Kibaale 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.

Executive summary

Vulnerability assessment, hazard and risk mapping is an important exercise carried out by OPM in response to The National Policy for Disaster Preparedness and Management (Section 4.1.1) and also targeting to counteract vulnerability at community and local government levels by reducing the impact of the hazards where possible through mitigation, prediction, warning and preparedness.

This report has been prepared in close collaboration and coordination with OPM as well as other stakeholders. The report is presented in 3 chapters with chapter one detailing the background of the report which comprises of the Government of Uganda shifting the disaster management paradigm from the traditional emergency response focus towards one of prevention and preparedness. Here the report highlights the objectives of the exercise as to Collect and analyze the field data using GIS and Develop specific multi-hazard, risk and vulnerability profiles using a standard methodology.

Chapter two highlights the overview of the district and its location where the District is located in in the Mid-Western part of the Uganda on a central plateau with an altitudinal range of about 2000-4000 ft. above sea level.

Chapter three clearly explains the materials and methods applied in conducting the assessment and here a multidisciplinary approach was adopted for the assessment of multi-hazard, risk and vulnerability profiles production. The approach included; an investigation of socio-economic parameters, biophysical characteristics and spatial analysis of hazards in the district. Kibaale District has a favourable climate. It receives a bi-modal rainfall type. There are three broad categories of vegetation in the District namely: the modified equatorial type, the wooded savannah mosaic and savannah grassland.

Chapter four has findings that encompass multi hazard, risk and vulnerability status of the district. It has been noted that Greater Kibale district has continuously experienced multi-hazards for over 30 years. The multi-hazards that are experienced in the district can be classified as:

   i.   Geomorphological and geological hazards including; soil erosion

   ii.   Climatological or hydro-meteorological including; hailstorms, Lightning, drought and floods

   iii.   Ecological or biological hazards including; pests, parasites and diseases and invasive species

   iv.   Technological hazards including; road and water accidents

   v.   Environmental hazards including; wetland degradation, deforestation, bush burning and land conflicts

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

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

   b)   Building capacities to withstand and cope with the hazards and risks;

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

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List of acronyms

DLG	:	District Local Government
DPP	:	District Development Plan
DWRM	:	District Water Resources Management
GIS	:	Geographical Information Systems
HRV	:	Multi hazard, Risk and Vulnerability
MWE	:	Ministry of Water and Environment
NARO	:	National Agricultural Research Organisation
NEMA	:	National Environmental Management Authority
NFA	:	National Forestry Authority
UNDP	:	United Nations Development Programme
OPM	:	Office of the Prime Minister
SRTM	:	Shuttle Radar Topography Mission
ToR	:	Terms of Reference
UBOS	:	Uganda Bureau of Statistics
UNRA	:	Uganda National Roads Authority

Definition of key terms

Hazard is a potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation

Risk is a probability of a hazard occurring or threatening to occur

Vulnerability refers to the propensity of exposed elements such as human beings, their livelihoods, and assets to suffer adverse effects when impacted by hazard events

Climate variability refers to the climatic parameter of a region varying from its long-term mean. Every year in a specific time period, the climate of a location is different. Some years have below average rainfall, some have average or above average rainfall

Disaster is a progressive or sudden widespread or localized, natural or human caused occurrence which causes or threatens to cause death or injury, damage to property, infrastructure or environment, disruption of life of a community and its magnitude exceeds the ability of those affected to cope using only their own resources

Disaster management is a continuous and integrated multi-sectoral and multidisciplinary process of planning and implementation of measures aimed at disaster prevention, mitigation, preparedness, response, recovery and rehabilitation

Mitigation means structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards

Preparedness means activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations

Response means measures taken during or immediately after an incident or a disaster in order to bring relief to affected communities or individuals

Adaptation means the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities

CHAPTER ONE

1.1 Background

Uganda has over the past years experienced frequent disasters that ranges from drought, to floods, landslides, human and animal diseases, pests, animal attacks, earthquakes, fires, conflicts and other hazards which in many instances resulted in death, property damage and loss of livelihood. With the increasing negative effects of hazards that accompany population growth, development and climate change, public awareness and proactive engagement of the whole spectrum of stakeholders in disaster risk reduction, are becoming critical. The Government of Uganda is shifting the disaster management paradigm from the traditional emergency response focus towards one of prevention and preparedness. Contributing to the evidence base for the 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 ensure mainstreaming of disaster and 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 sub-regions of Rwenzori, Karamoja, Teso, Lango, Acholi, West Nile, Central and South Western sub regions. During the exercise, Local Government officials and community members actively participated in the data collection and analysis through focus groups discussions and the key informant interviews. The data collected was used to generate hazard, risk and vulnerability maps and profiles for each district. Validation workshops were held in close collaboration with the District Local Government (DLG) technocrats, Development Partners, Agencies and academic/research institutions. The developed maps show the local geographical distribution of hazards and vulnerabilities up to sub county level of the district.

1.2 Justification

The National Policy for Disaster Preparedness and Management (Section 4.1.1) requires the Office of the Prime Minister to "Carryout vulnerability assessment, hazard and risk mapping of the whole country and update the data annually". UNDP's DRM project 2016 Annual Work Plan; Activity 4.1 is "conduct national hazard, risk and vulnerability (HRV) assessment including sex and age disaggregated data preparation of district profiles."

1.3 Objectives of the consultancy

The objectives of the assignment were to:
1) Collect and analyze field data using GIS in close collaboration and coordination with OPM in Greater Kibaale District
2) Develop district specific multi-hazard, risk and vulnerability profiles using a standard methodology.
3) Preserve the spatial data to enable use of the maps for future information.
4) Produce age and sex disaggregated data in HRV maps

1.4 Scope of the assignment

This assignment was carried out by a team of consultants under the overall technical supervision by the Office of the Prime Minister and UNDP, Uganda. The assignment was conducted in the month of May, 2016.

CHAPTER TWO

2.1 Overview of Greater Kibaale District

Kibaale District is located in the Mid-Western part of the Uganda. The District is bordered by Lake Albert to the West, Hoima District to the North, Kyankwanzi District to the East, and Mubende District to the South where-as in the South-West lies Kyenjojo, Kabarole and Ntoroko Districts.

Kibaale District is part of a central plateau with an altitudinal range of about 2000- 4000 ft. above sea level. The lowest area of the District is occupied by L. Albert at 2040 ft. above sea level while one of the highest points is Magoma hills (5100 ft. above sea level) in Kasambya sub-county - Bugangaizi County.

The process of erosion and accumulation that acted upon the land surfaces gave rise to several types of soils in Kibaale District. In exception of the lowlands which are covered by alluvial and lake deposits, the soils of the district are of ferrallistic type. Productivity of these soils largely depends on favourable rainfall, adequate depth and maintenance of the humic top soil. However, some clay deep loams of Buyaga catena are sufficiently fertile to support a diversity of crops. There are basically 3 soil mapping units in Kibaale District namely Buwekula Catena Buyaga Catena and Kamusenene series. Buwekula Catena covers 90 percent of Buyanja and Bugangaizi counties and comprises three major types of granitic soils namely: shallow loams, Red clay loams and Brown gravelly clay loams. Shallow Loams have moderate acidity with moderate productivity and mainly support the growing of Tobacco and Cotton (Kibaale district higher local government statistical abstract, 2009).

Kibaale District has a favourable climate. It enjoys a bi-modal rainfall type which varies between 1000 mm- 1500 mm per annum i.e moderate to high rainfall. Rainfall comes in two peaks, one from March to May and the second from September to December. However, the Western part of the district, bordering the rift valley, is generally dry. The temperatures are relatively high, varying between 150°C and 300 °C with the hottest temperatures recorded in the Rift Valley Zone.

There are three broad categories of vegetation in the District namely: the modified equatorial type, the wooded savannah mosaic and savannah grassland. The modified equatorial vegetation covers a greater of the District especially in the Sub counties of Bwamiramira, Kyebando, Kiryanga, Kakindo and parts of Nalweyo. This type of vegetation used to be equatorial in nature but has been modified as a result of human activity. The wooded savannah mosaic covers a greater part of the district and forms a transitional zone from the modified equatorial vegetation to the open savannah grassland. It is common in the Sub Counties of Kyanaisoke, Mabaale, Kagadi, Muhorro, parts of Bwikara, Matale and Bwanswa. The savannah grassland is typical in areas where human activity has modified the wooded savannah mosaic. It is mainly found in the Sub Counties of Rugashari, Mpeefu and Kisiita. The open grassland and thicket promote livestock farming although most of such range lands have not yet been properly developed (Kibaale district higher local government statistical abstract, 2009).

