THE REPUBLIC OF UGANDA

Nakasongola District

Hazard, Risk and Vulnerability Profile

2016

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ACRONYMS

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

ACKNOWLEDGMENTS

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

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

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

My appreciation also goes to Nakasongola District Team.

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

Hon. Hilary O. Onek
Minister for Relief, Disaster Preparedness and Refugees

DEFINITION OF KEY CONCEPTS

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

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

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

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

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

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

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

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

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

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

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

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

EXECUTIVE SUMMARY

The multi-hazard vulnerability profile outputs from this assessment for the Nakasongola District was a combination of spatial modeling using adaptive, sensitivity and exposure spatial layers 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; preliminary spatial analysis, and hazard prone areas' base maps were generated using Spatial Multi-Criteria Analysis (SMCA) was done in a GIS environment (ArcGIS 10.3).

Stake holder engagements were carried out in close collaboration with OPM's DRM team and the District Disaster Management focal persons with the aim of identifying the various hazards ranging from; drought, floods, landslides, human and animal disease, pests, animal attacks, earthquakes, fires, conflicts etc. Hazard, risk and vulnerability assessment was done using a stack of methods including participatory approaches such as Participatory GIS (PGIS), Focus Group Discussions (FGDs), key informant interviews, transect drives as well as spatial and non-spatial modelling. Key informant interviews and Focus Group Discussions were guided by a checklist (Appendix 1 and 2). Key Informant Interviews for District officers included: Districts Natural Resources Officers, Environment Officers, Wetland Officers, Forest Officers, Production and Marketing Officers, Veterinary Officers, Health Inspectors. At sub-county level Key informants for this assessment included: Sub-county and parish chiefs, community Development mobilizers and health workers.

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.

Ground-truthing and geo-referencing was done using a handheld Spectra precision Global Positioning System (GPS) unit, model: Mobile Mapper 20 set in WGS 1984 Datum. The entities captured included: hazard location, (Sub-county and parish), extent of the hazard, height above sea level, slope position, topography, neighboring land use among others. Hazard hot spots, potential and susceptible areas were classified using a participatory approach on a scale of "not reported/ not prone", "low", "medium" and "high", consistent with the methodology specified in Annex I.

Data analysis and spatial modeling by integrating spatial layers and non-spatial attribute captured from FGDs and KIIs to generate final HRV maps at Sub-county level. 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 the districts were classified as geomorphological or Geological hazards including landslides, rock falls, soil erosion and earth quakes, climatological or Meteorological hazards including floods, drought, hailstorms, strong winds and 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 and human induced or technological hazards including bush fires, road accidents land conflicts.

General findings from the participatory assessment indicated that identifying hazards, risks and vulnerable communities is important in the planning process to know which areas require agent attention to address vulnerability. It was also noted that hazard and disaster management should be mainstreamed with a special policy regarding preparedness at all the levels at the district departments to the lower local governments in order to effectively respond to these hazards. Finally, with these hazards profiled it is possible to approach Development partners to assist in intervening or supporting the district in putting up mitigation measures.

1.0 INTRODUCTION

1.1 Background

Uganda has over the past years experienced frequent disasters that ranges from drought, to floods, landslides, human and animal disease, pests, animal attacks, earthquakes, fires, conflicts and other hazards which in many instances resulted in deaths, property damage and losses of livelihood. With the increasing negative effects of hazards that accompany population growth, development and climate change, public awareness and proactive engagement of the whole spectrum of stakeholders in disaster risk reduction, are becoming critical. The Government of Uganda is shiting the disaster management paradigm from the traditional emergency response focus towards one of prevention and preparedness. Contributing to the evidence base for Disaster and Climate Risk Reduction action, the Government of Uganda is compiling a national risk atlas of hazard, risk and vulnerability conditions in the country to encourage mainstreaming of disaster and climate risk management in development planning and contingency planning at National and local levels.

Since 2013 UNDP has been supporting the Office of the Prime Minister to develop district hazard risk and vulnerability profiles in the sub-regions of Rwenzori, Karamoja, Teso, Lango, Acholi and West Nile covering 42 districts. During the exercise above, local government officials and community members actively participated in the data collection and analysis. The data collected was used to generate hazard risk 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 subcounty level of each district.The analytical approach to identify risk and vulnerability to hazards in the pilot sub-regions visited of Rwenzori andTeso,was improved in subsequent sub-regions.

