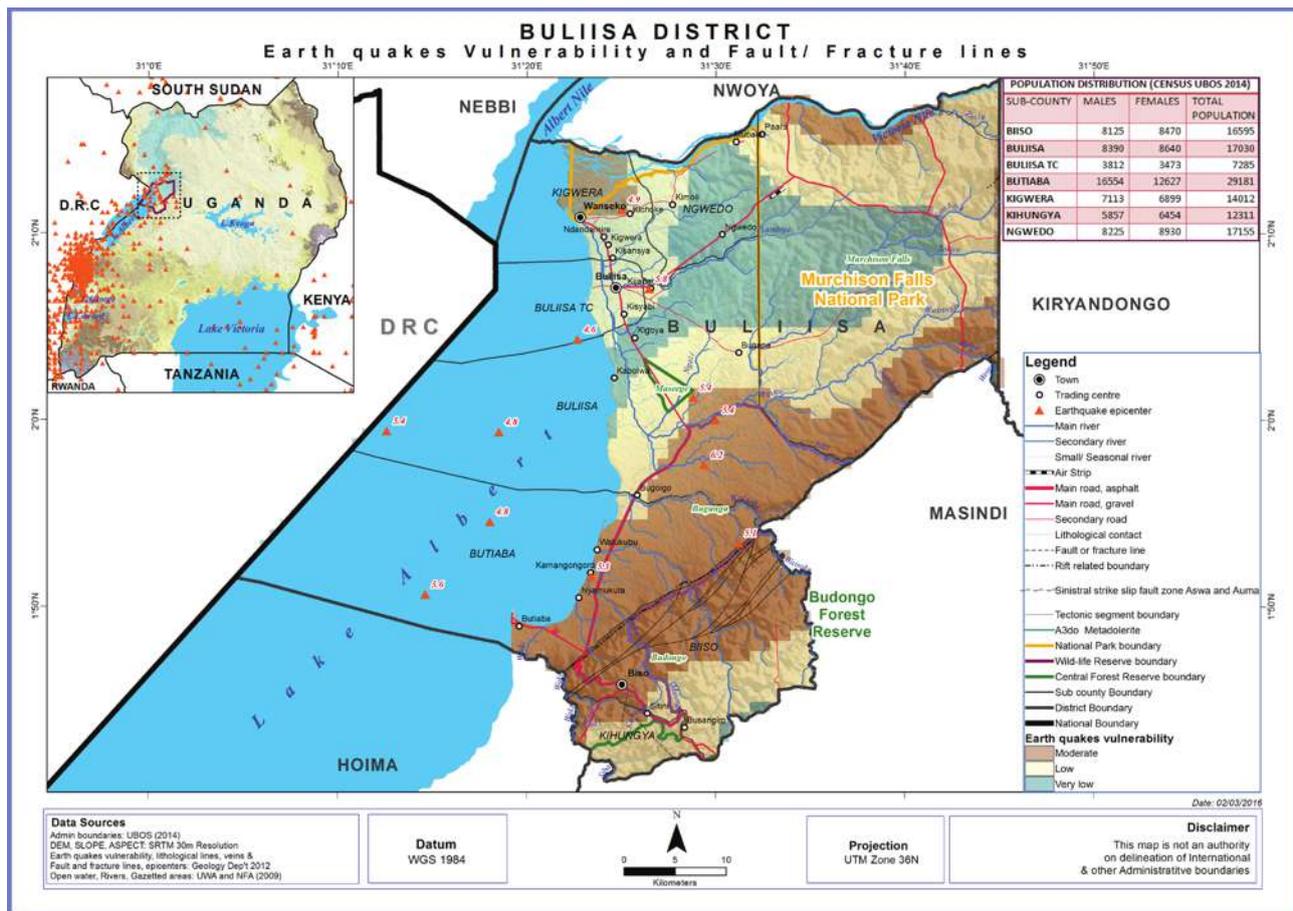


Figure 8: Earth quakes Vulnerability, Fault lines, Buliisa District

4.1.3 Meromicticism of Lake Albert

A meromictic lake has layers of water that do not intermix. The lack of mixing between layers creates radically different environments for organisms to live in: among the consequences of this stratification, lake waters at the bottom layer receive little oxygen from the atmosphere, and hence becomes depleted of oxygen. A meromictic lake may form when its basin is unusually deep and steep-sided compared to the lake's surface area and; the lower layer of the lake is highly saline and denser than the upper layers of water.

When the layers do mix for whatever reason, the consequences can be devastating for organisms that normally live in the top layer. This layer is usually much smaller in volume than the bottom layer; therefore, when the layers mix, the oxygen concentration at the surface will decrease dramatically. This can result in the death of many organisms, such as fish e.g. *Lates abertianus* (Nile perch) and *Bagrus docmak* (*Bagrus* catfish) that require oxygen.

Participants observed that Lake Albert occasionally experiences meromicticism (Nyamuraro) which causes death of big fish species such as Nile perch due to suffocation. The landing sites at Wanseko in Kigwera sub-county, Bugoigo in Buliisa sub-county, Walukuba and Butiaba in Butiaba sub-county are the most affected.

4.2 Climatological and Meteorological Hazards

4.2.1 Floods

Results from the participatory assessment indicated that flooding is the most prominent hazard in Buliisa district. Floods usually occur in the low lying areas during the rainy season particularly in the months beginning October to November. In 2013, several households at Wanseko and Butiaba landing sites in Kigwera and Butiaba sub-counties respectively were submerged. Participants also observed that crops and livestock were severely affected. This information was integrated with the spatial modelling using socio-ecological spatial data i.e. generated from Soil texture (data for National Agricultural Research Laboratories – Kawanda (NARL) 2014, Rainfall (Meteorology Department 2014), Digital Elevation Model (DEM), SLOPE, ASPECT (30m resolution data from SRTM Shuttle Radar Topography Mission (SRTM). Figure 9 shows areas susceptible to floods. The map also shows hot spot areas where floods have occurred in the past 20 years.



Plate 2: Flood area in Kihungya Sub-county

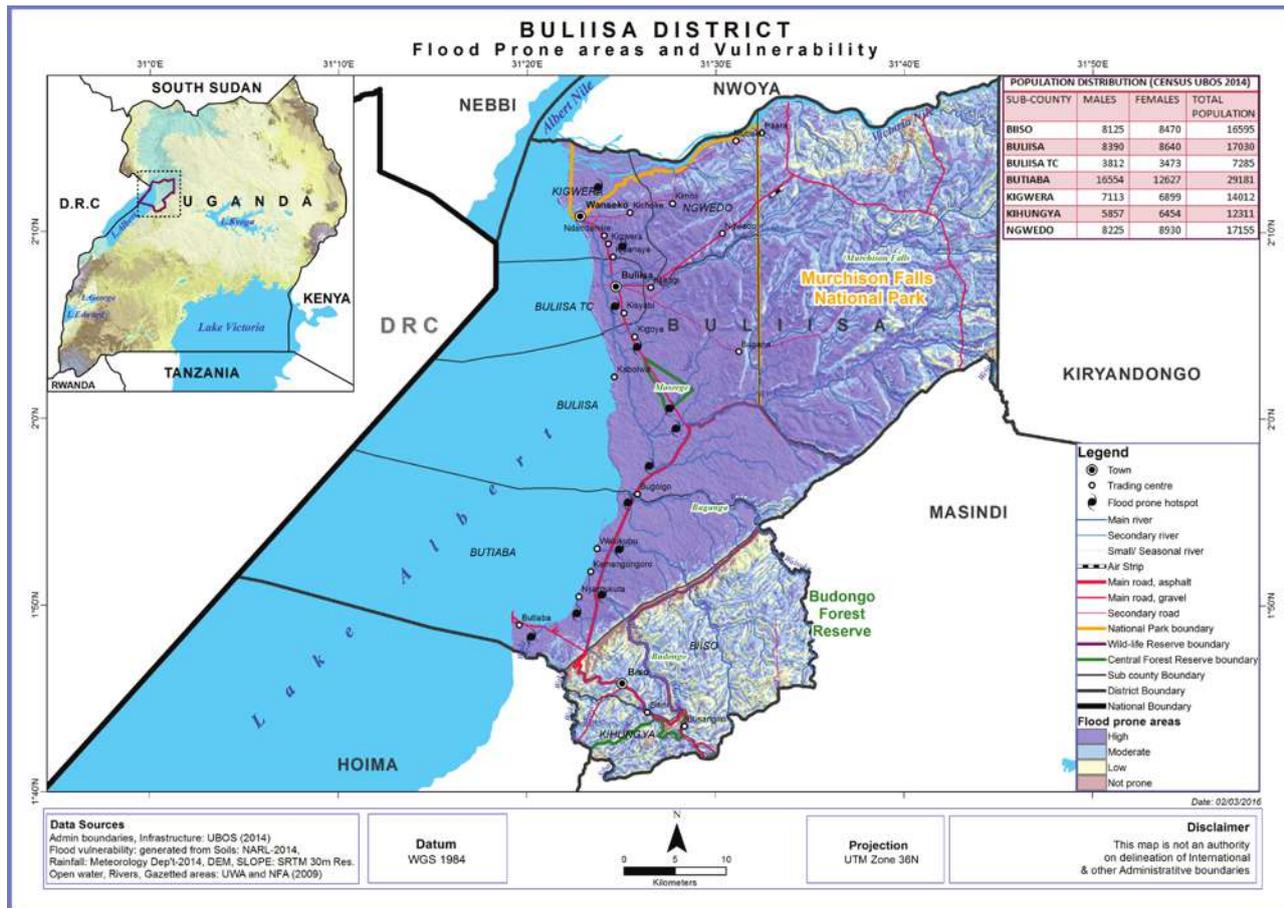


Figure 9: Flood Prone Areas and Vulnerability Ranking, Buliisa District

4.2.2 Drought

Participants in the focus group discussions indicated that the entire district of Buliisa is prone to long dry spells during the dry season .i.e. December to March. These are characterized by scorching heat, high temperatures of up to 41°C and heavy dry Easterly winds especially in the lower Buliisa zone. The most recent drought occurred in March 2012, where more than 150 herds of cattle died. The worst hit sub counties usually are Ngwedo and Kigwera (SoER).Drought and prolonged dry spells have led to increased crop failures, food insecurity, scarcity of water and pastures for livestock and increased incidences of diseases. This information was integrated with the spatial modeling using socio-ecological spatial data i.e. generated from Rainfall and Temperature (Uganda National Meteorological Authority, 2014) using the Standardized Precipitation Index. Figure 10 shows areas that are affected by drought and their ranking.