The majority of people (86.2 percent) in Kibaale are involved in crop farming industry. The public sector including Education and Health only employs 3.1 percent.
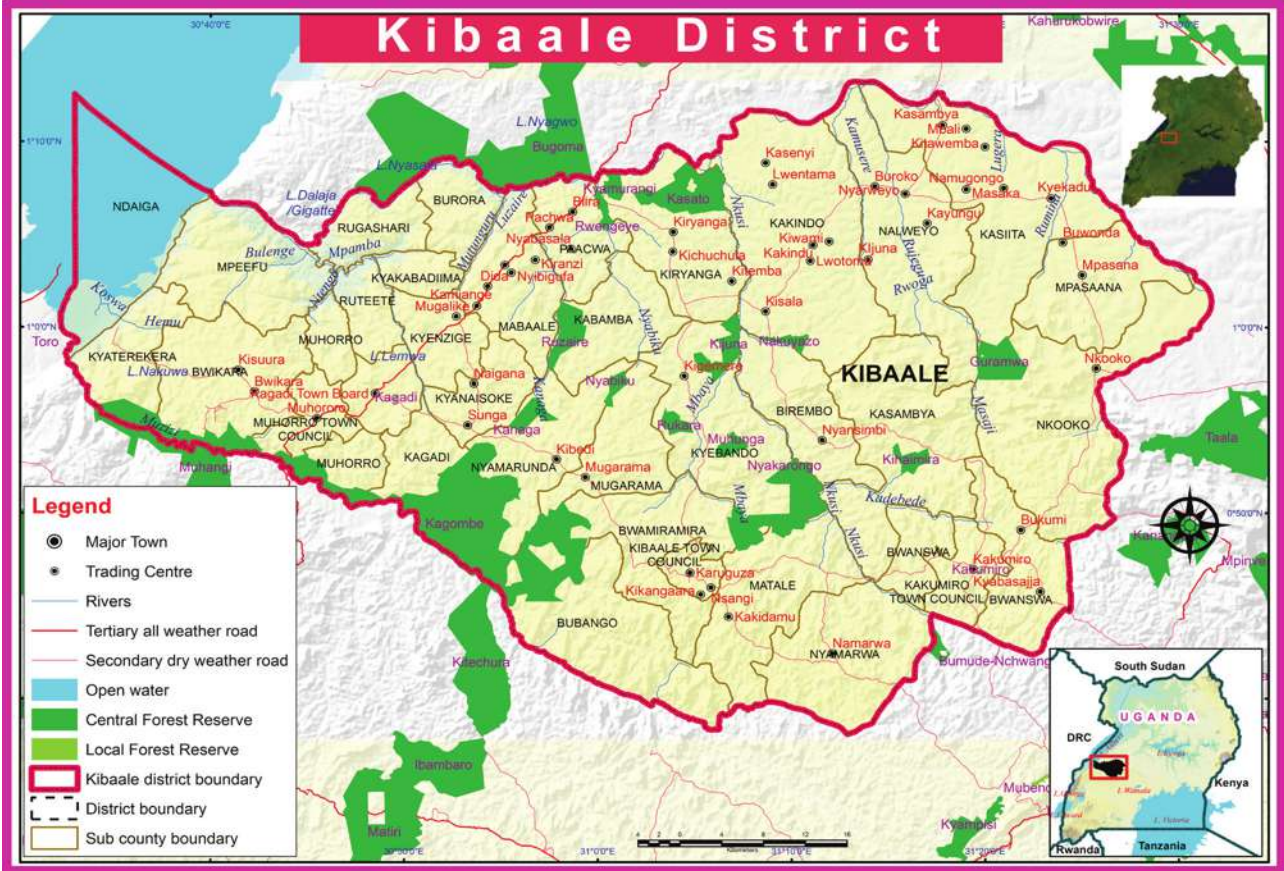
Figure 1: Greater Kibaale District

CHAPTER THREE

3.1 Materials and methods

3.1.1   Multi-hazard, risk and vulnerability profile assessment

3.1.1.1 Approach

A multidisciplinary approach was adopted for the assessment of multi-hazard, risk and vulnerability profiles production. The approach included; the investigation of socio-economic parameters, biophysical characteristics and spatial analysis of hazards in the district.

3.1.1.2 Data collection

3.1.1.2.1 Socio economic investigation

The socio economic assessment of hazards, risks and vulnerability was threefold: the consultations, key informant interviews and Focus Group Discussion. The consultations were conducted at the district level and this included government officials who were selected on the advice of the Chief Administrative Officer and assessment team. The issues and concerns discussed were the causes, effects, adaptive responses, risks and vulnerability of multi-hazards experienced in the district. The question and answer session was selected purely because the officials were knowledgeable and had vast experience in the occurrence, severity and frequency of hazards in the district.

In addition to consultations, the key informant interviews were also carried out on the sub county officials for evidence based discovery. A total of two focus group discussions were also conducted in the sub counties of Muhorro and Kyebando. The groups on average comprised 10-15 members who were randomly selected by the sub county focal persons from the different parishes. The risk and vulnerability factors were determined through ranking and weighting procedures. The discussions helped to identify the most prone areas that were later visited for more site risk and vulnerability study. Four broad vulnerability areas were participatory identified in the district, these being social, economic, environmental and physical components. In each of these vulnerability components, participants characterised the exposure agents, including multi-hazards, elements at risk and their spatial dimension.

3.1.1.2.2 Spatial analysis

A series of spatial datasets were collected, pre-processed and processed to extract information on the magnitude and distribution of hazards, risks and vulnerability. The primary and secondary datasets were collected and collated prior to information extraction. The primary data include GPS coordinates while the secondary dataset included satellite images, land use/cover maps, digital elevation model, population and hydrological maps.

The utilised datasets used to create multi-hazards, risks and vulnerability maps are here indicated below:

Table 1: Sources of spatial datasets obtained and utilised in the study

No	Datasets	Sources	Period
1	Population	UBOS	2014
2	Roads	UNRA	2009
3	Land use/cover	NFA	2010
4	Hydrography	MWE	2010
5	Wetlands	MWE	2009
6	Protected areas	NFA	1990
7	Soil	NARO	2013
8	Trading centres	NFA	2014
9	Digital Elevation Model (30m)	SRTM	2014

The identified multi-hazards were mapped following standards procedures and methods for acceptability and reasonable output. Some of the analytical procedures are stated here below:

Table 2: Multi-hazard analytical detailed description of procedures

No	Multi hazards	Procedures
1	Flood inundation	Yang et al. (2006)
2	Soil erosion	Fistikoglu & Harmancioglu (2002)
3	Land conflicts	Homer-Dixon (1994)
4	Strong winds	Bunting & Smith (1993)
5	Invasive species	Venette et al. (2010)
6	Road accidents	Kamijo et al. (2000)
7	Lightning	Yokoyama (2002)

3.1.1.2.3   **Validation**

The hazard, risk and vulnerability prone areas were identified and studied in the field. The Spectra Precision handheld Global Positioning System (model: Mobile Mapper 20) units were used to map the hotspot and vulnerable areas. The field compiled profile was validated by the representative district government officials in a validation workshop held in Jinja District from 27th June – 1st July, 2016.

3.2 Multi-hazard assessment

3.2.1 **Introduction**

The multi-hazards that are experienced in Greater Kibaale District can be classified as:
    vi. Geomorphological and geological hazards including soil erosion

    vii. Climatological or hydro-meteorological including hailstorms, Lightning, drought and floods

    viii. Ecological or biological hazards including pests, parasites and diseases and invasive species

    ix. Technological hazards including road and water accidents

    x. Environmental hazards including wetland degradation, deforestation, bush burning and land conflicts

The comprehensive information on the frequency, severity and distribution of multi-hazards is presented here below in a chronological episodes order.

3.2.2   Deforestation

Plate 1: Deforestation for agriculture at Bwamiramira sub county

Deforestation is perceived as the cutting of trees for firewood, charcoal, timber and clearing land for cultivation. This has mainly affected Greater Kibaale district because most of the trees have been wiped away in search of land for settlement and farming caused by the high birthrates and migration and increased demand for charcoal and timber products. Deforestation is being accelerated by search of fertile farm land since the soils have lost their fertility and commercialization of agriculture, corruption and weak laws that are not adhered to or enforced to protect forest reserves and forests.

The factors that contribute to the vulnerability include weak enforcement of forestry laws, high population growth rates, drought and reduced soil fertility among others in the district.

The resultant effects have led to increases in pests, parasites and diseases, destruction of habitats and drought. In addition to the loss of biodiversity, water resource conflicts and loss of water quality have been recorded in the district. The activities are prevalent in all the sub counties (figure 2).

Figure 2: Deforestation risk map

3.2.3   Pests, parasites and diseases

The occurrence, severity, frequency and distribution of pests, parasites and diseases are high as compared to the last 30 years in the district. In crop production, the farmers are engaged in the growing of cassava, beans, groundnuts, rice, potatoes, millet maize and Bananas as food and cash crops. The farmers are also involved in the growing of coffee, tea, cocoa, trees and tobacco as cash crops. However, their production and productivity have drastically reduced over time due to increasing and emergence of new pests and diseases.

The high pre-and post-harvest pest and disease incidences in crops is mainly attributed to changes in weather patterns, deforestation, inadequate extension services, inadequate regulation and surveillance, trans-boundary movement, soil exhaustion, type of crop grown (cereals), poor farming methods, high costs of pesticides, substandard pesticides and poor storage facilities. The changes in weather patterns favour the life cycle of pests that continuously destroy crops resulting into famine and on the other hand poor farming methods are attributed to poverty, attitude, ignorance and poor mind-sets. The crop pests and diseases are associated with crop destruction, stunted growth, early rotting and farmer ignorance on better farming methods
(Plate2).

Plate 2: Banana bacteria wilt disease- Bwamiramira sub-county

The factors that have contributed to the vulnerability of farmers include: poor seedlings, substandard pesticides and limited extension services. The adverse effects include low crop yields, low income levels, build-up of pests and soil degradation among others. Some of the notable pests and diseases are indicated here below (table 4). The effects of pests, parasites and diseases were evident in all the sub counties (figure 3).

Table 3: Major pests and diseases

No	Crops	Pests and diseases
1	Cassava	Cassava brown streak virus disease, cassava mosaic disease
2	Groundnuts	Groundnut rosette, Leaf miner
3	Maize	Stem borers, maize smurt, maize streak virus disease
4	Sorghum	sorghum midge, stem borers, sorghum shoot fly
5	Cowpeas	Aphids
6	Soybean	Web worm, rust
9	Bananas	Banana Bacterial Wilt, banana weevils, sigatoka
10	Tomatoes	Tomato Blight
11	Rice	Stem borers, rice yellow mortal virus
12	Beans	Aphids
13	Coffee	Coffee wilt disease, coffee twig borer

In Greater Kibaale District livestock production is being affected by the occurrences of parasites and diseases which are accelerated by communal grazing, ignorance, poor on-farm management, deforestation, mixing of livestock due to limited pasture fields, wetland degradation, animal movement, grazing along road reserves and reduced surface water quality.

The parasites and diseases are associated with low milk yield, low meat products, slow growth in livestock and encroachment of marginal lands such as wetlands among others. The predictability of the parasites and diseases is on the increase of each year. The livestock keepers are apparently vulnerable due to sub-standard pesticides, unreliable weather patterns, limited extension services, water and pasture.