1.2 Objectives of the study

1.2.1 Main Objective of the study

The main objectives of this study was to develop the District Hazard, Risk and Vulnerability Profiles for Mubende District in mid Central Uganda.

1.2.2 Specific objectives

The study had the following specific objectives

i. Collect and analyse field data generated using GIS in close collaboration and coordination with OPM in the targeted districts;
ii. Develop district specific multi-hazard risk and Vulnerability profiles using a standard methodology;
iii. Preserve the spatial data to enable use of the maps for future information;
iv. Produce age and sex disaggregated data in the HRV maps.

1.3 Scope of work and deliverables

The study had the following scope of work and deliverables that have been achieved by the consultant;

i. Collection of field data using GIS in close collaboration and coordination with OPM in the target districts and quantify them through a participatory approach on a scale of "not reported", "low", "medium" and "high", consistent with the methodology specified in Annex 3;

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

iii. Complete all the district Hazard, Risk and Vulnerability Profiles in the time frame provided;

iv. Submit for printing soft copies of the complete HRV profiles and maps for all the 10 districts by the end of the duration assigned to this activity;

v. Generate and submit shape files for all the districts visited showing disaggregated hazard risk and vulnerability profiles to OPM and UNDP.

1.4 Justification

The government recognizes climate change as a big problem in Uganda. The draft National Climate Change Policy (NCCP) notes that the average temperature in 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."