Plate 3: Drought hot spot in Butiaba Sub-county

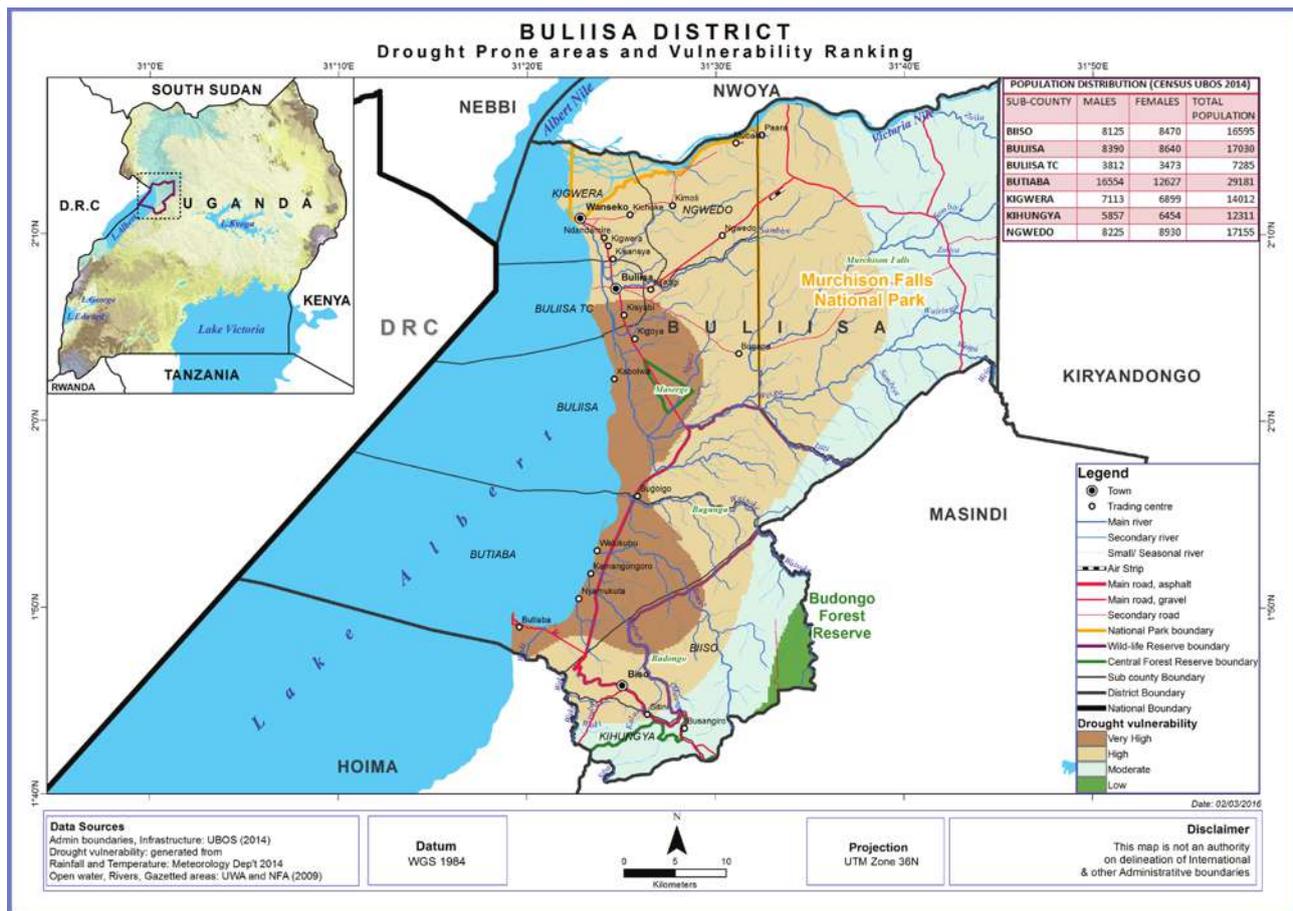


Figure 10: Drought Prone Areas and Vulnerability Ranking, Buliisa District

4.2.3 Hailstorms

Results from the participatory assessment indicated that hailstorms usually occur during the rainy seasons. Participants reported that hailstorms destroy crops thus causing food insecurity and significant economic losses. The most affected sub-counties included; Kihungya and Biiso. A case in example was the hailstorm that hit and destroyed banana and cassava plantations in Busingiro parish in Kihungya sub-county in 2015.

4.2.4 Strong winds

Participants in the focus group discussions indicated that strong winds were a serious problem along the Lake Albert shore line in Buliisa district especially during the rainy season. Participants observed that strong winds usually blow off roof tops with the most recent being at Wanseko landing site in 2012. It was reported that strong winds capsize boats on the Lake Albert thus causing accidents. In another incident that happened in 2012, very strong winds blew a boat from the shores of Lake Albert to the roof top of one of the houses at Wanseko landing site. Wanseko, Butiaba and Walukuba landing sites in Kigwera and Butiaba sub-counties respectively are the most affected. In a recent incident that occurred in March 2016, a devastating storm hit Lake Albert and killed about 30 fishermen and destroyed 608 houses at Walukuba and Butiaba landing sites in Butiaba sub-county. The roofs of several other structures including Butiaba primary school, Butiaba seed secondary school, Nyamukuta primary school, Nyamukuta police post, Butiaba health center III, Walukuba market, Walukuba Catholic Church and Pentecostal Church of Uganda were blown off by the storm.

4.2.5 Lightning

Lightning is a sudden high-voltage discharge of electricity that occurs within a cloud, between clouds, or between a cloud and the ground. The distribution of lightning on Earth is far from uniform. The ideal conditions for producing Lightning and associated thunderstorms occur where warm, moist air rises and mixes with cold air above. These conditions occur almost daily in many parts of the Earth and rarely in other areas. Globally, there are about 40 to 50 flashes of lightning every second or nearly 1.4 billion flashes per year. These electrical discharges are powerful and deadly. Each year, lightning strikes kill people, livestock, and wildlife. In the subsequent focus group discussions conducted, it was observed that there are increased incidences of Lightning during rainy seasons. The participants identified Biiso and Butiaba sub-counties as the most affected. It was reported that in 2013, about two teachers were killed by Lightning at Biiso War Memorial Primary School. Figure 11 indicates areas where hailstorms, strong winds and Lightning are prominent and their ranking.

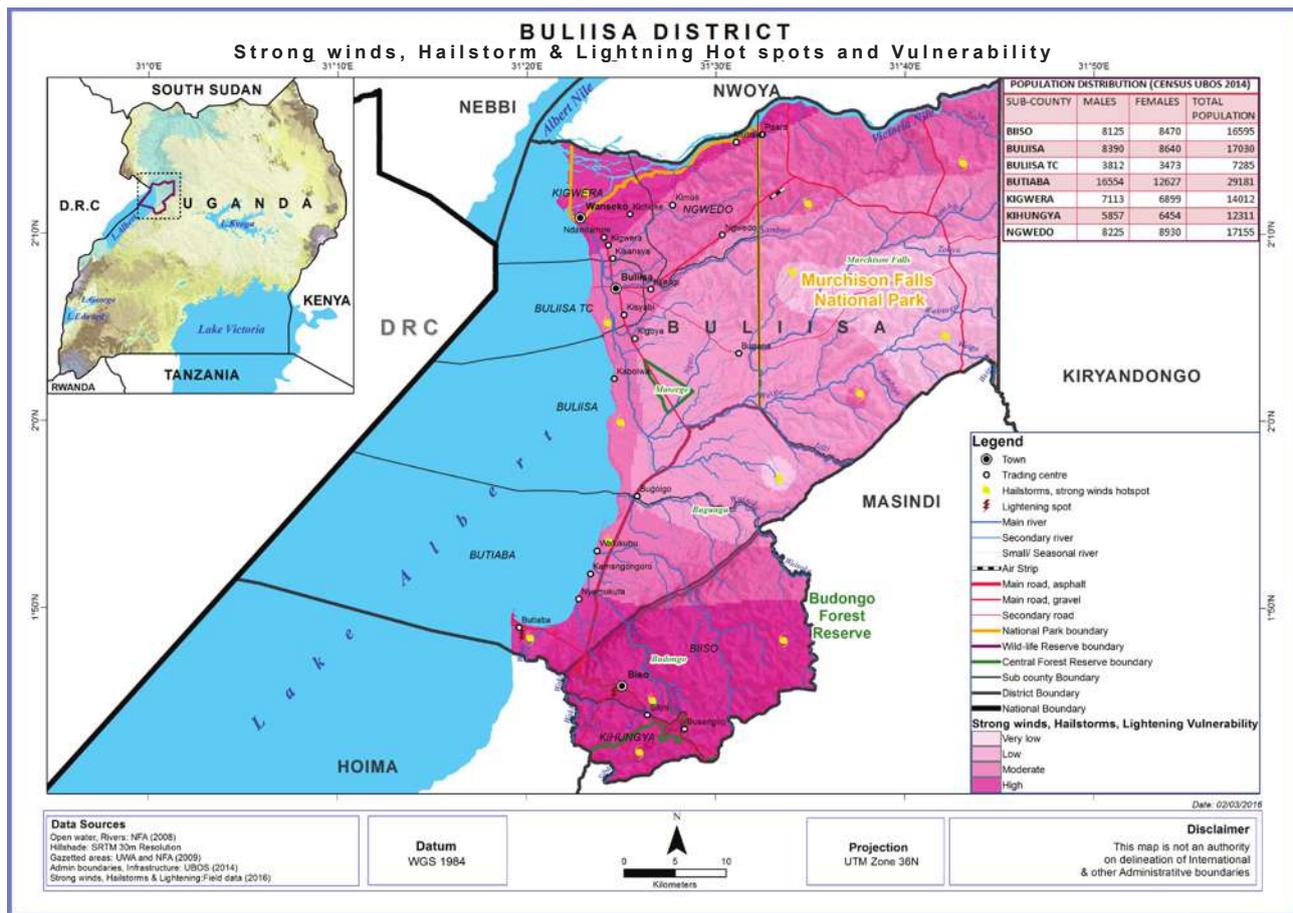


Figure 11: Hailstorms, Strong winds, Lightning Hot spots and Vulnerability, Buliisa District

4.3 Ecological and Biological Hazards

4.3.1 Crop Pests and Diseases

Participatory assessments through focus group discussions indicated that crop pests and diseases were a serious problem in Buliisa District. Results showed that the most affected crops were bananas and cassava while the most reported diseases were banana bacterial wilt, cassava brown streak, groundnut rosette, anthracnose, bacterial blight, orange leaf miner, bean anthracnose and coffee wilt. The most mentioned crop pests are maize stalk borer, white fly and aphids (aphids spread groundnut rosette disease in groundnuts). Participants reported that the entire district is affected by cassava brown streak disease. The sub-counties of Biiso and Kihungya in upper Buliisa were the most affected by banana bacterial wilt. It was also reported that Ngwedo, Biiso, Kihungya and Buliisa sub-counties were prone to groundnut rosette. Figure 12 indicates areas where crop pests and diseases are prominent and ranking.