The adverse effects of livestock parasites and diseases include: loss of livestock, reduced household income levels, loss of revenue to the district, malnutrition, illness and human death. Some of the notable parasites and diseases included ticks, tsetse flies, worms, mites in poultry, New castle, Swine fever, Nagana, East Coast fever, foot and mouth disease among others. The livestock parasite and disease incidences are reported in all the sub counties (figure 3).
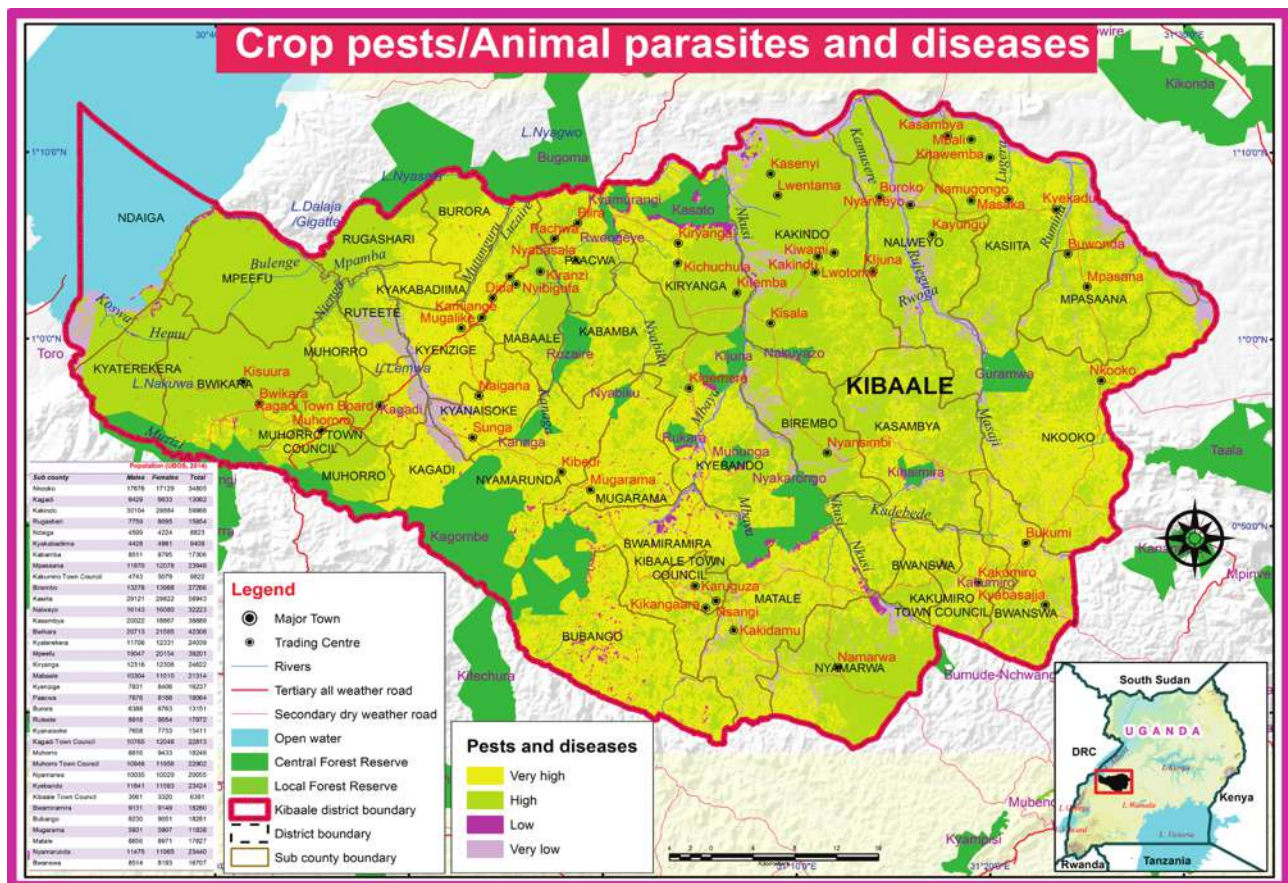

Figure 3: Pests, parasites and diseases

3.2.4 Drought

Greater Kibaale is one of the districts found in the cattle corridor. The experienced drought events are manifested as prolonged dry spells that cause shifts in the onset of rainy seasons.

Plate 3 : Maize plantation being affected by drought-June 2016

The frequency and severity of drought episodes are perceived to be caused by changes in the climate pattern, wetland degradation, location in the rain shadow, changes in land use, poor farming methods and deforestation. Drought occurrences are associated with deficit in soil moisture, reduction of surface water sources, rotting of crops and reliance on imported foods. It is aggravated by low adaptive capacity of farmers and reduced soil fertility. Predictably, the most affected months are those from December – March and July – September of each seasonal calendar. (Plate 3)

Notably, the most adverse effects of drought include reduced income levels for farmers and district revenue, reduced farm yields, reduced inputs and investment in the agricultural sector. In addition, drought increases prices of staple food, food insecurity, migration, theft of crops in gardens, wetland degradation, famine, illness and loss of livestock. The severity and distribution of drought affects all the sub counties in particular Nkooko , Mpasaana, Kisiita, and Mpeefu

3.2.5 **Wetland degradation**

Plate 4: Brick making in the wetland in Kyebando sub county

The wetland types found in Greater Kibaale District are characterized as thickets, bush lands, grasslands, seasonal (MWE, 2009). The wetland systems are under continual threats from the increasing rates of encroachment for wetland products and services. The wetlands are utilised as livestock grazing fields, brick making extraction of building materials, crop growing, fishing and firewood among others (Plate 4). The major causes of wetland degradation include land shortage, drought, reduced soil fertility, political interference, soil erosion, drought, poor farming methods, assumed ownership, change in land use, ignorance, resource conflicts, brick making, sand mining, seasonal fires, over harvesting and invasion by invasive species .

The degradation is associated with silting of water bodies, reducing soil nutrients, lowering the water table, resource conflicts and over cultivation. The rates of wetland encroachments are high during the prolonged dry months characterised with low water availability and limited pastures. The factors that have increased the vulnerability of wetlands include limited enforcement mechanism and funds to demarcate the wetland boundaries.

The adverse effects of wetland degradation include subsequent occurrences of flash floods, erratic rains and drought, reduced water quality and quantity in water sources, loss of wetland biodiversity, drought, increased incidences of pests, parasites and diseases, loss of property, livestock and human life. The severe effects have been reported in Rugashari, Kasambya, Bwamiramira, Bubango, Mpeefu, Nalweyo, Kisiita,   sub counties found in the district (figure 4).
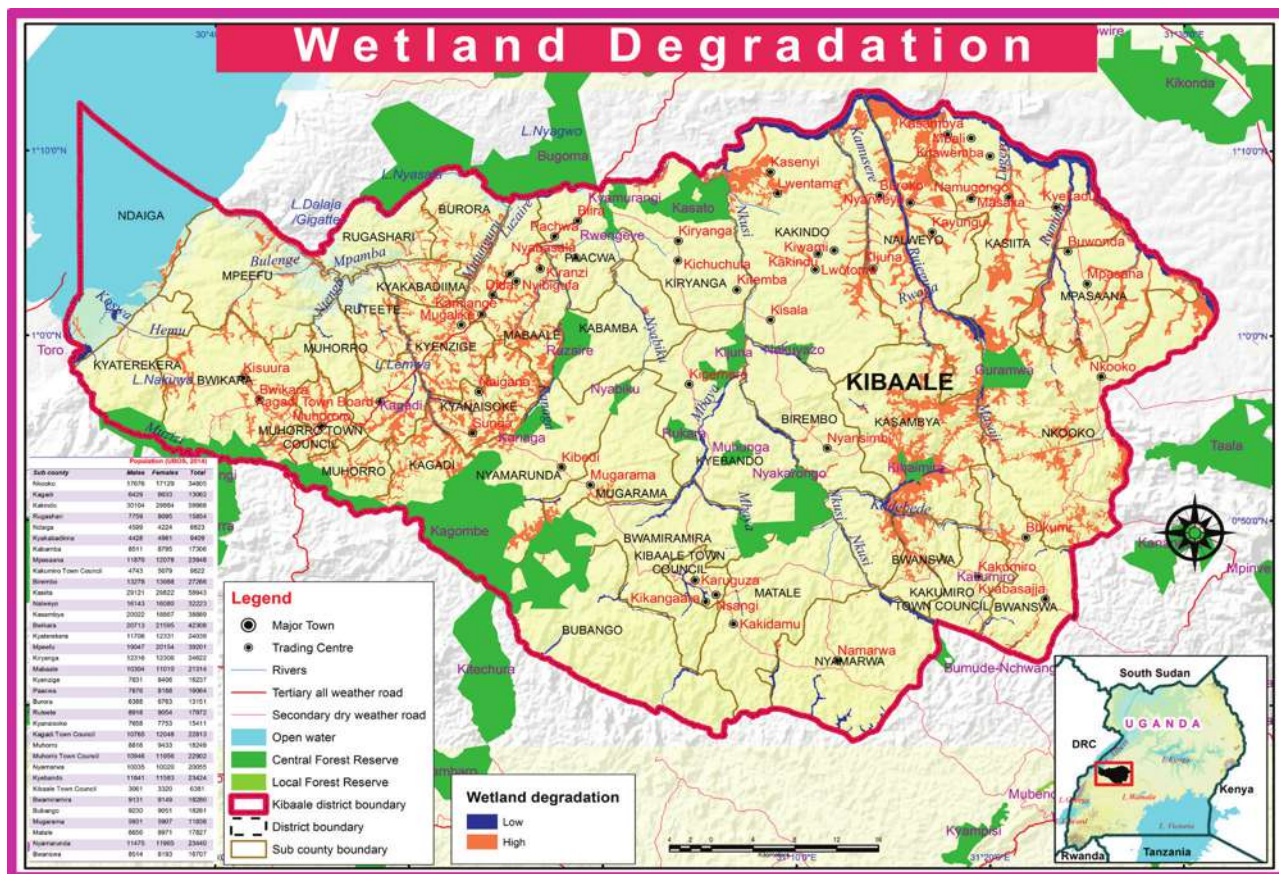
Figure 4: Wetland degradation

3.2.6 Land conflicts

Land conflicts have now become rampant in the district for the last 5 years. Most of the land in the district is owned by absentee landlords under mailo land tenure system including unregistered customary ownership with an increasing number of leaseholds and freeholds. The conflicts are between the people and government, communities and cultural institutions and vice versa.

The land conflicts in the district are fuelled by unclear ownership of wetlands, population pressure (uncontrolled migration), customary land ownership, overlapping land policies, ignorance, unclear administrative and protected area boundaries, absent land lords, land grabbing, unequal distribution of land in families and untitled land. The conflicts are associated with prolonged court cases, displacement of people and low crop and livestock production among others. The land conflicts are more frequent in the populated sub counties in the district. The households are vulnerable to the frequent occurrence of land conflicts due to land ownership rights, land grabbers, unplanned settlements and lack of clear boundaries with the neighbours.