Plate 4: Cassava garden affected by cassava brown streak disease in Ngwedo Sub-county



Plate 5: A Banana plantation affected by banana bacterial wilt in Kihungya Sub-county

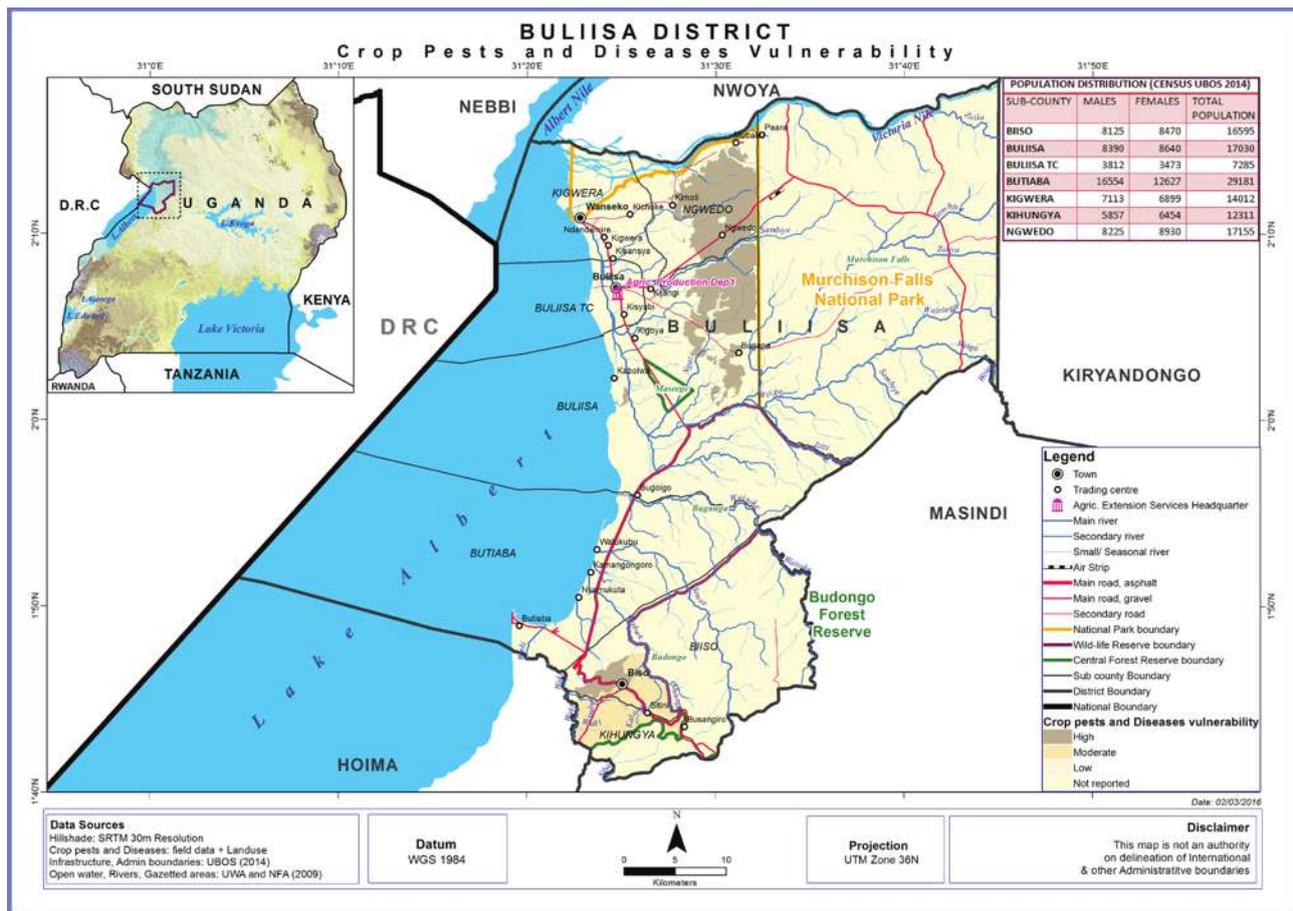


Figure 12: Crop Pests and Diseases Vulnerability, Buliisa District

4.3.2 Livestock Pests and Diseases

Participatory assessment through the focus group discussions indicated that incidences of livestock pests and diseases were high in Buliisa district. This has been attributed to the neighboring protected areas of Murchison falls National Park and Bugungu Wildlife Reserve. And also the large numbers of cattle in lower Buliisa particularly Butiaba, Kigwera, Buliisa and Ngwedo sub- counties and Buliisa town council. Results from the discussions showed that East Coast Fever which is a tick borne disease is the most rampant disease especially in lower Buliisa. The other cattle diseases reported by the participants were trypanosomiasis (Nagana), lumpy skin disease and Brucellosis. It was noted that Foot and Mouth Disease was curbed down by quarantine a few years ago and was no longer a problem. It was also mentioned that African swine fever was common among pigs in the entire Buliisa district. In poultry, the most prominent diseases included Newcastle, coccidiosis and gumboro (IBD infectious bursal disease). The most mentioned livestock pests were ticks and Tsetse flies. Figure 13 indicates areas vulnerable to Livestock pests and diseases.

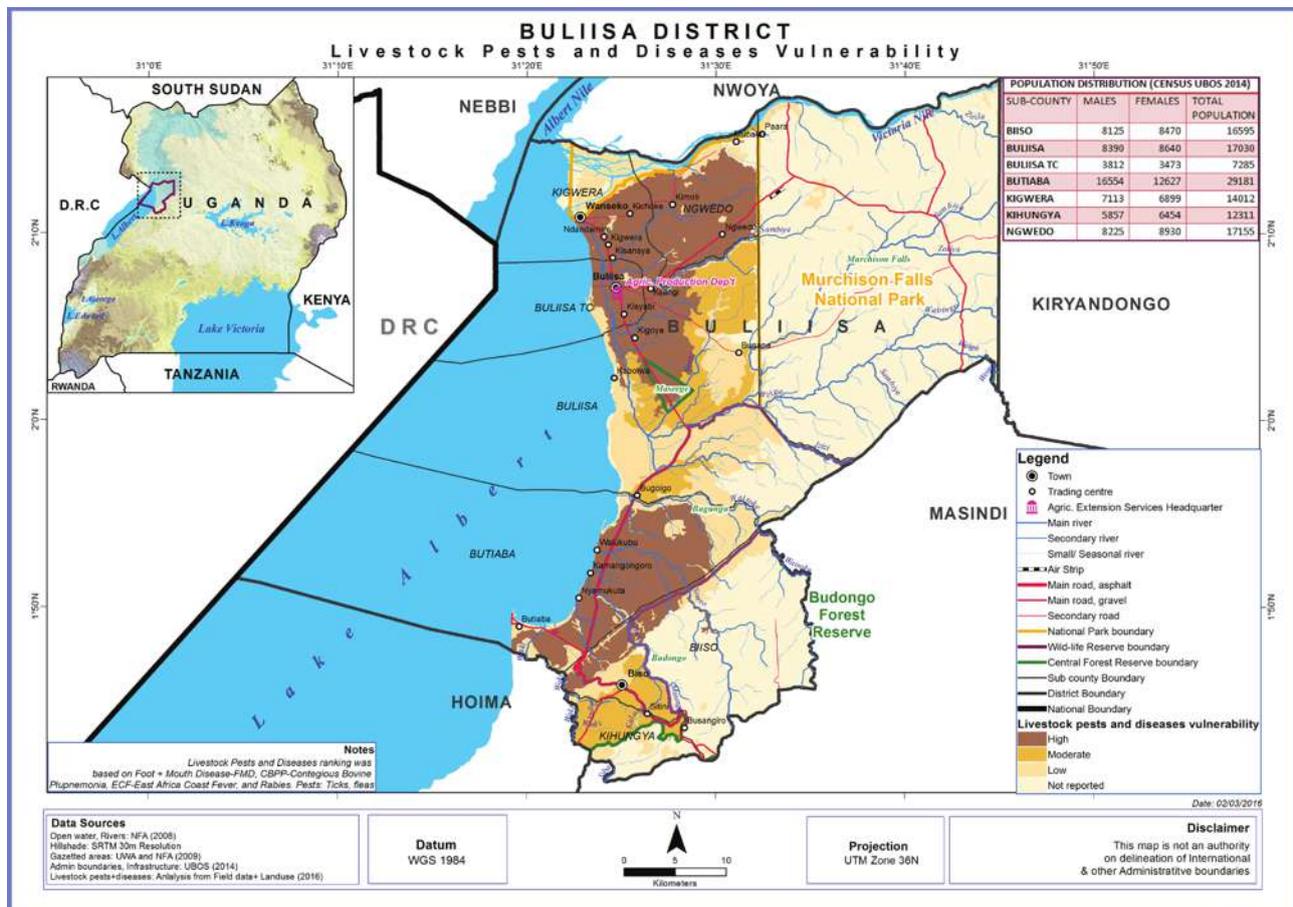


Figure 13: Livestock Pests and Diseases Vulnerability, Buliisa District

4.3.3 Human Diseases

Results from the focus group discussions indicated that malaria and HIV/AIDS were the most prominent human diseases in Buliisa district. Participants revealed that the prevalence rate of HIV/AIDS was very high at Butiaba, Walukuba and Wanseko landing sites on Lake Albert. Although Government of Uganda provided treated mosquito nets to every household in Buliisa district, the prevalence rates for malaria have remained very high in the entire district. Incidences of cholera outbreaks mainly during the rainy seasons were reported to be common in Butiaba, Buliisa and Kigwera sub-counties and Buliisa town council. The other prominent human diseases mentioned included; bilharzia and river blindness mainly along fast flowing rivers of Waki and Sonsiyo in upper Buliisa. Figure 14 presents Human Diseases risk and vulnerability ranking.