The conflicts have resulted into the migration of people to the neighbouring sub counties and other districts, under development, loss of human life and livestock; and loss of property and income due to court cases. Furthermore, the tenure arrangements are associated with over exploitation by several implemented land use options such as overgrazing, bush burning and land fragmentation on the allocated piece of land. The eventualities are more severe in all the sub counties (figure 5).
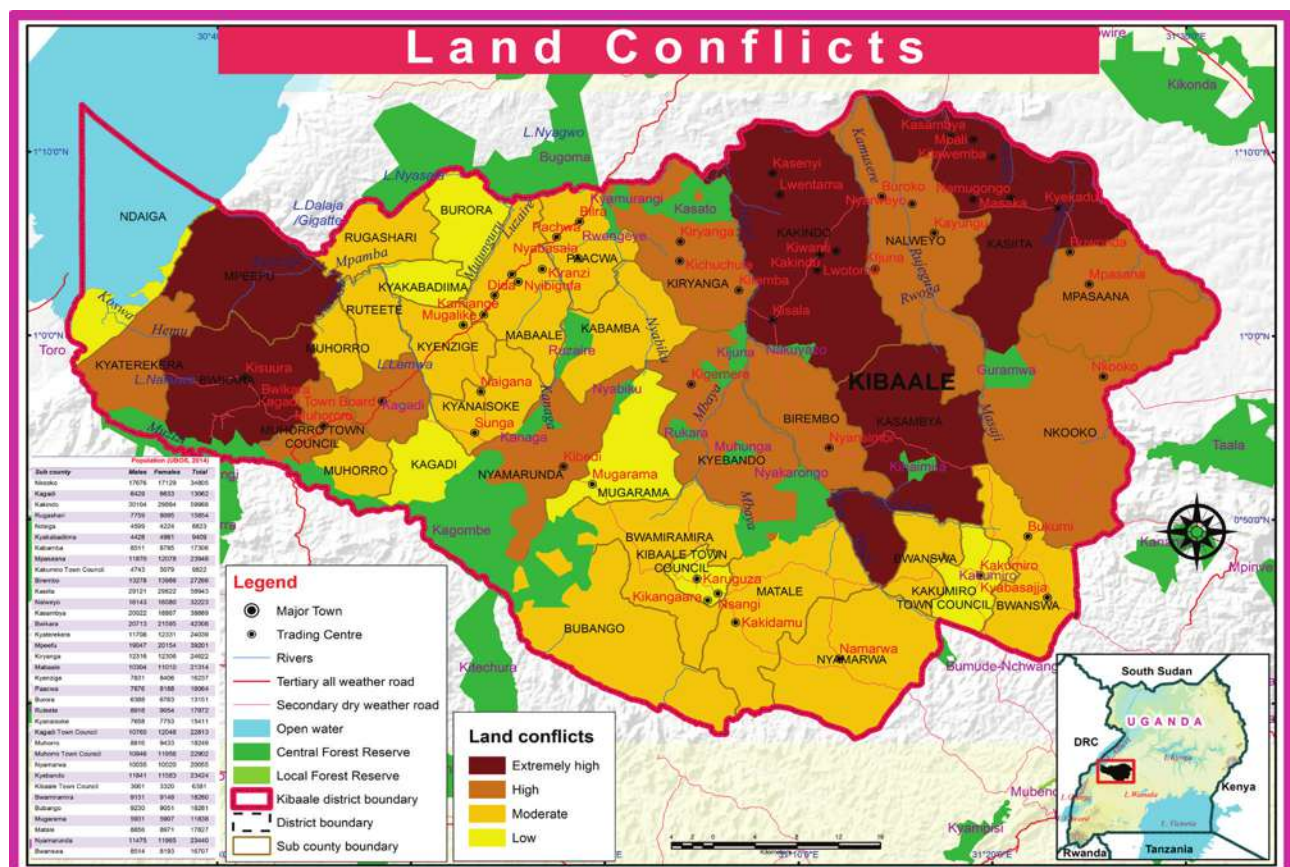

Figure 5: Land conflicts

3.2.7   Bush fires

The occurrence and frequency of fires is seasonal in the district. The fires are started by majorly the cattle keepers to break the cycle of parasites and facilitate pasture regeneration as perceived and farmers during opening of gardens. Some of the fires are attributed to poverty, ignorance, charcoal burning, poor farming methods, crude honey harvesting methods, hunting and land conflicts (Plate 5)

Plate 5: Bush burning at Kisiita Sub County

Bush burning is associated with the clearance of vegetation, conversion of wood into charcoal, destruction of crops and property. The bush fire incidences are rampant during the dry season (December-March and July-September). Vulnerability to the fires is due to the rampant land conflicts, drought, livestock production and inadequate enforcement of conservation policies.

The secondary effects of unmonitored fires include loss of property, loss of human life and livestock, low crop yields, migration of animals, displacement of people, soil degradation and loss of biodiversity. Severe fire incidents have been recorded in all the sub counties.

3.2.8   Soil erosion

The soil erosion has affected the integrity of farmlands, wetlands and water sources in the district. The main soil erosion types common in the district include rill, gulley and sheet erosion. Soil erosion is principally triggered by poor farming methods, over grazing, deforestation, poor land use planning, poor maintenance of roads and intensive rainfall events.

The occurrence of soil erosion is associated with the washing away of top soil, siltation of water sources and destruction of infrastructure including roads and bridges.   The events are common and widespread during the rainy season. The famers are vulnerable to the severity of soil erosion due to poor farming methods, and land shortage which lead to cultivation of steep slopes and low lying flood prone areas.

The adverse effects of soil erosion experienced in the district include: low crop yields, low income levels, land abandonment, reduction in the quality and quantity of surface water sources, high costs of transport, increased incidences of pests, parasites and diseases, loss of landscape beauty, land conflicts, introduction of new invasive species and famine. The occurrences and severity of soil erosion mostly affects Rugashari, Matale, Bwanswa, Kakindo , Kasambya, Bwamiramira, Bubango sub counties in the district (figure 6).
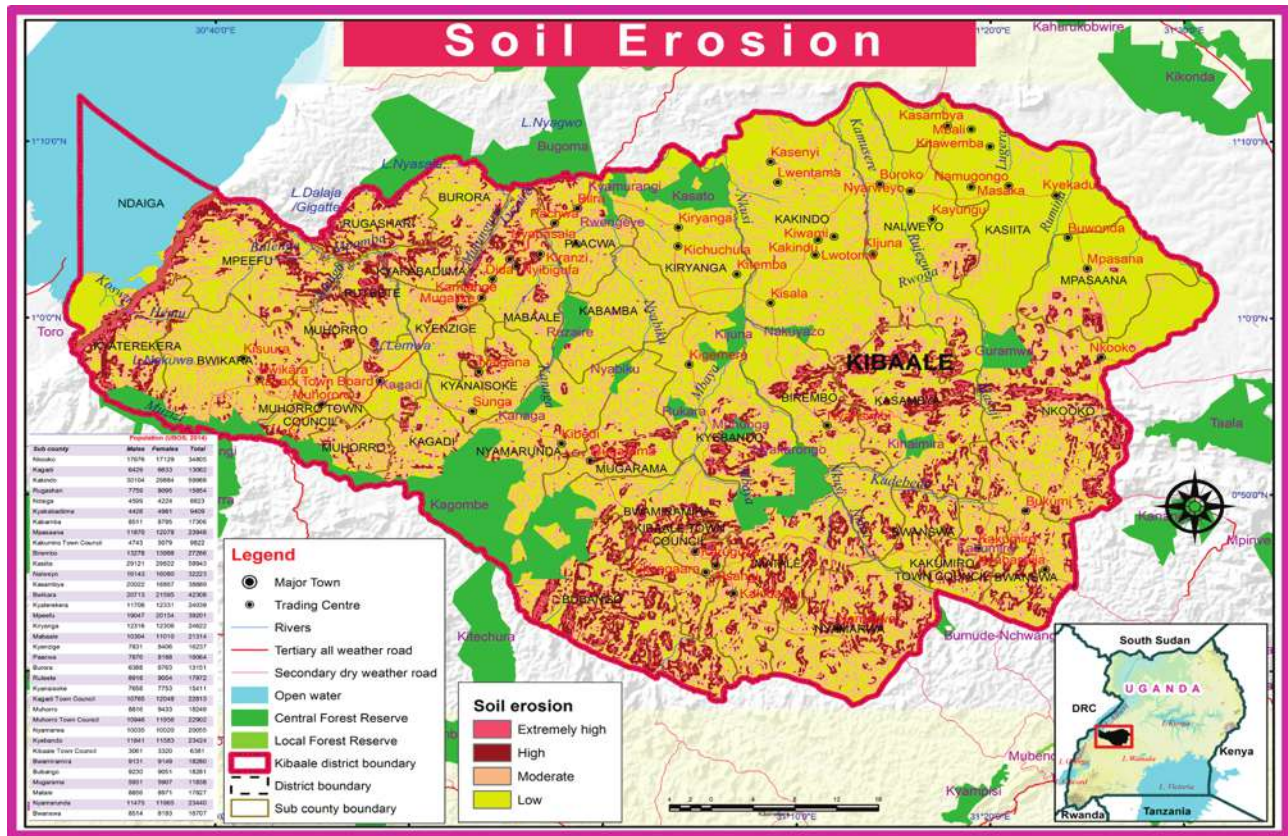
Figure 6: Soil erosion risk map

3.2.9   Flash floods

Greater Kibaale district experiences flash floods that destroy several acres of crops and properties. In addition to erratic/heavy rainfall, wetland degradation, poor drainage and farming methods, siltation, unplanned settlement, deforestation and political pronouncements are the major causes of flash floods in the district. The district experiences a bi-model type of rainfall pattern. The floods occur in the months of April-May and September-November of each year. The rainfall patterns are largely influenced by neutral conditions of sea surface temperatures in the eastern and central equatorial Pacific Ocean, and the warming of sea surface temperatures in the western sector of equatorial Indian Ocean.

The wetlands are degraded in search of cultivable fields for crop growing and establish settlements. In their happening, the wetland vegetation is cut down resulting into less absorption of excess water. The cultivation is responsible for the blockage of stream channels that cause excess water to inundate. In addition, the nature of clay soil type which exhibits hard soil structure does not easily allow runoff water to percolate resulting into stagnation of water.

The characteristics of flash floods is associated with water logging of crop fields, increment in water borne diseases (malaria, typhoid, cholera etc), submergence of roads and houses etc. However,

seasonal predictions show that the district has a high chance of receiving near normal rains. The factors that contribute to the vulnerability of households include: ignorance, sub-standard agro inputs, and weak enforcement of wetland policies among others.

The adverse effects of flash floods include a reduction in household income levels, low crop yields, increased prices of staple foods, illness, destruction of water sources, displacement of families, destruction of roads, loss of human life, property and livestock. The phenomenon inundates Birembo, Kiasiita, Muhorro, Kyebando, Kasambya, Nalweyo sub counties in the district (figure 7).
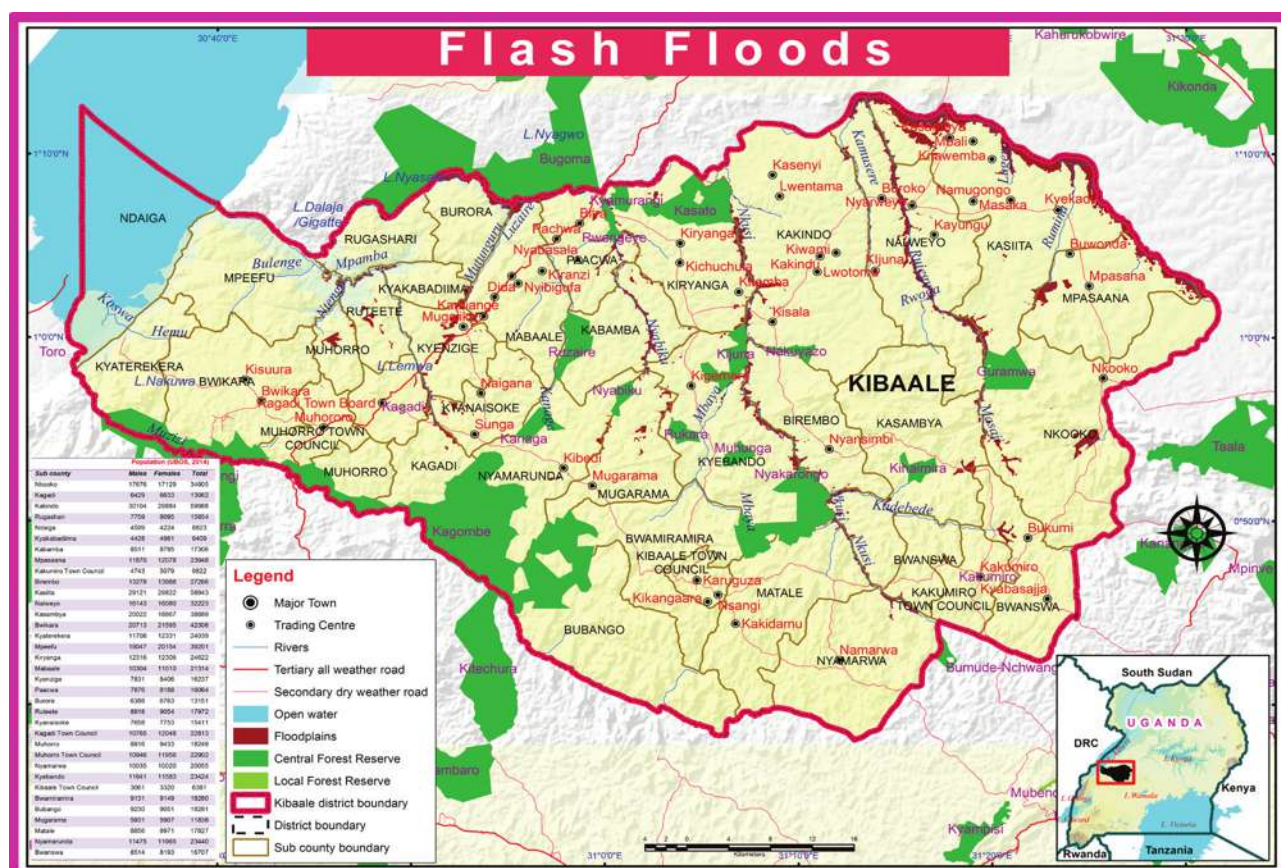
Figure 7: Flood inundation risk map

3.2.10 **Road and water accidents**
Road and water accidents claim a number of lives in the district of recent than before. The prevalence of road accidents are attributed to the driving of cars in dangerous mechanical conditions, reckless driving, negligence, indiscipline, lack of road sign posts, bad weather, overloading, lack of driving documents, livestock grazing in the road reserves, narrow roads, incompetent drivers and over speeding. The road accidents mainly involve pedestrians, cars, bicycles, motorcycles and boats. The water accidents are largely caused by strong winds and flooding in the water bodies especially along Lake Albert.

The road and water accidents are associated with injuries, disabilities and arrests among others. The incidences are more frequent during the festive seasons such as Christmas and Easter, election days and at the start and closure of schools. The factors that contributed to the vulnerability of households to road accidents are; weak enforcement of traffic laws, poor road network and establishment of road markets among others.

The notable effects of road and water accidents include: loss of human life and livestock, illness, disabilities, loss of property and documentation, reduction in crop and livestock production and loss of income in compensations. The accident incidents have been recorded in all the sub counties throughout the year (figure 8).

Figure 8: Road accidents risk map

3.2.11 Hailstorms

The occurrence and severity of hailstorms are a frequent phenomenon in Greater Kibaale District. The hailstones fall during heavy downpour and these take a period of about 10-30minutes. The frequency and distribution of hailstorms is primarily caused by changes in the onset of rainy seasons especially after prolonged dry spells, erratic rains and deforestation. Hailstorms are associated with vegetation, crop and property destructions. In addition to increasing surface rainfall runoff, they also clog water channels. The hailstorms are severely predicted to occur during the second rainy season. The deforestation activities have increased the magnitude of severity especially in farmlands and homesteads. The trees are cut down to acquire timber for brick making and construction including farmland.

The famers are vulnerable to the effects of hailstorms due to the massive clearance of trees, limited availability of tree seedlings, unreliable seasonal weather forecasts and limited agro input among others.

The adverse effects of hailstorms include destruction of property, low household income levels, loss of district revenue, food shortages, loss of human life and livestock. Severe episodes have been reported in Kakindo, Kasambya, Bwikara, Muhorro, Birembo, Burora, Kyenzige and Bubango sub counties (figure 9).
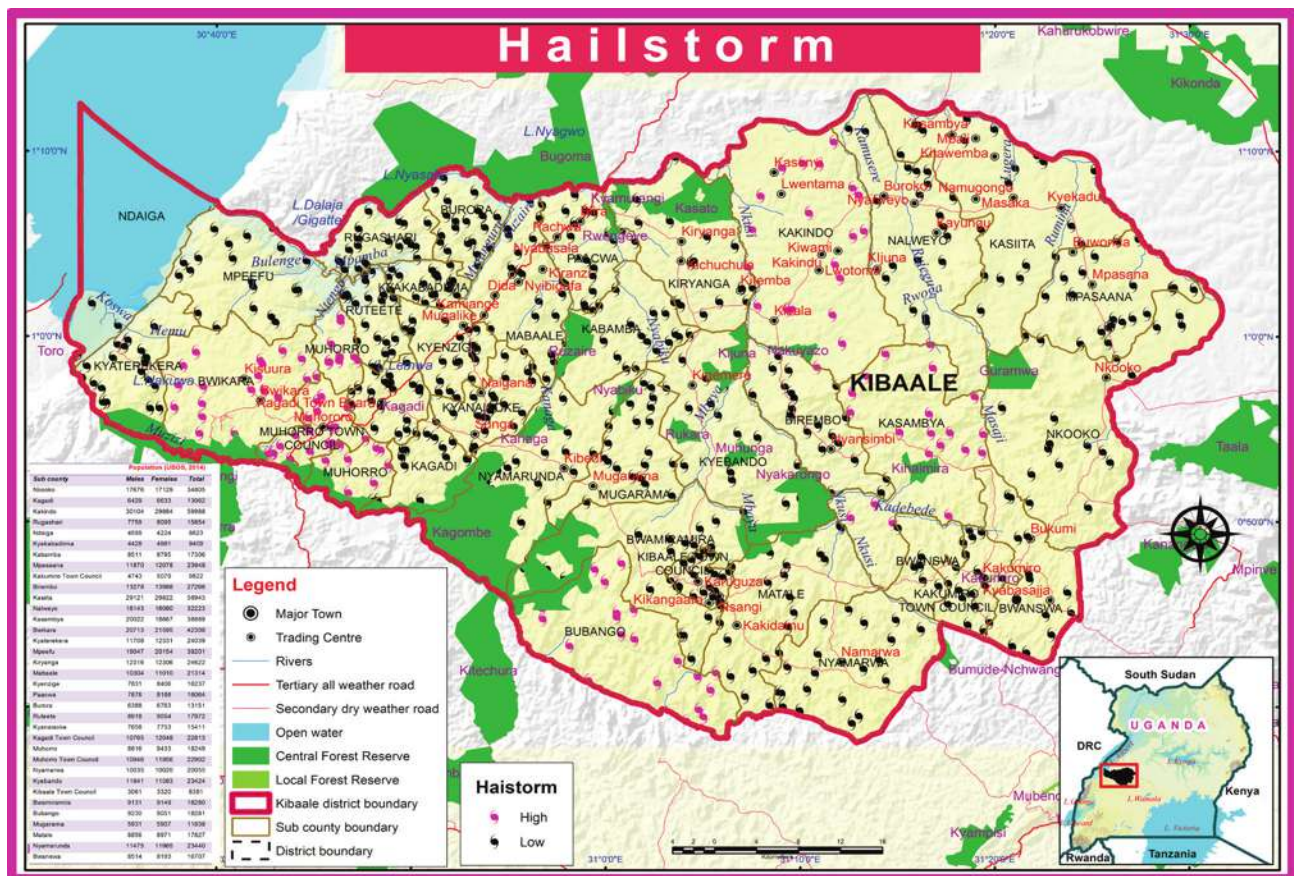
Figure 9: Hailstorms risk map

3.2.12 **Invasive species**

The occurrence of invasive species in the district is twofold: those that are land and water based. The invasions on land are mainly in farmlands while the water based can be seen on the lakes, ponds and wetlands. The frequency and severity of invasive species are sometimes determined by both natural and anthropogenic factors. In particular, the invasive species on land have evaded the district purely because of changes in weather patterns, reduced soil fertility, poor farming methods, soil erosion, animal movements, wetland degradation, high seed multiplication and dispersion by wind. Some of the notable species include Acacia, cassia Lantana Camara, and water hythenes among others. On water, the species are spread by strong winds, boat movements, wetland degradation, fishing activities, high seed multiplication and siltation of Lake Albert.

The occurrence of land based species is associated with stunted crop growth, crop failure, frequent weeding, poor yields and land abandonment. The water species are characterised with slow boat movement, migration of fish stocks, high transport costs and water pollution among others. The invasions are high during the rainy season due to the increase in the plant water content that facilitates their high growth.