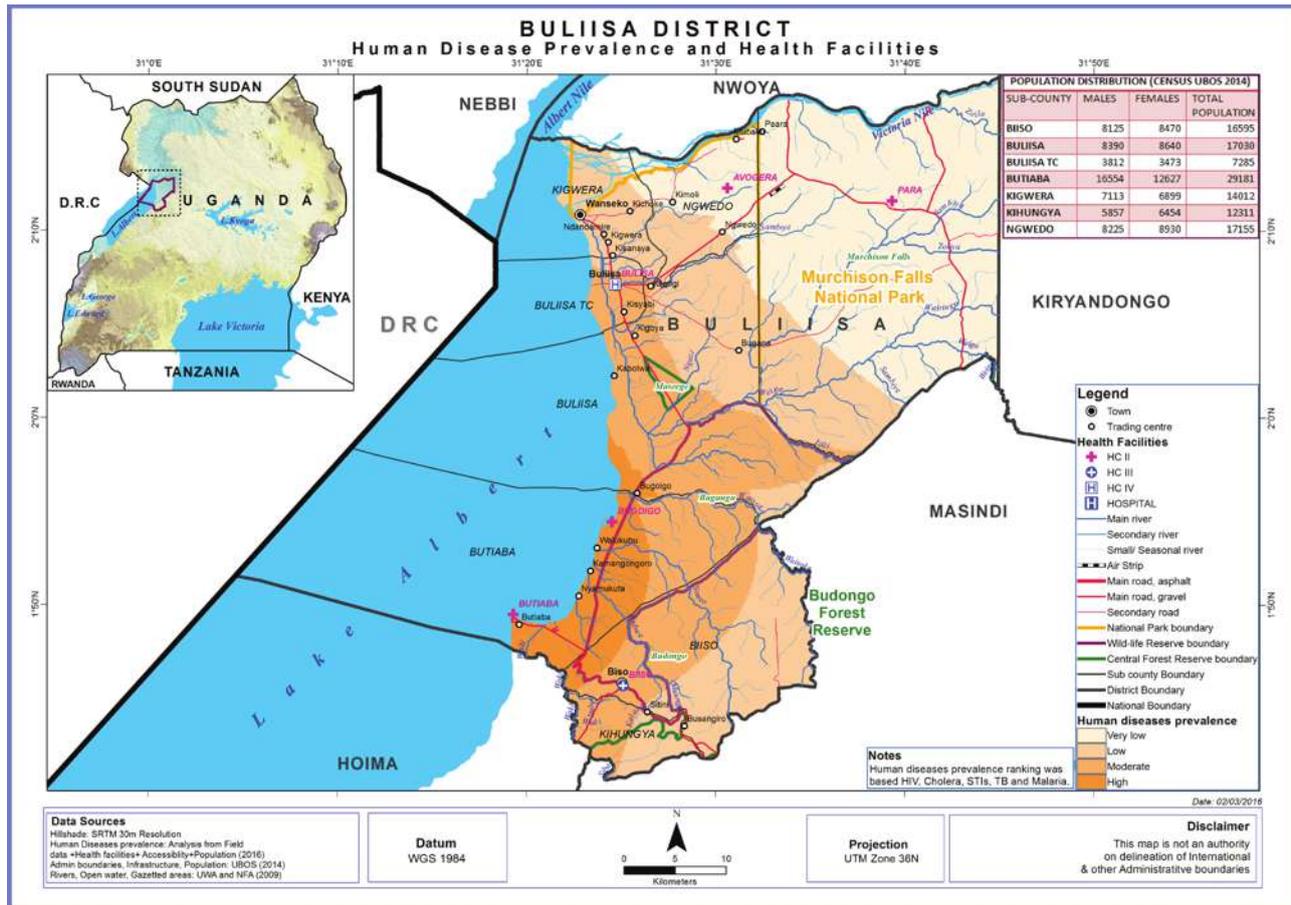


Figure 14: Human Diseases Prevalence and Health Facilities, Buliisa District

4.3.4 Vermin and wildlife animal attacks

Participatory assessments through focus group discussions indicated that there are many incidences of vermin and wildlife animal attacks because Bugungu Wildlife Reserve and part of Murchison falls National Park are in Buliisa district. Participants reported that hippos and crocodiles along River Nile and Lake Albert, as well as buffaloes, baboons and lions are some of the prominent wild animals that attack humans. Participants observed that in 2014, a lady who had gone to cut thatching grass from Bugungu Wildlife reserve was attacked and killed by a buffalo. Butiaba, Ngwedo and Kigwera sub-counties are the most affected. Figure 15 indicates areas at risk of wild-life animal attacks and their vulnerability ranking.



Plate 6: A baboon in Bugungu Wildlife Reserve, Butiaba Sub-county

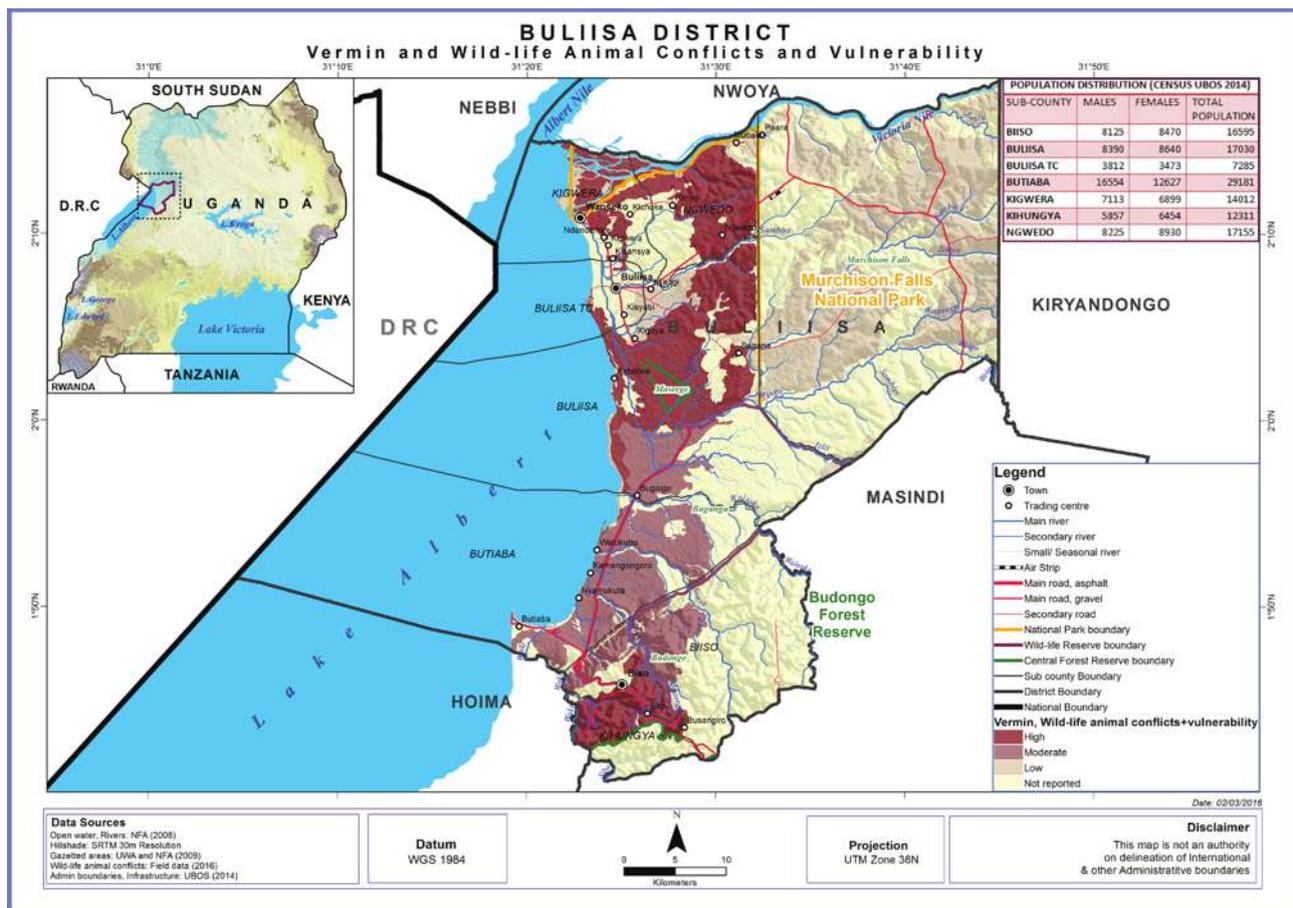


Figure 15: Vermin and Wildlife Animal Conflicts and Vulnerability, Buliisa District

4.3.5 Invasive species

Results from the discussions indicated that *Lantana camara*, water hyacinth and Nankabirwa weed (*salvinia molesta*) are the most reported invasive species in Buliisa district. The rangelands in the sub-counties of Butiaba, Kigwera and Buliisa in lower Buliisa are dominated by *Lantana camara* which suppresses the growth of palatable pastures. Figure 16 indicates areas that have invasive species and the risk and vulnerability ranking.