The adverse effects of land based species include loss of biodiversity, loss of livestock, low income levels, poor crop yields and encroachment of public land among others. On the other hand in water, the species cause illness, loss of biodiversity, depletion of fish stocks, high transport costs and malnutrition among others. The invasion of both alien species is common in all the sub counties (figure 10).

Figure 10: Invasive species risk map

3.2.13 Lightning

Uganda has one of the highest rates of lightning strike deaths in the world. The incidences are attributed to changes in climate and weather patterns, construction of houses on high grounds, and loss of natural tree cover due to deforestation activities. In particular, the Lightning incidences are influenced by the unusual serge of the moist air from the Atlantic Ocean and Congo air-mass that occur during the rainy seasons.

The thunderbolt incidences are associated with the destruction of crops and vegetation, loss of life in human and livestock, heavy downpour and hailstorms. The incidences normally occur at the onset of the rainy season. These are frequent in the months of April-May and September-December of every year. The increase in vulnerability to Lightning cases is attributed to deforestation, degradation of hills and shift in seasons.

The strikes have resulted into the loss of household income, loss of property and drought. Severe cases have been recorded in Rugashari, Muhorro and Nyamarwa sub counties in the District.

Plate 6: Lightning strike
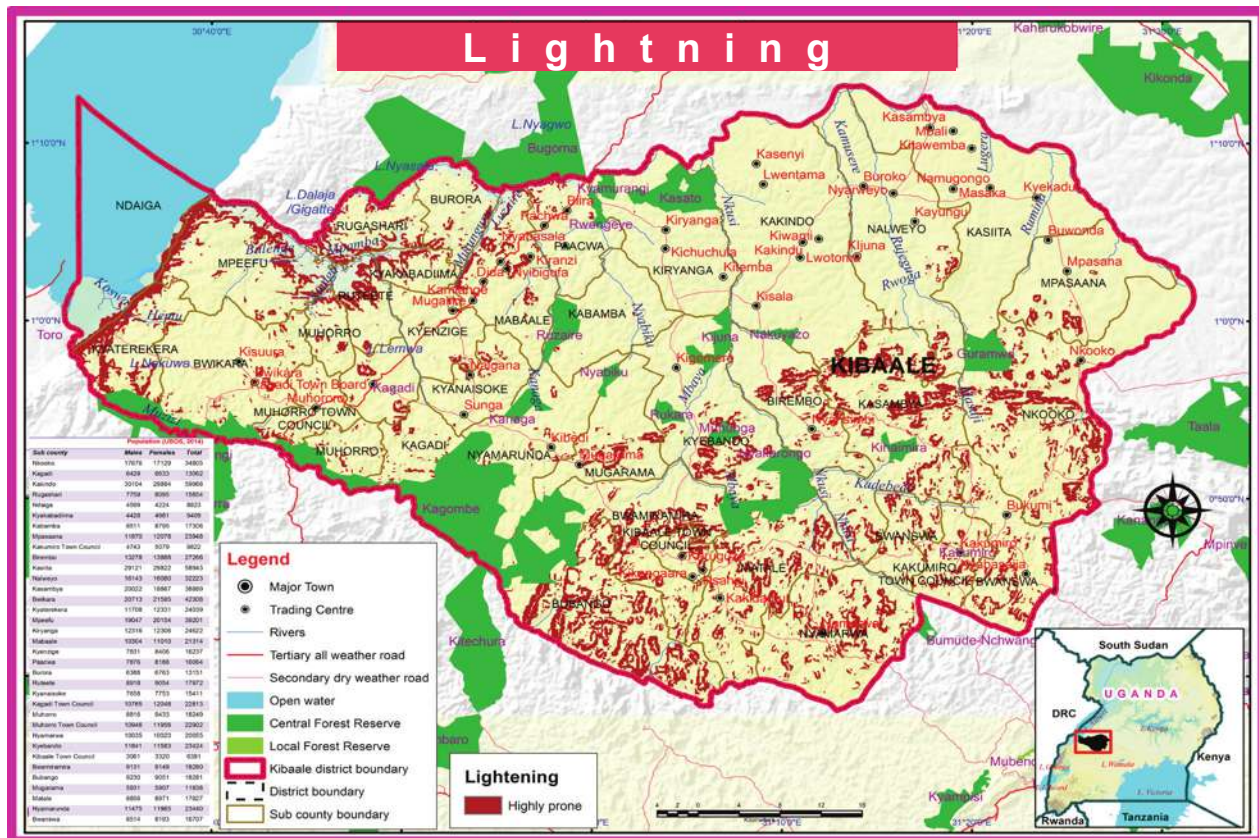
Figure 11: Lightning risk map

3.3 Multi-hazard adaptation responses

According to the key informant interviews and FGDs, indicated here below are responses undertaken by the communities to adapt to the multi-hazards.

Table 4: Multi-Hazard adaptation responses

No	Multi-Hazards	Adaptation Reponses	Recommendations
1	Deforestation	• Re-afforestation • Farmer managed natural regeneration • Agro forestry • Bi-laws enforcement on bush burning • Sensitization	• Bi-laws enforcement • Promote indigenous tree planting • Promote land use planning • Evicting people from forests reserves • Resettling foreigners who encroach on forests for settlements • Sensitizations and training • Funding the natural resource department
2	Pests/parasites and Diseases	• Planting clean seeds and seedlings • Spraying • Vaccination • Treatment • Planting resistant species • Sensitization	• More research on resistant varieties • Strengthen the drug authority inspections • Recruitment of extension workers • Subsidizing agricultural inputs • Provision of resistant varieties • Increase sensitization on control measures • More funds to the natural resource department
3	Drought	• Irrigation innovations • Water harvesting • Reduce Wetland encroachment • Planting drought resistant crops • Diversification of production • Early planting • Sensitization and training • Food preservation and storage • Planting quick maturing crops • Planting pests, parasites and diseases resistant varieties	• Establish improved irrigation technologies • Provision of tree seedlings and quick maturing seeds • Construction of valley dams • Make disaster preparedness system functional at a district level • Provision of resistant varieties • Put up early warning systems at a district level • Demarcation of wetlands
4	Wetland degradation	• Sensitization and training • Eviction of encroachers • Wetland gazetting and demarcations • Law enforcement	• More funds to the natural resource department • Strict enforcement of wetland laws • Gazetting and demarcation of wetlands • Evicting people from wetlands • Cancellation of land titles in wetlands • Wetland recovery and restoration
5	Land Conflicts	• Law enforcement through courts like Clan, LC's, magistrate courts • Sensitization • Training the land committee • Land registration	• Cancellation of land titles in wetlands and forest reserves • Subsidization of the land registration • Resettling people in the extremes of wetlands • Increase the land fund • More sensitization on document acquisition
6	Bush fires	• Sensitization • Watch guards • Fire breaks • Fire lines	• Revising the bush burning act • Increased sensitization and training • Need for more extension workers • Bi-law enforcement

7	Soil erosion	• Tree planting • Sensitization and training • Reduced encroachment of wetlands • Growing of cover crops • Soil and water conservation structures • Mulching • Terracing • Minimal use of fertilizers • Minimum tillage • Reduced bush burning • Restoration of excavated sites	• Sensitization of the farmers on proper farming methods • Training farmers on soil management • Funding the natural resource department • Recruitment of more extension workers • Encourage the use of fertilizers • Re afforestation • Enforcement of by-laws • Encourage crop rotations • Promote farm planning
8	Floods	• Sensitization on wetland usage • Eviction of illegal Wetland users • Ensure planned Migration • Wetlands demarcation • Promote afforestation/reforestation • Develop and use wetland management plans	• Sensitization on wetland degradation • Funding the natural resource department • Gazetting and demarcation of wetlands • Disseminate timely metrological weather forecasts • Eviction of encroachers • Enforce settlement policy • Enforce environment and natural resources laws and regulations • Promote and implement physical planning act 2010
9	Road and water accidents	• Installation of road signs • Installation of humps • Community policing • Sensitization • Road maintenance • Law enforcement by traffic officers	• Enforce driving permit acquisitions • Frequent maintenance and widening of roads • Sensitization on the road safety and use • Road signs installations • Construction of better roads
10	Hailstorms	• Provision of physical relief • Provision of early maturing planting materials • Promote afforestation • Provision of early warning information	• Strengthening the metrological department for early detection and mitigation • Need for disaster preparedness committee at district and sub-county level • Provision of planting materials • Sufficient food aid
11	Invasive species	• Selective weeding • Sensitization • Optimum stocking rates • Uprooting • Burning	• More research on invasive species • More sensitization and training on the control • Observe phytosanitary regulations
12	Lightning	• Tree planting • Sensitization • Installation of Lightning arrestors • Provision of early warning information	• Enforced installation of Lightning arrestors • Enforcing tree planting • More sensitization on Lightning • Subsidization of Lightning arrestors • Take precautionary measures

CHAPTER FOUR

Elements at Risk and Vulnerability assessment

4.1 Risk assessment

This table presents relative risk for hazards to which the communities attached probability and severity scores.

Table 5: Risk assessment of multi-hazards for Greater Kibaale District

	PROBABILITY	SEVERITY OF IMPACTS	RELATIVE RISK	VULNERABLE SUB COUNTIES
	Relative likelihood this will occur	*Overall Impact (Average)*	*Probability x Impact Severity*	
Multi-hazard	*1 = Not occur 2 = Doubtful 3 = Possible 4 = Probable = Inevitable*	*1 = Very Low 2= Low 3= Moderate 4 = High 5= Very High*	*1-10 = Low 11-20=Moderate 21-25= High*	
Floods/ Runoffs	3	4	12	Birembo, Kisiita, Muhorro, Kyebando, Kasambya, Nalweyo
Droughts	5	5	25	Nkooko , Mpasaana, Kisiita, Mpeefu
Hail storms	3	4	12	Kakindo, Kasambya, Bwikara, Muhorro, Birembo, Bubango,
Lightning	2	4	8	Rugashari, Muhorro, Nyamarwa
Pests, parasites and diseases	5	5	25	Nkooko, Kagadi, Kakindo Rugashari, Ndaiga, Kyakabadiima, Kabamba, Mpasaana, Kakumiro Town Council, Birembo, Kasiita, Nalweyo, Kasambya, Bwikara, Kyaterekera, Mpeefu, Kiryanga, Mabaale, Kyenzige, Paacwa, Burora, Ruteete, Kyanaisoke, Kagadi Town Council, Muhorro, Muhorro Town Council, Nyamarwa, Kyebando, Kibaale Town Council, Bwamiramira, Bubango, Mugarama, Matale, Nyamarunda, Bwanswa
Land conflicts	4	5	20	Nkooko, Kagadi, Kakindo Rugashari, Ndaiga, Kyakabadiima, Kabamba, Mpasaana, Kakumiro Town Council, Birembo, Kasiita, Nalweyo, Kasambya, Bwikara, Kyaterekera, Mpeefu, Kiryanga, Mabaale, Kyenzige, Paacwa, Burora, Ruteete, Kyanaisoke, Kagadi Town Council, Muhorro, Muhorro Town Council, Nyamarwa, Kyebando, Kibaale Town Council, Bwamiramira, Bubango, Mugarama, Matale, Nyamarunda, Bwanswa
Invasive species	3	4	10	Nkooko, Kagadi, Kakindo Rugashari, Ndaiga, Kyakabadiima, Kabamba, Mpasaana, Kakumiro Town Council, Birembo, Kasiita, Nalweyo, Kasambya, Bwikara, Kyaterekera, Mpeefu, Kiryanga, Mabaale, Kyenzige, Paacwa, Burora, Ruteete, Kyanaisoke, Kagadi Town Council, Muhorro, Muhorro Town Council, Nyamarwa, Kyebando, Kibaale Town Council, Bwamiramira, Bubango, Mugarama, Matale, Nyamarunda, Bwanswa

Road, water accidents	3	5	15	Nkooko, Kagadi, Kakindo Rugashari, Ndaiga, Kyakabadiima, Kabamba, Mpasaana, Kakumiro Town Council, Birembo, Kasiita, Nalweyo, Kasambya, Bwikara, Kyaterekera, Mpeefu, Kiryanga, Mabaale, Kyenzige, Paacwa, Burora, Ruteete, Kyanaisoke, Kagadi Town Council, Muhorro, Muhorro Town Council, Nyamarwa, Kyebando, Kibaale Town Council, Bwamiramira, Bubango, Mugarama, Matale, Nyamarunda, Bwanswa
Soil erosion	4	4	16	Rugashari, , Kasambya, Bwamiramira, Bubango, Birembo
Bush fire	4	4	16	Nkooko , Mpasaana, Kiasiita, Mpeefu
Wetland degradation	4	5	20	Rugashari, , Kasambya, Bwamiramira, Bubango, Mpeefu, Kissita, Nalweyo, Kakindo, Burora, Mabaale, Kabamba
Deforestation	5	5	20	Nkooko, Mpasaana, Kisiita, Nkooko, Kagadi, Kakindo Rugashari, Ndaiga, Kyakabadiima, Kabamba, Mpasaana, Kakumiro Town Council, Birembo, Kasiita, Nalweyo, Kasambya, Bwikara, Kyaterekera, Mpeefu, Kiryanga, Mabaale, Kyenzige, Paacwa, Burora, Ruteete, Kyanaisoke, Kagadi Town Council, Muhorro, Muhorro Town Council, Nyamarwa, Kyebando, Kibaale Town Council, Bwamiramira, Bubango, Mugarama, Matale, Nyamarunda, Bwanswa

Key for Relative Risk

	High
	Moderate
	Low

4.2 Occurrence and frequency of multi-hazards

The table below shows the years in record and recurrence intervals of multi-hazards reported by the respondents in the district (table 6).

Table 6: Frequency of multi-hazards

No	Multi-hazard	Number of Events (last 30 years)	No. years in record	Recurrence Interval per year (months/ seasons)	Hazard Frequency (%) Chance/year
1	pests, parasites and diseases	30	1986-2016	12	40
2	Drought	3	2011,2012,2016	2	66.6
3	Hailstorms	10	2000-2016	2	20
4	Bush fires	30	1986-2016	2	13.3
5	Invasive species	10	2000-2016	12	120
6	Wetland degradation	15	2001-2016	12	80
7	Soil erosion	30	1986-2016	2	13.3
9	Land conflicts	30	1986-2016	12	40
10	Lightning	2	2013,2014	2	100
11	Water, Road accidents	10	2006-2016	12	120
12	Deforestation	30	1986-2016	12	40
	Water logging/floods	4	2011,2012,2015,2016	2	50

4.3 Elements at Risk and Vulnerability assessment

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 for Greater Kibaale district was assessed based on exposure, susceptibility and adaptive capacity at sub county and district levels highlighting their sensitivity to multi-hazards. 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.

The assessment reveals that geomorphological and geological hazards in form of soil erosion; climatological or hydro-meteorological in the forms of hailstorms, drought, Lightning and strong winds; ecological or biological hazards in the form of pests, parasites and diseases, and invasive species; technological hazards in the form of road and water accidents and environmental hazards in the form of wetland degradation, deforestation, bush burning and land conflicts predispose the community to high vulnerability state in the Greater Kibaale district (table 7).

Table 7: Components of vulnerability in Greater Kibaale District

Vulnerability Components	Exposure	-	Susceptibility		-	Resilience	
	Hazards	Elements at risk	Geographical Scale	Potential impacts	Geographical Scale	Coping strategies	Geographical Scale
	Land conflicts	• Human population • Crops • Livestock • infrastructures like buildings, fences	Sub county	• Loss of property • Displacement of people • Retards developments • Loss of life	Sub county	• Sensitise people on land developments and land use • Clearly demarcating and defining land owner ship • Court • Acquiring land titles	District
	Invasive species	• Crops • Livestock • Human population	District	• Interfere with water transport. • Loss crop yields • reduced livestock production • Poisonous to human population and livestock	District	• Destruction of weeds through uprooting, burning and slashing	District
	Soil erosion	• Human population • Crops • livestock	District	• Stunted crop growth • Reduced yields • Poor crop production • Siltation of water bodies • Decreased biodiversity • Decrease in soil fertility • Reduced water quality • Destruction of property • Reduced livestock production and productivity	District	• Tree planting • Sensitization • Soil and water conservation i.e. bridges, trenches, mulching, cover crops, bunds, terraces • Optimum livestock stocking • Promote agroforestry • Restoration of excavated places	District
Social components	pests, parasites and diseases	• Human and livestock populations • Crops	District	• Loss of livestock and humans • Reduced livestock productivity • Complete crop failure • Stunted growth of crops • Abandoning farms e.g. coffee farms	District	• Vaccination • Spraying • Sensitization • Crop rotation • Planting disease resistant crops • Quarantine • Mosquito nets • Destruction of effected crops, alternative hosts & animals • Alternative income sources • Crop rotation	District
	Hail storms	• Human and livestock populations • Crops	District	• Complete crop failure • Stunted growth of crops • Destruction of houses • Destruction of animals	District		District

Hazard	Elements at risk	Level	Effects	Level	Interventions	Level
Wetland degradation	• Lakes • Crops • Human population	District	• Flooding • Drying of water sources • climatic change • Diseases • Loss of water quality and quantity • Loss of grazing grounds • Conflicts on water water	District	• Sensitisation through radios • Enforcement of wetland laws • Demarcation of wetlands • Prosecuting culprits to Court • Wetland management committee • Eviction	District
Water, Road accidents	• Human and livestock populations	District	• Human deaths • Disabilities after injuries	District	• Regular guidance by traffic officers • Construction of humps and road signs • Reflector jackets, seat belts and helmets • Spot checks for alcoholism • Construction of good roads and proper maintainance	District
Drought	• Human and livestock populations • Crops	Sub county	• Reduced crop and animal production • Theft of food • Promiscuity	Sub county	• Drought resistant crops • Storage of food • Sensitization • Regulated farming in wetlands • Water harvesting • Reduced food ratios, one meal per day • Theft • Transactional sex • Labour for food • Migration	District
Deforestation	• Human and livestock populations • crops	District	• Loss of water quality and quantity • Climatic weather changes • Loss of fire wood • Decreased crops and livestock production and productivity • Loss of timber	Sub county	• Tree planting • Use alternative sources of fuel like bio gas • Use of energy saving stoves • Awareness • Promote agroforestry	Sub county
Lightning	• Human and livestock populations • Crops • Infrastructure including homes, schools and hospitals • Natural vegetation including trees	Sub county	• Tension • Loss of human life, animals • Destruction of crops	Sub county	• Install Lightning conductors • Planting specific tree species	District

Hazard	Elements at risk	Level	Effects	Level	Interventions	Level
Water logging/ floods	• Crops • Human Population • animals	Sub county	• Diseases • Stunted growth of crops • Reduced animal production • Famine • Death	Sub county	• Sensitization • Demarcation of wetlands • Law enforcement	District
Bush fires	• Crops • Animals • Human beings	Sub county	• Soil erosion and its effect	Sub county	• Fire lines • Law enforcement • sensitization	Sub county
Invasive species	• Crops • Livestock • Human beings	District	• Low income in the long run as a result of poor yield and low productivity • High costs of removal • Increased costs of production • Poisonous to livestock and human beings	District	• Destruction of weeds through uprooting, burning and slashing	District
Land conflicts	• Human population • Animals • Infrastructure	Sub county	• Retards personal and community development • High court expenses	Sub county	• Sensitise people on land developments and land use • Clearly demarcating and defining land owner ship • Court	District
Wetland degradation	• Lakes • Crops • Human population • rivers	District	• Loss of income • Loss of government revenue • droughts	District	• Sensitisation through radios • Enforcement of wetland laws • Demarcation of wetlands • Prosecuting culprits to Court • Wetland management committee • Eviction	District
Pests, parasites and diseases	• Human and livestock populations • Crops	District	• Loss of income • Loss of government revenue • Increased expenditure on pesticides and drugs • Low food production	District	• Vaccination • Spraying • Sensitization • Crop rotation • Planting disease resistant crops • Quarantine • Mosquito nets • Abandoning farms e.g. coffee farms • Destruction of effected crops& animals • Alternative income sources • Crop rotation	District