Plate 7: Acacia tree species invasive in Maseege Central Forest Reserve, Buliisa Sub-county

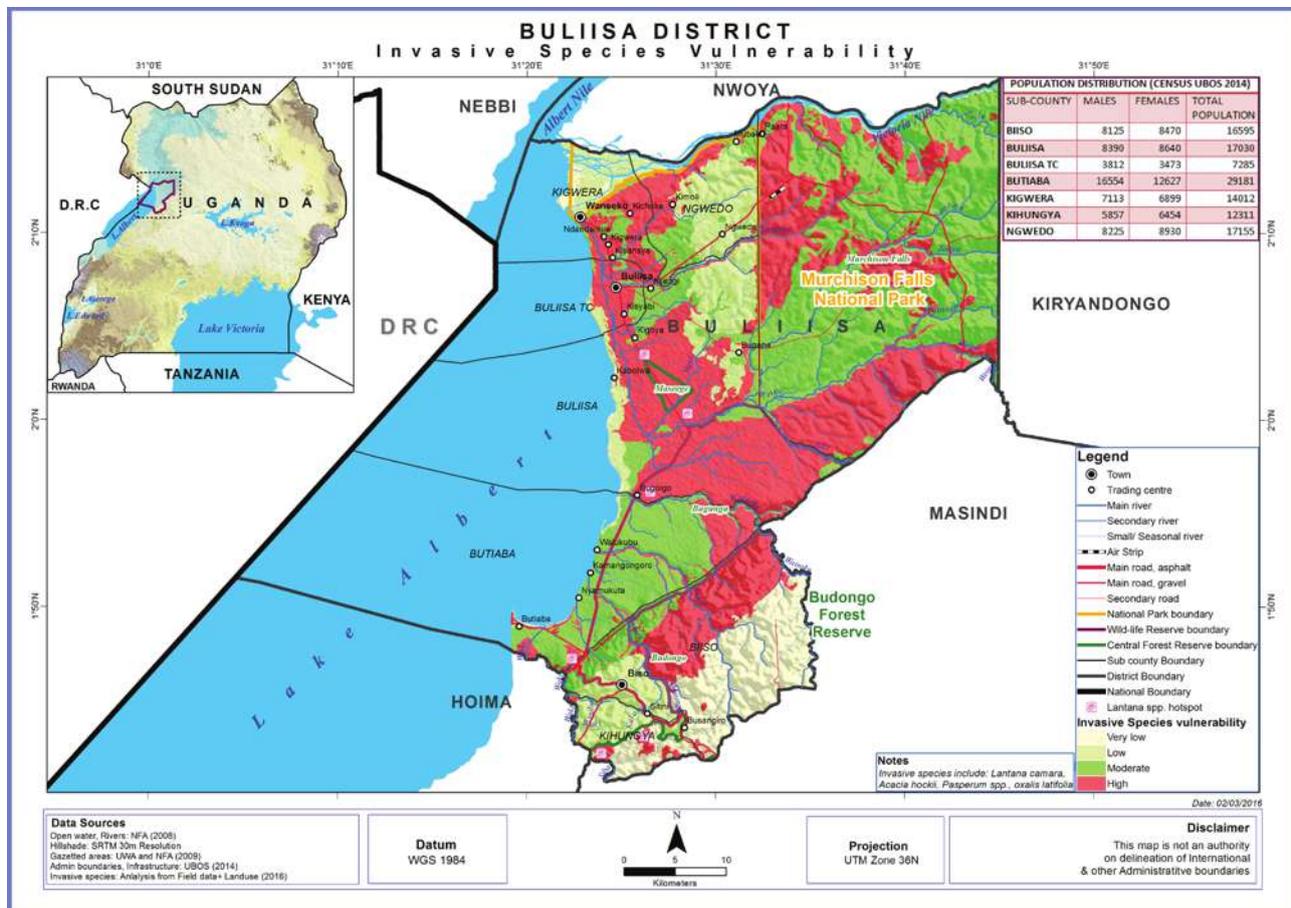


Figure 16: Invasive Species Vulnerability, Buliisa District

4.4 Human Induced and Technological Hazards

4.4.1 Bush fires

During the focus group discussions, participants indicated that bush burning was a serious problem in the entire Buliisa district especially during the dry season. It was reported that cattle keepers often burn mature grass in the dry season to allow regeneration of fresh pastures at the onset of the wet season. Participants observed that charcoal burners are also fond of spreading bush fires. During the fieldwork some parts of Bugungu Wildlife Reserve along the road to Buliisa town were being burnt. The most affected sub-counties were Butiaba, Biiso, Kigwera, Ngwedo and Kihungya. Figure 17 indicates areas where bush fires have occurred and their vulnerability ranking.



Plate 8: Bush burning in Butiaba Sub-county

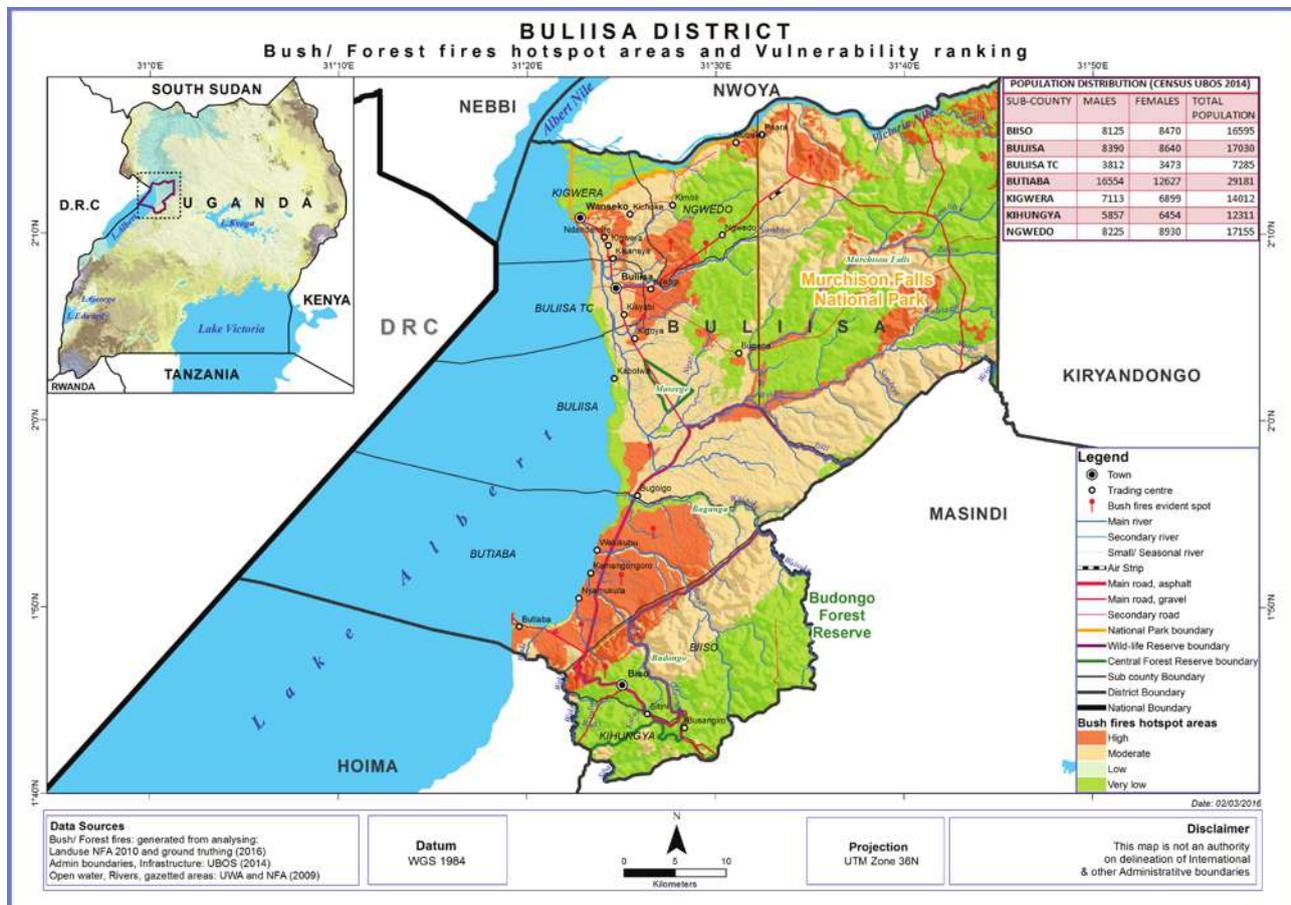


Figure 17: Bush/Forest fires Hot spot Areas and Vulnerability Ranking, Buliisa District

4.4.2 Land conflicts

Results from the participatory assessments showed that land conflicts were a serious problem in Buliisa district. The participants observed that the most recent land dispute in 2007 was among the indigenous Bagungu communities and the pastoralists commonly known as Balaalo. It was reported that the Balaalo had grabbed the communal land owned by the indigenous communities in Buliisa and Butiaba sub-counties. Government intervened and evicted the Balaalo. The other reported incidences of land disputes were among the Bagungu and Alur in Kihungya sub-county. Bagungu cattle keepers and Alur in Buliisa sub county (Kabolwa and Waiga) areas. Figure 18 presents Land conflicts risk and vulnerability ranking.

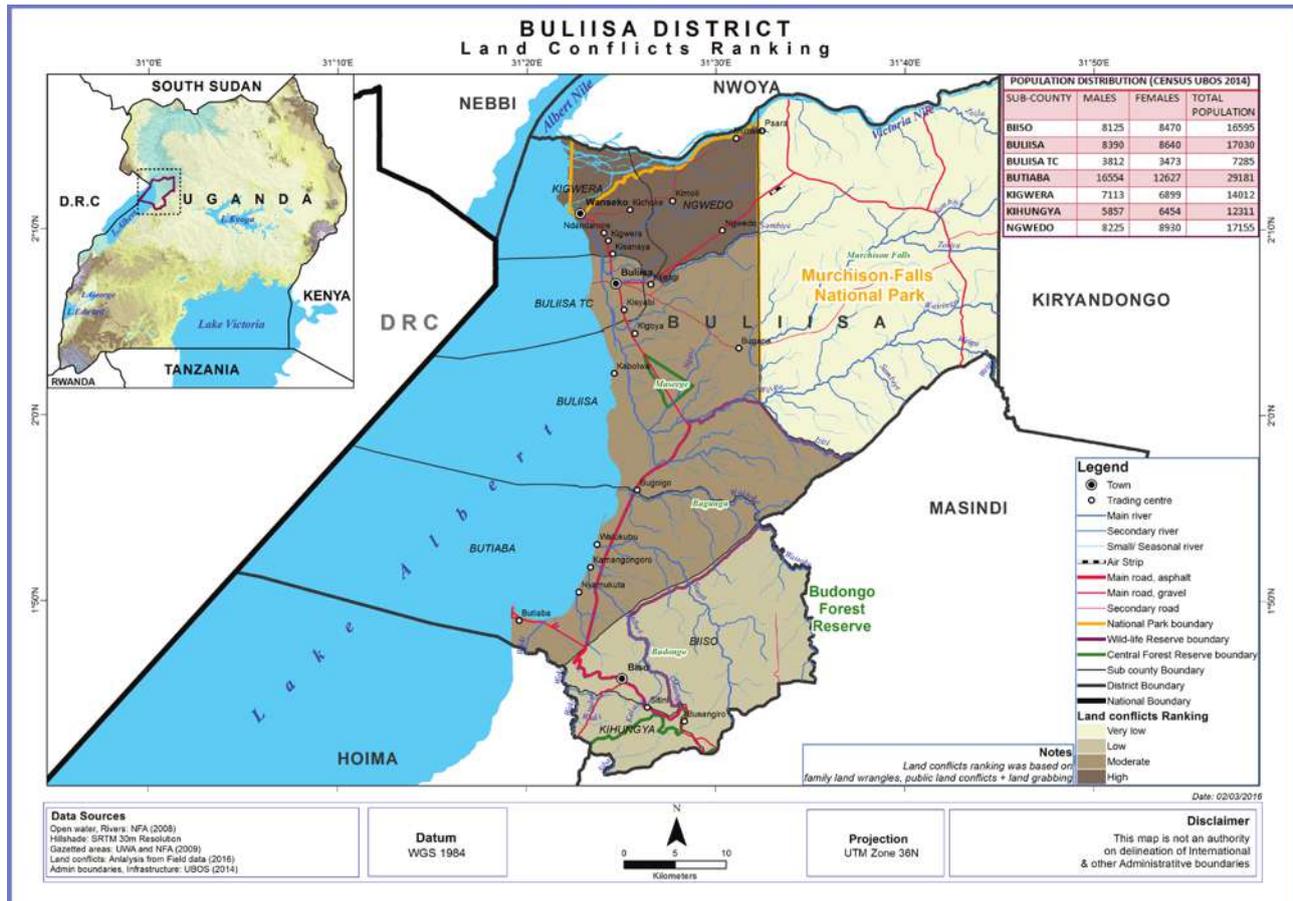


Figure 18: Land Conflicts Ranking, Buliisa District

4.4.3 Environmental Degradation

Participants in the focus group discussions mentioned massive cutting down of trees for timber, building materials, firewood and charcoal burning, swamp reclamation, unplanned settlements at the landing sites, overfishing, sand mining in the lake, overgrazing and indiscriminate disposal of polyethene bags were the most reported forms of environmental degradation in Buliisa district. It was also reported that pockets of Budongo forest were being encroached on for timber and this has greatly reduced the coverage of this forest. The most affected sub-counties are; Butiaba, Buliisa, Kigwera and Buliisa town council. Figure 19 indicates areas where degradation has occurred and ranking.



Plate 9: Indiscriminate dumping of kaveera at Wanseko Landing site, Kigwera Sub-county



Plate 10: Overgrazing at Walukuba village in Butiaba Sub-county

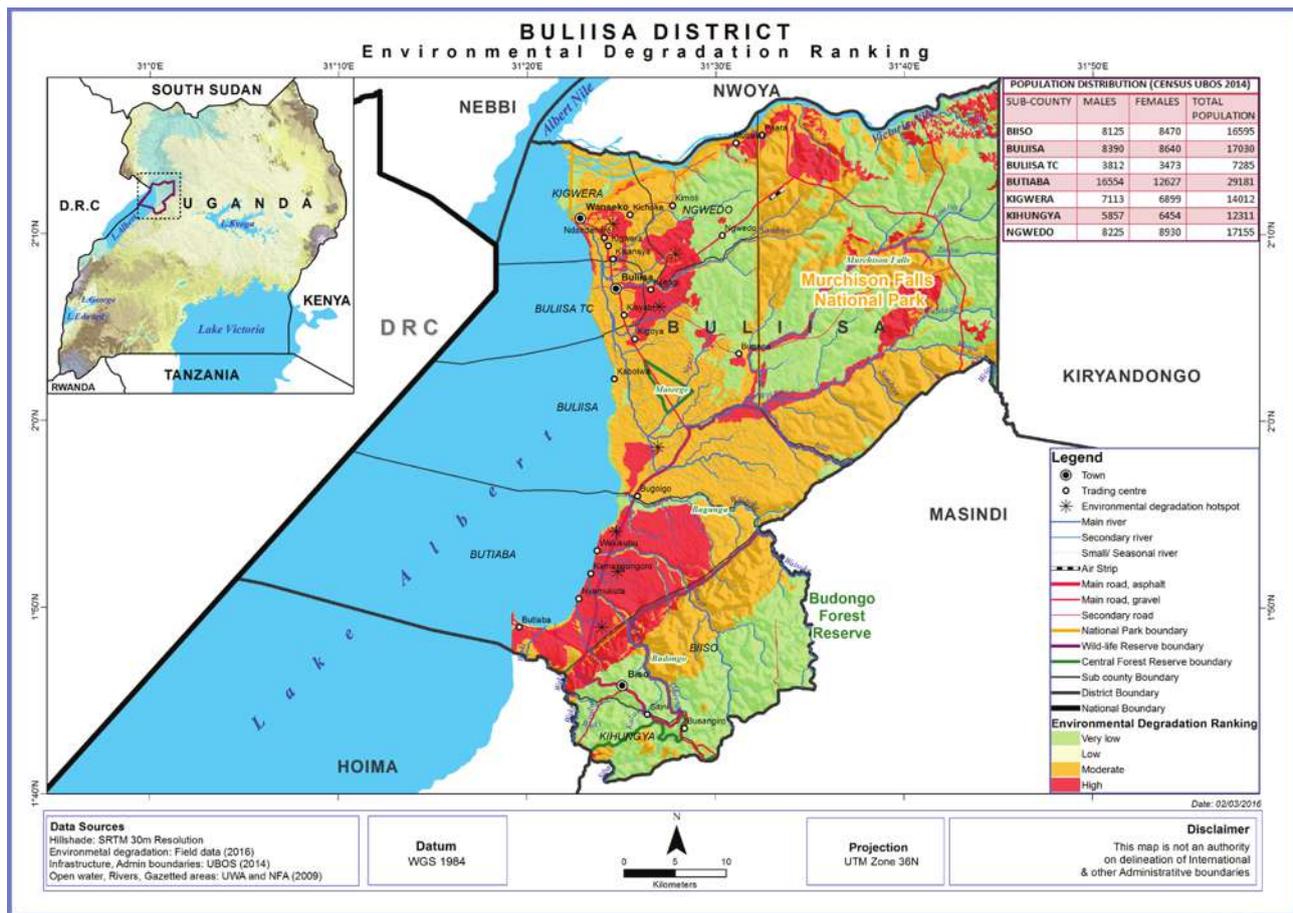


Figure 19: Environmental Degradation Ranking, Buliisa District

4.4.4 Road and Water Accidents

Participants reported that water accidents such as boat capsizing and drowning on Lake Albert were common compared to road accidents which are not a serious problem in Buliisa district. It was observed that water accidents were mainly caused by strong winds. Overloading and strong waves on the lake especially during the rainy season were reported as major causes of water accidents such as capsizing of boats and canoes. In a recent incident that happened in March 2016, a strong storm hit Lake Albert thereby causing death of a several fishermen who drowned after their boats capsizing. Figure 20 indicates roads prone to accidents and specific hotspots for road accidents and water accidents.

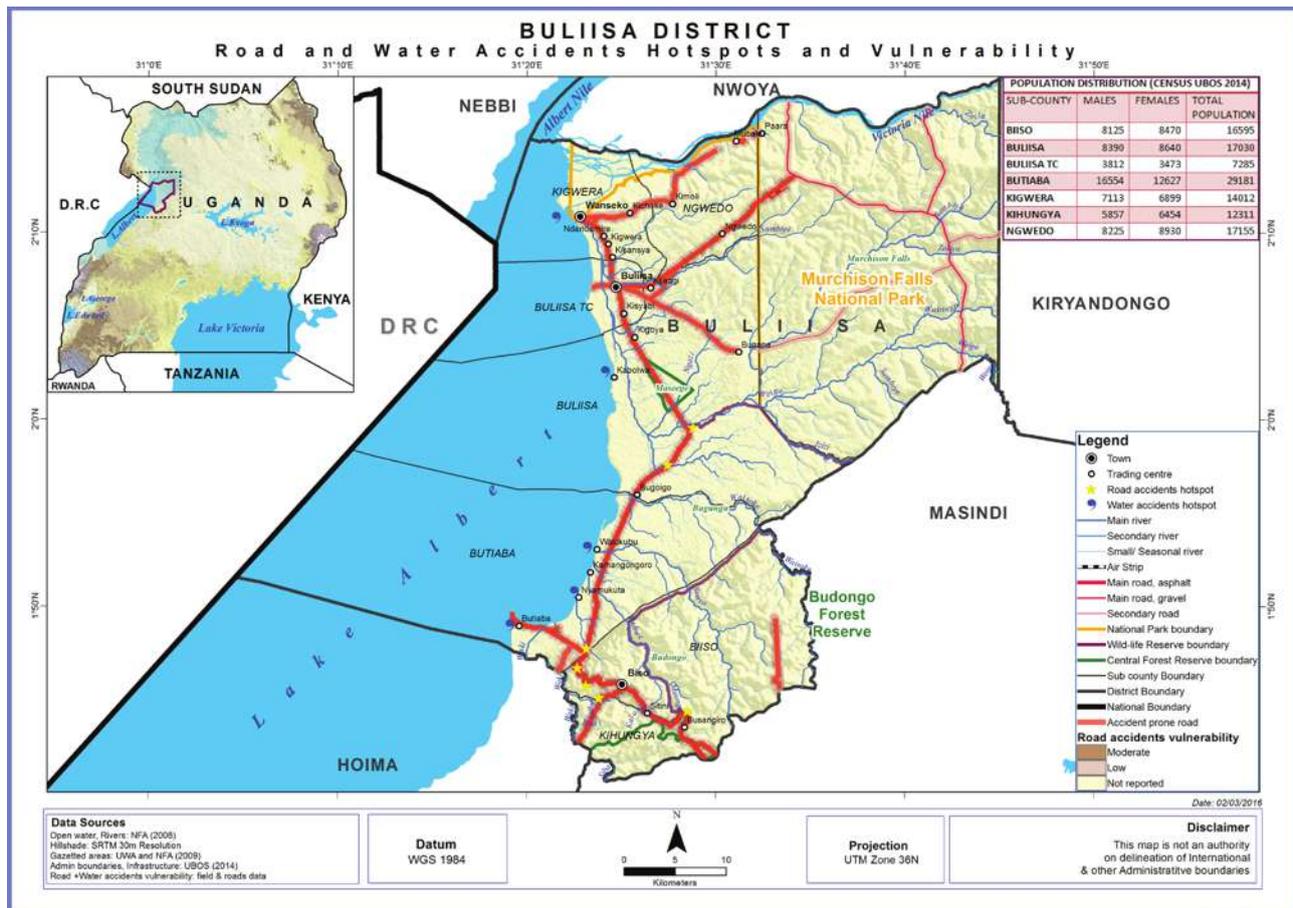


Figure 20: Road and Water Accidents Hot spots and Vulnerability, Buliisa District

4.4.5. Oil and gas related hazards

Buliisa District is endowed with Oil and Gas as the most potential natural resource. The extent of Oil and gas resources in terms of acreage in Buliisa District is estimated at approximately 620-650 sq. Km.