Economic component	Hazard	Elements at risk	Level	Effects	Level	Interventions	Level
	Soil erosion	• Human population • Crops	Sub county	• Loss of income • Loss of government revenue • Low production	Sub county	• Tree planting • Sensitization • Soil and water conservation i.e. bridges, trenches, mulching, bunds, terraces	District
	Hailstorms	• Human and livestock populations • Crops	District	• Loss of income • Loss of government revenue • Low production	District	• Tree planting	District
	Drought	• Human and livestock populations • Crops	Sub county	• Loss of income due to low productivity • Loss of government revenue • Low production • Thefty of food and animals	Sub county	• Drought resistant crops • Storage of food • Sensitization • Regulated farming in wetlands • Water harvesting • Reduced food ratios, one meal per day • Transactional sex • Labour for food • Migration	District
	Water, Road accidents	• Human and animal populations	District	• Loss of lives hence low incomes • Reduced labour	District	• Regular guidance by traffic officers • Construction of humps and road signs • Reflector jackets, seat belts and helmets • Spot checks for alcoholism	District
	Wetland degradation	• Crops • Human and livestock population	District	• Loss of biodiversity • Reduced water quality • Increased incidences of water borne diseases • Increased flooding	District	• Tree planting along the wetland area • Awareness • Demarcation of wet lands	District
	Deforestation	• Human and livestock populations	Sub county	• Loss of water quality and quantity • Climatic weather changes • Loss of fire wood • Decreased crops and livestock production and productivity • Loss of timber	Sub county	• Tree planting • Use alternative sources of fuel like bio gas • Use of energy saving stoves • Awareness • Promote agroforestry	Sub county

Hazard	Elements at risk	Level	Effects	Level	Interventions	Level
Environmental component						
Water logging/ floods	• Crops • Human Population	Sub county	• Diseases • Stunted growth of crops • Reduced production and productivity	Sub county	• Sensitization • Demarcation of wetlands • Law enforcement	Sub county
Bush fires	• Crops • animals	Sub county	• Loss of crops and animals	Sub county	• Fire lines • Awareness • Law enforcement • Sensitization	Sub county
Invasive species	• Crops • Animals and human beings	Sub county	• Loss and stunted growth of crops • Loss of pasture	Sub county	• Destruction of weeds through uprooting, burning and slashing	District
Land conflicts	• Crops • Human and animal population	District	• Destruction of crops	District	• Sensitise people on land developments and land use • Clearly demarcating and defining land owner ship • Arbitration through Courts of law	District
Wetland degradation	• Lakes • Crops • Human population • Rivers	District	• Loss of bio diversity • Drying of water resources • climatic change • increased flooding	District	• Sensitisation through radios • Enforcement of wetland laws • Demarcation of wetlands • Prosecuting culprits to Court • Wetland management committee • Eviction	District
Soil erosion	• Human and animal population • Crops	Sub county	• Loss of vegetation cover including trees and crops • Land degradation • Reduction of soil fertility • Reduced pasture • Reduced beauty	Sub county	• Tree planting • Sensitization • Soil and water conservation i.e. bridges, trenches • Controlled stocking • Promote minimum tillage • Promote agroforestry • Restoration of excavated places	District
Pests, parasites and diseases	• Human and livestock populations • Crops	District	• Loss of crops and animals □	District	• Vaccination • Spraying • Sensitization • Crop rotation • Planting disease resistant crops • Quarantine	District

Hazard	Elements at risk	Level	Effects	Level	Interventions	Level
Hailstorms	• Human and livestock populations • Crops	District	• Loss of vegetation cover including trees, livestock and crops	District	• Tree planting	District
Drought	• Human and livestock populations • Crops	Sub county	• stunted growth of crops • Loss of pasture • Increased chances of fires	Sub county	• Drought resistant crops • Storage of food • Sensitization • Regulated Farming in wetlands • Water harvesting • Reduced food ratios, one meal per day • Transactional sex • Labour for food • Migration	Sub county
Lightning	• Human and livestock populations • Crops • Infrastructure including homes, schools and hospitals • Natural vegetation including trees	Sub county	• Destroy natural vegetation and crops • Destruction of infrastructure	Sub county	• Install Lightning conductors • Planting specific tree species	Sub county
Deforestation	• Human and livestock populations	Sub county	• Loss of water quality and quantity • Climatic weather changes • Decreased crops and livestock production and productivity • Loss of timber • Soil erosion • Increased flooding • Increases strong winds	Sub county	• Tree planting • Use alternative sources of fuel like bio gas • Use of energy saving stoves • Awareness • Promote agroforestry	Sub county
Water logging/ floods	• Crops • Human and animals Population	Sub county	• Stunted growth of crops • Destruction of crops • Spread of water borne diseases	Sub county	• Sensitization • Demarcation of wetlands • Law enforcement	Sub county
Bush fires	• Crops • Human and animals Population	Sub county	• Soil erosion and its effect • Loss of biodiversity • Air pollution	Sub county	• Fire lines • Awareness • Law enforcement • sensitization	Sub county

Hazard	Elements at risk	Level	Effects	Level	Interventions	Level
Physical components						
Invasive species	• Crops • Livestock • Human beings	District	• Low fish production • Harbours snakes and crocodiles • Blocks water transport	District	• Destruction of weeds through uprooting, burning and slashing	District
Pests, parasites and diseases	• Human and livestock populations • Crops	District	• Loss of livestock and humans • Complete crop failure • Stunted growth of crops	District	• Vaccination • Spraying • Sensitization • Crop rotation • Planting disease resistant crops • Quarantine • Mosquito nets • Abandoning farms e.g. coffee farms • Destruction of effected crops& animals • Alternative income sources • Crop rotation	District
Wetland degradation	• Lakes • Crops • Human population	District	• Drying of water sources • Bio diversity destruction • Flooding	District	• Sensitisation through radios • Enforcement of wetland laws • Demarcation of wetlands	District
Soil erosion	• Human and animal population • Crops	District	• Stunted crop growth • Siltation of water bodies • Decreased biodiversity • Destruction of property	District	• Tree planting • Sensitization • Soil and water conservation i.e. bridges, trenches, mulching	District
Water, Road accidents	• Human and livestock populations	District	• Human deaths • Animal death • Disabilities	District	• Regular guidance by traffic officers • Construction of humps and road signs • Reflector jackets, seat belts and helmets • Spot checks for alcoholism • Construction of good roads and proper maintainance	District
Hailstorms	• Human and livestock populations • Crops • infrastructure	Sub county	• Loss of livestock • Complete crop failure • Stunted growth of crops • Loss of human life • Loss of property	Sub county	• Tree planting	Sub county

Hazard	Elements at risk	Level	Effects	Level	Interventions	Level
Land conflicts	• Human population • Crops • Animals	Sub county	• Loss of property • Displacement of people • Loss of human life	Sub county	• Sensitise people on land developments and land use • Clearly demarcating and defining land owner ship • Arbitration through Courts of law • Acquiring land titles	District
Drought	• Human and livestock populations • Crops	Sub county	• Loss of vegetation cover • Lowering of water levels • Death of livestock • Scarcity of water • Proliferation of livestock diseases • Limited pasture • Famine • Reduced income	Sub county	• Drought resistant crops • Storage of food • Sensitization • Farming in wetlands • Water harvesting • Reduced food ratios, one meal per day • Theft • Transactional sex • Labour for food • Migration	District
Lightning	• Human and livestock populations • Crops • Infrastructure including homes, schools and hospitals • Natural vegetation including trees	Sub county	• Death and injury of human and livestock • Destroy properties	Sub county	• Install Lightning conductors • Planting specific tree species	District
Deforestation	• Human and livestock populations	Sub county	• Loss of water quality and quantity • Loss of fire wood • Decreased crops and livestock production and productivity • Loss of timber	Sub county	• Tree planting • Use alternative sources of fuel like bio gas • Use of energy saving stoves • Awareness • Promote agroforestry	Sub county
Water logging/floods	• Crops • Human Population • Animals	Sub county	• Destruction of crops • Destruction of roads • Destruction of property • Loss of human life and animals	Sub county	• Sensitization • Demarcation of wetlands • Law enforcement	District
Bush fires	• Crops • Human Population • Animals • infrastructure	Sub county	• Loss of bio diversity • Destruction of crops • Migration of wildlife • Loss human life and animals • Loss of infrastructure like buildings	Sub county	• Fire lines • Awareness • Awareness • Law enforcement • sensitization	Sub county

Wetland degradation	• Lakes • Crops • Human population • Rivers	District	• Bio diversity destruction • Low arts and crafts production • Conflicts on water s • Floods • Scarcity of water • Poor water quality and pollution	District	• Sensitisation through radios • Enforcement of wetland laws • Demarcation of wetlands • Prosecuting culprits to Court • Wetland management committee • Eviction • Protection of water catchment areas	District

CONCLUSION AND RECOMMENDATION

It was established that Greater Kibaale district has over the last 30 years increasingly experienced multi-hazards including floods, drought, invasive species, strong winds, pests, parasites and diseases for crops and livestock, soil erosion, land conflicts, Lightning, deforestation, bush burning, wetland degradation, road accidents and hailstorms putting livelihoods at increased risk. The limited adaptive capacity (and or/resilience) and high sensitivity of households and communities in Greater Kibaale district increase their vulnerability to multi-hazard exposure necessitating urgent external support.

The multi-hazards that are experienced in Greater Kibaale District can be classified as:
  i.   Geomorphological and geological hazards including; soil erosion

  ii. Climatological or hydro-meteorological including; hailstorms, Lightning, drought and floods

  iii. Ecological or biological hazards including; pests, parasites and diseases and invasive species

  iv. Technological hazards including; road and water accidents

  v.   Environmental hazards including; wetland degradation, deforestation, bush burning and land conflicts

However, reducing vulnerability at community, local government and national levels should be a threefold effort hinged on:
  i.   Reducing the impact of the hazard where possible through; mitigation, prediction, early warning and preparedness

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

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

Recommended policy actions that should target vulnerability reduction include:
  i.   Improved enforcement of policies aimed at enhancing sustainable environmental health;

  ii. Increased awareness campaigns aimed at sensitizing farmers/communities on disaster risk reduction initiatives and practices.

  iii. Revival of disaster risk committees at the district and sub county levels

  iv. Support extensive research on the occurrence and frequency of disasters prior to disaster management

  v.   Improve the communication channel between the disaster department and local communities

  vi. Office of the Prime Minister should decentralize their activities at the district and sub county level

  vii. OPM should strengthen the District Disaster Committees by developing guidelines and trainings

  viii. Establishment of disaster fund at the district levels.

  ix. Fund and equip recruited extension workers.

  x.   Establish a fund aimed at disaster preparedness and management at district levels

  xi. Increase funding and staff to monitor wetland degradation and non-genuine agro-inputs

  xii. Support establishment of a disaster risk early warning systems

xiii. Provide support in form of free seedlings to promote afforestation and reforestation programmes

xiv. Conduct regular monitoring and follow up for compliance and timely implementation

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