There are two licensed oil companies that have just completed exploration in Block 1A and B, which are Tullow Oil and Total E & P. Company staffs, during their operations, have been housed in camps, one in Buliisa Town Council housing Tullow and the other near Bugungu gate housing Total. Due to the scaled down activities, currently both companies are being housed in the Buliisa camp to minimize operational costs.

Main oil fields include:

- Under Tullow: Kasememe, Kigogole, Nsoga, Ngara, Wairindi and Karuuka
- Under TOTAL EP: Mpyo, Gombya, Begiri and Ngiri

Oil Waste

Waste consolidation sites at Bugungu Gate (Total) and Ngara (Tullow) have been ridden of drill waste and taken to Nyamasoga (Hoima) and Nakasongola respectively for treatment.

Expected Infrastructure Developments

Expected infrastructure that may impact on Biodiversity and local communities include:

- Proposed CPF, central processing facility
- Proposed Pipelines (Nile crossing)
- Proposed Housing and camp site
- Proposed Road infrastructure

The above oil and gas development are greatly associated with potential hazards ranging:

- Oil spills
- Associated oil waste generation
- Ground water contamination
- Accidents like blow ups on site, on road (road kills), fires, occupational hazards,
- Environmental degradation e.g. quarrying, barrow pits, vegetation clearance, soil and land degradation,
- Land take and property destructions in various dimensions
- Pollution e.g. air, sound. light, surface water
- Traffic volumes amidst the existing road infrastructure
- Influx of oil workers amidst inadequate resources
- Land conflicts

Figure 21: indicates areas at risk of potential Oil and Gas hazards and also indicates drilled oil wells in the District.

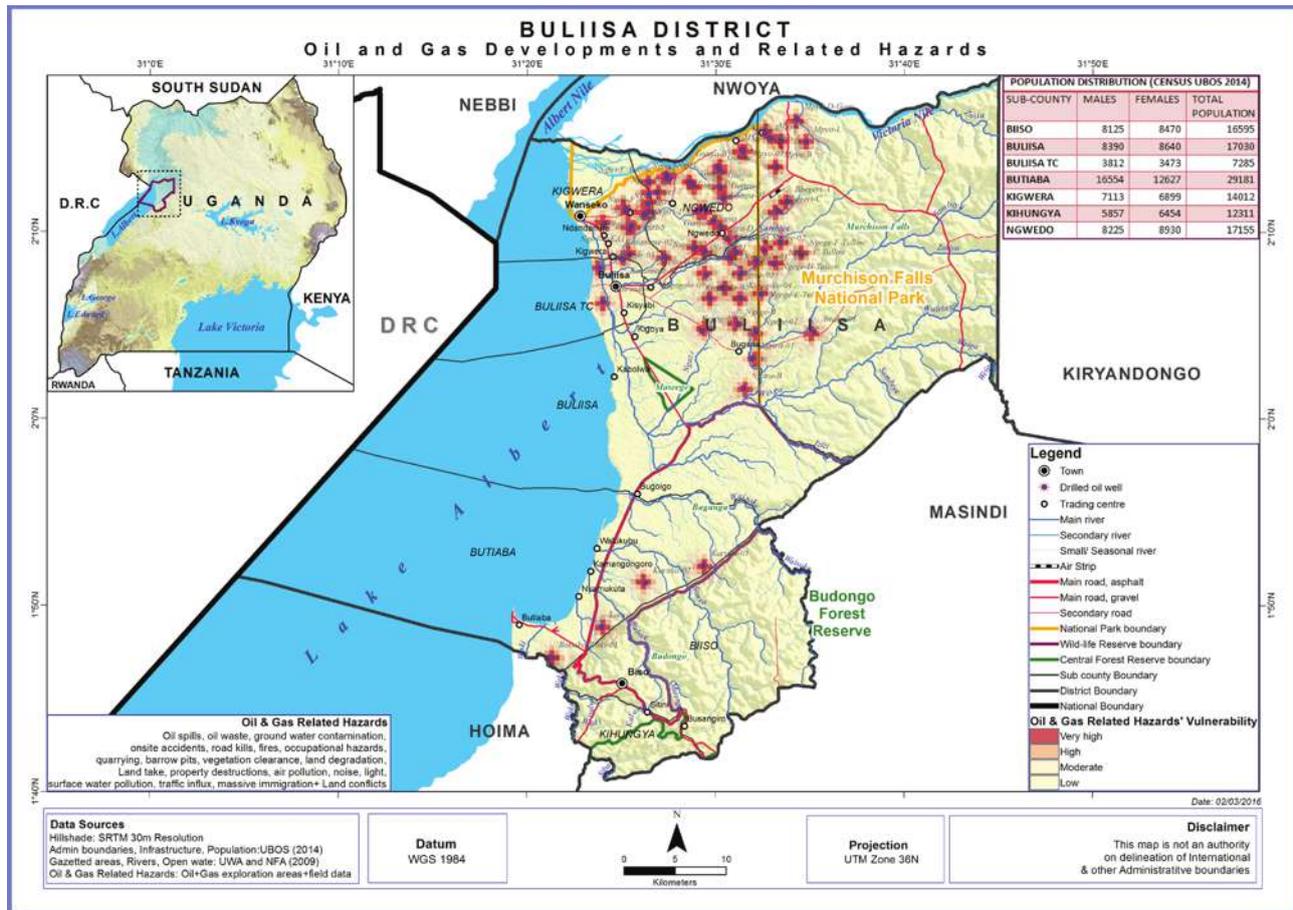


Figure 21: Oil and Gas Related Hazards' Hotspots

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

Vulnerability was assessed basing on two broad criteria i.e. socio-economic and environmental components of vulnerability. Participatory approach was employed to assess these vulnerability components by characterizing the exposure agents, including hazards, elements at risk and their spatial dimension. Participants also characterized the susceptibility of the district including identification of the potential impacts, the spatial disposition and the coping mechanisms. Participants also identified the resilience dimension at different spatial scales (Table 3).

Table 4 (Vulnerability Profile) shows the relation between hazard intensity (probability) and degree of damage (magnitude of impacts) depicted in the form of hazard intensity classes, and for each class the corresponding degree of damage (severity of impact) is given. It reveals that climatological and meteorological hazards in form of drought and hailstorms predispose the community to high vulnerability state. The occurrence of pests and diseases and Lightning, also create a moderate vulnerability profile in the community (Table 4). Table 5 shows Hazard assessment for Buliisa District.

Table 3: Components of Vulnerability in Buliisa District

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

Bush fires	<ul style="list-style-type: none"> - Livestock - Crops - Infrastructure e.g. houses, schools 	Sub-county	<ul style="list-style-type: none"> - Loss of livestock - Shortage of pasture - Destruction of crops - Destruction of infrastructure e.g. houses, schools 	Sub-county	-Sensitization	Sub-county
Road accidents	<ul style="list-style-type: none"> - Human population - Infrastructure adjacent to accident black spots e.g. houses, schools etc. 	Sub-county	<ul style="list-style-type: none"> - Loss of lives - Destruction of vehicles - Destruction of infrastructure adjacent to accident black spots e.g. houses, schools etc. 	Sub-county	<ul style="list-style-type: none"> - Humps on roads - Signage on speed limits - Sensitization on traffic rules 	Sub-county
Land conflicts	<ul style="list-style-type: none"> - Human population 	Village	<ul style="list-style-type: none"> - Loss of lives - Family violence and break outs 	Village	<ul style="list-style-type: none"> - Community dialogue - District court in charge of land issues 	Village
Vermin and Wildlife animal attacks	<ul style="list-style-type: none"> - Human population - Livestock - Crops 	Parish	<ul style="list-style-type: none"> - Loss of lives - Livestock loss - Crop destruction 	Parish	<ul style="list-style-type: none"> - Report to UWA - Guard gardens - Poison - Hunt and kill - Fence water collection points with Wildlife animals 	Village
Environmental degradation	<ul style="list-style-type: none"> - Human and livestock populations - Crops - Natural vegetation 	Sub-county	<ul style="list-style-type: none"> - Crop failure - Shortage of pasture - Shortage of water - Decline of water quality 	Sub-county	<ul style="list-style-type: none"> - Sensitization on wetland conservation - Sensitization on tree planting - Setting bi-laws 	Sub-county
Landslides, Rock falls and Soil erosion	<ul style="list-style-type: none"> - Human and livestock adjacent to hill slopes - Crops on hill slopes - Infrastructure e.g. houses, schools, roads adjacent to hill slopes 	Parish	<ul style="list-style-type: none"> - Loss of lives - Complete crop failure - Destruction of infrastructure e.g. homes, and schools 	Parish	<ul style="list-style-type: none"> - Migration - Sensitization by both government and non-governmental agencies 	
Earth quakes	<ul style="list-style-type: none"> - Infrastructure e.g. houses, schools 	District	<ul style="list-style-type: none"> - Loss of lives - Destruction of infrastructure e.g. houses, schools 	District	-No much measure so far	
Floods	<ul style="list-style-type: none"> - Livestock adjacent to flood plain - Crops on flood plain - Infrastructure e.g. houses, schools, roads adjacent to flood plain 	Parish	<ul style="list-style-type: none"> - Livestock loss - Destruction of crops - Destruction of infrastructure e.g. houses, schools, roads adjacent to flood plain 	Parish	<ul style="list-style-type: none"> - Migration - Sensitization on wetland conservation - Dig trenches 	
Drought	<ul style="list-style-type: none"> - Livestock - Crops - Human population 	Village	<ul style="list-style-type: none"> - Hunger & poverty - Livestock loss - Crop failure - Shortage of pasture - Shortage of water 	Village	<ul style="list-style-type: none"> - Migration - Sensitization on tree planting - Buy food from elsewhere 	

Environmental component									
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 bury affected crops. -Sensitization on crop disease management
Livestock Pests and Diseases	-Livestock (cattle, goats etc.)	District	- Loss of livestock - Reduced livestock productivity	District					- Vaccination - Bury 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 - 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 planting -Setting bi-laws

Table 4: Vulnerability Profile for Buliisa District

	PROBABILITY	SEVERITY OF IMPACTS	RELATIVE RISK	VULNERABLE SUB COUNTIES
	<i>Relative likelihood this will occur</i>	<i>Overall Impact (Average)</i>	<i>Probability x Impact Severity</i>	
Hazards	1 = Not occur 2 = Doubtful 3 = Possible 4 = Probable 5 = Inevitable	1 = No impact 2 = Low 3 = medium 4 = High	0-1 = Not Occur 2-10 = Low 11-15 = Medium 16-20 = High	
Floods	5	4	20	The most affected sub-counties are; Buliisa, Butiaba, Kigwera, Ngwedo and Buliisa T.C.
Droughts	5	4	20	The most affected sub-counties are; Buliisa, Butiaba, Butiaba T.C, Kigwera, Ngwedo and Biiso in order of severity.
Soil erosion, rock falls and landslides	4	3	12	The most affected sub-counties are; Biiso, Kigwera and Kihungya.
Hail storms, Lightning and strong winds	4	4	16	The most affected sub-counties are; Buliisa, Butiaba, Kigwera and Buliisa T.C.
Bush fires	5	4	20	The most affected sub-counties are; Buliisa, Butiaba, Kigwera and Buliisa T.C.
Crop pests and diseases	3	2	6	The most affected sub-counties are; Buliisa and Ngwedo.
Livestock pests and diseases	5	3	15	The most affected sub-counties are; Buliisa, Butiaba, Kigwera, Ngwedo and Buliisa T.C.
Human Diseases outbreaks	4	3	12	The most affected sub-counties are; Biiso, Buliisa, Butiaba, Kigwera and Buliisa TC
Land conflicts	4	4	16	The most affected sub-counties are; Buliisa, Butiaba, Kigwera, Ngwedo and Buliisa T.C.
Vermin and Wild-life animal attacks	5	3	15	The most affected sub-counties are; Biiso, Buliisa, Butiaba, Kigwera and Ngwedo
Earthquakes and faults	4	3	12	The most affected sub-counties are; Biiso, Butiaba and Kigwera.
Road accidents	2	2	4	These were low in the entire district.
Water accidents	3	2	6	The most affected sub-counties are; Buliisa, Butiaba and Kigwera
Environmental degradation	4	4	16	The most affected sub-counties are; Buliisa, Butiaba, Kigwera and Buliisa T.C.
Oil and Gas related Hazards	5	4	20	The most affected sub-counties are Ngwedo, Buliisa, Kigwera, Butiaba and Buliisa Town Council

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 5: Hazard Risk Assessment

Hazard	Biiso	Buliisa	Buliisa Town Council	Butiaba	Kigwera	Kihungya	Ngwedo	Conservation area
Floods	M	H	H	H	H	M	H	L
Drought	H	VH	VH	VH	H	M	H	M
Landslides, Rock falls and Erosion	M				M	M		L
Strong winds, Hailstorms and Lightning	M	H	H	H	H	M	M	L
Crop pests and Diseases	M	H				M	H	
Livestock pests and Diseases	M	H	H	H	H	M	H	
Human disease outbreaks	H	H	H	H	H	M	M	
Vermin and Wildlife animal attacks	H	H	M	H	H	H	H	
Land conflicts	M	H	H	H	H	M	H	
Bush fires	M	VH	VH	VH	VH	M	M	H
Environmental degradation	M	H	H	H	H	M	M	L
Earthquakes and faults	M	L	L	M	L	L	L	L
Road accidents	L	L	L	L	L	L	L	
Water accidents		L	L	L	L			
Invasive species	M	H	H	H	H	M	M	H
Meromicticism		H	H	H	H			

Key

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

4.5.1 Gender and Age groups mostly affected by Hazards

Table 6: 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 6).

Table 7: Coping strategies to the Multi-hazards in Buliisa District

No	Multi-Hazards		Coping strategies
1	Geomorphological or Geological	Landslides, Rock falls and Erosion	<ul style="list-style-type: none"> • Migration to safe areas • Terracing/ 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		Earthquakes and faults	<ul style="list-style-type: none"> • Designs of houses (pillars) • Early warning system • Vigilance • Sensitization • Emergency response mechanisms
3	Climatological or Meteorological	Floods	<ul style="list-style-type: none"> • 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		Drought	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Plant trees as wind breakers • Use of stakes against wind in banana plantations • Use of ropes to tie 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

No	Multi-Hazards	Coping strategies
6	Ecological or Biological	Crop pests and Diseases <ul style="list-style-type: none"> • Spraying pests • Cutting and burying BBW affected crops • Burning of affected crops • Vigilance
7		Livestock pests and Diseases <ul style="list-style-type: none"> • Spraying pests • Vaccinations • Burying animals that have died from infection • Quarantine
8		Human epidemic Diseases <ul style="list-style-type: none"> • Mass immunisation • Visiting health centres • Use of mosquito nets
9		Vermin and Wild-life animal attacks <ul style="list-style-type: none"> • Guarding the gardens • Poisoning • Hunt and kill • Report to UWA
10		Invasive species <ul style="list-style-type: none"> • Uproot • Cut and burn • Sensitization on Invasive species management
11	Human induced or technological	Land conflicts <ul style="list-style-type: none"> • Community dialogues • Report to court • Migration
12		Bush fires <ul style="list-style-type: none"> • 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
13		Road accidents <ul style="list-style-type: none"> • Construction of humps • New road has Signage including speed limits • Sensitisation
14		Environmental degradation <ul style="list-style-type: none"> • Leave wetlands as water catchments • Plant trees as climate modifiers • Sensitization
15	Oil and Gas Hazards <ul style="list-style-type: none"> • Resettlement from exploration areas • Restoration of degraded areas • Land ordinance and by laws • EIAs • Environmental inspections , audit, monitoring • Sensitivity atlas • DEAP • Development of Management plan • Oil spill contingency plan • Strategic environment assessment • Physical planning 	

GENERAL CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

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

Hazards experienced in Buliisa 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, environmental degradation, oil and gas hazards.

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

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

5.2 Policy-related Recommendations

The following recommended policy actions targeting vulnerability reduction include:

- i. The government should improve enforcement of policies aimed at enhancing sustainable environmental health.
- ii. The government through MAAIF should review the animal diseases control act because of low penalties given to defaulters.
- iii. The government should establish systems to motivate support of political leaders toward government initiatives and programmes aimed at disaster risk reduction.

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

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APPENDIX I: DATA COLLECTION TOOLS



FGD meeting at Butiaba landing site

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, environmental degradation, oil and gas hazards)

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 Participant	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 earthquakes)

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

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

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

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

challenges?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

79. Which crops or animals are majorly affected by invasive species in your community?
80. In which way are the crops or animals affected by invasive species?
81. Which mitigation practices are being adopted by farmers in a bid to mitigate the above invasive species?
82. What are the relevant government's interventions focusing at helping farmers mitigate the invasive species mentioned?

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

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

FOCUS GROUP ATTENDANCE LIST FOR DISTRICT DISASTER RISK MANAGEMENT FOCAL PERSONS

Name of Participant	Designation	Contact
1. Ngongaha Phillip	Acting Environment Officer	0772487542
2. Kaahwa Robert	Acting District Production Officer	0774161223

FOCUS GROUP DISCUSSION ATTENDANCE LIST FOR LOCAL COMMUNITIES

Name of Participant	Village/Parish	Contact
1. Bingi Cathbert	Kigwera Southwest	0786262756
2. Wabyona Robert	Kigwera Southeast	0780286068
3. Aganyira Pamela	Kigwera Southeast	0777459371
4. Tumuhaise Justus	Kigwera Southwest	0787052926
5. Tibenda Charles	Kigwera Southeast	0777454617
6. Tibangwa Joyce	Kigwera Southeast	0783585064
7. Kusemererwa Doreen	Kigwera Southeast	-
8. Ngaronsa Lunguard	Kibambura	0775005930
9. Masendi Jackson	Ngwedo Trading center	0783483324
10. Ozelle Stephen	Ngwedo Trading center	0771405870
11. Chui Muzamil	Kamandindi/Avogera	0775716111
12. Kiiza Herbert	Kibambura	0773484106
13. Onen James Kiwanuka	Ngwedo Trading center	0782346241
14. Atuhura Sharon	Kibambura	0774180229
15. Pikwo Emmanuel	Avogera	0774719906
16. Ozelle Nicholas Kiwanuka	Ngwedo Trading center	0780283414
17. Mujumba David	Ngwedo Trading center	-
18. Mulimba Seremoth	Piida	0773462604
19. Mugonzebwa Esau	Booma	0782875754
20. Tumusiime Julius	Piida	0782517898
21. Matongo Phillip	Piida	0783776878
22. Matongo Constance	Piida	0775086262

Name of Participant	Village/Parish	Contact
23. Nyamusango Dorotiya	Booma	0779657045
24. Oyanyi Dubugira	Piida B	-
25. Tibenda Perez	Piida B	0787665129
26. Mugisa Crecyor	Piida B	-
27. Byenkya Lagnfor	Piida	0788227910
28. Bihemaiso Patrick	Piida	0777710621
29. Balamu Keeya	Piida	0777396189
30. Byenkya Edward	Piida	0779402970
31. Bigirwenkya Elisha	Piida	-
32. Muhangi Gerald	Piida	0774946534
33. Kabahumuza Faridah	Waaki	0782954983
34. Mbabazi Mildred	Mugume	0787127746
35. Kyalimpa Gordon	Kihungya Trading center	0771075505
36. Kitembo Sarah	Waaki	-
37. Asiimwe Beatrice	Mugume	-
38. Ndazaho Grace	Mugume	-
39. Kasangaki Gradd	Mugume	0784157765
40. Lubeni Babyasiza	Kimbeni	0787045156
41. Bamaturaki David	Tutwe	0773462855
42. Birungi Rosemary	Garasoya B	-
43. Katuhunde Wycliff	Kihungya Trading center	0751405712

SPATIAL DATA COLLECTION SHEET FOR HAZARD VULNERABILITY AND RISK MAPPING

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

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