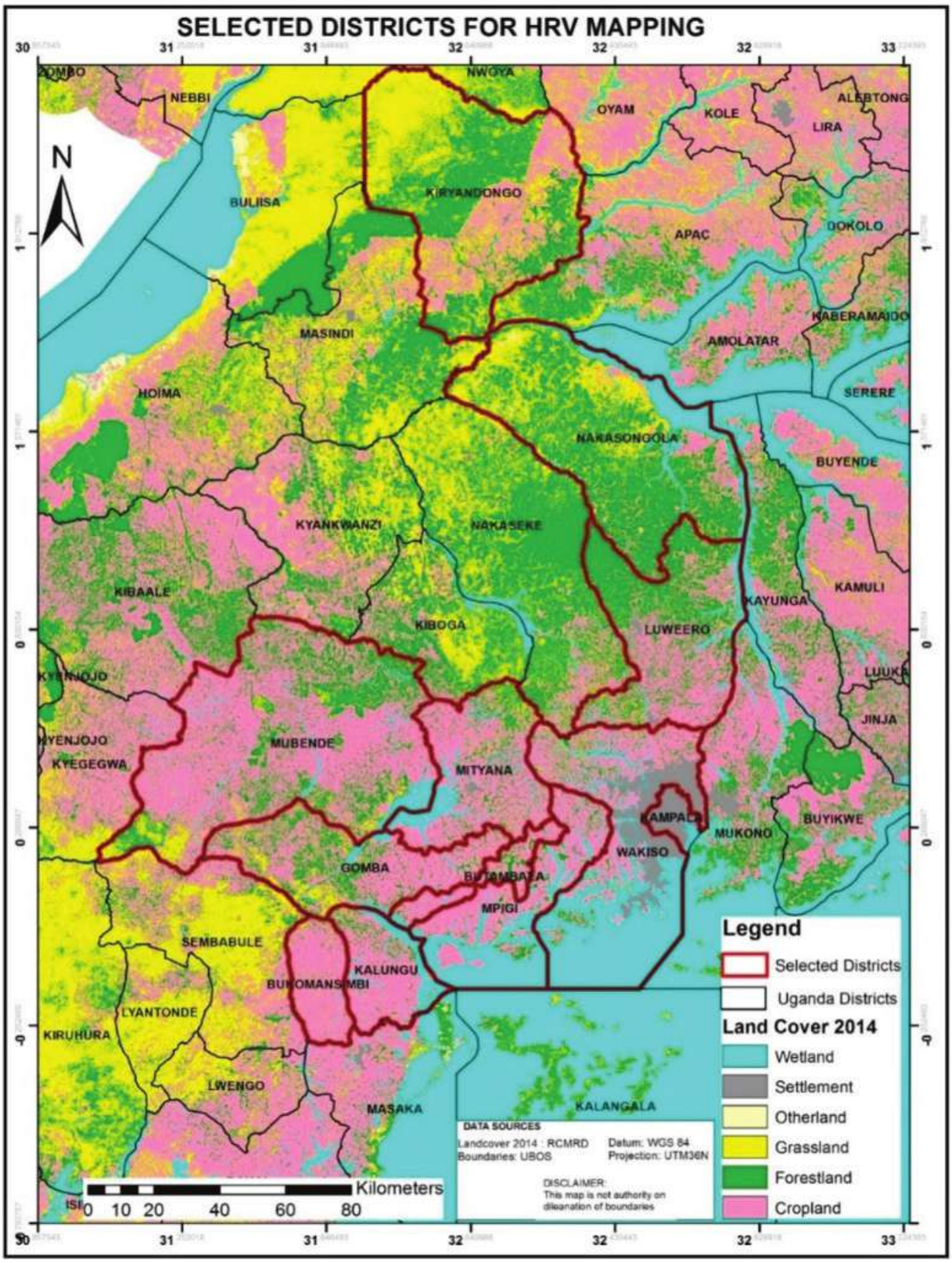

Figure 1: Location of the study area

2.0 OVERVIEW OF NAKASONGOLA DISTRICT

Nakasongola District is a district in the central region of Uganda. The town of Nakasogola is the site of the district's administrative headquarters. Nakasongola District is bordered by Apac district to the northwest, Amolatar district to the northeast, Kayunga district to the east, Luweero district to the south, Nakaseke district to the southwest, and Masindi to the northwest. Nakasongola, the main municipal, administrative, and commercial center of the district, is approximately 140 kilometres (87 miles), by road north of kampala, the capital city of Uganda. The coordinates of the district are 01 18N, 32 30E. Nakasongola suffered from relative neglect due to the distance from the then district headquarters and this became the basis for the creation of Nakasongola District in 1997. The district is composed of three counties, namely: Kyabujingo County, Buluuli County, Budyebo County.

2.1 Geology

The geology of the area generally consists of mobilized and intrusive granites derived from the 'basement complex' rocks. The geomorphology of the area is less complex; the landform is highly subdued. Tanganyika and Acholi surfaces underlie the area. Much of the land is gently to moderately undulating with broad bottom valleys. Some massive granitic rock outcrops occupy areas around the town of Nakasongola.

Lateritic ironstone is frequently found on this Tanganyika surface but is not prominent as on the remnants of the Buganda peneplain. The laterite is frequently overlain by soils and is encountered in pits on the crests and sides of hills. But-on the lower slopes of the pediments the lateritic crust frequently emerges from under the soils and may increase the sensitivity of these areas to heavy runoff and soil loss. In the north, along the shores of Lake Kyoga and the valley of the River Kafu, there are extensive areas of alluvium and a series of terraces.

The soils of the study area belong to the ancient lake sediments overlying the Tanganyika surface and its dissected remnants. A large part of the area is dominated by red ferrallitic soils or plinthic feralsols of sandy loam and sandy clay loam type. The ferrallitic soils have little reserve of weatherable minerals, deep horizons not clearly differentiated and Kaolinite (1:1) as the main clay mineral associated with Fe, and Al oxides. Langlands (1974) categorised them as fair productivity soils, which occupies much of the area described as the cattle corridor. The hydromorphic soils, rich in sodium minerals and belonging to the ancient lake sediments, occur in areas close to Lake Kyoga and River Lugogo low- lying swampy areas. Their texture varies from sandy to loamy type while the pH ranges from acidic to neutral. Soil erodibility is low, and the soils especially in the north-west part of the area are observed to harden on drying. Soil productivity is generally high basing on texture, depth, pH, fertility, drainage, organic matter, workability and water holding. However, nutrients and water are known to constrain crop productivity (Wortmann and Eledu, 1999).

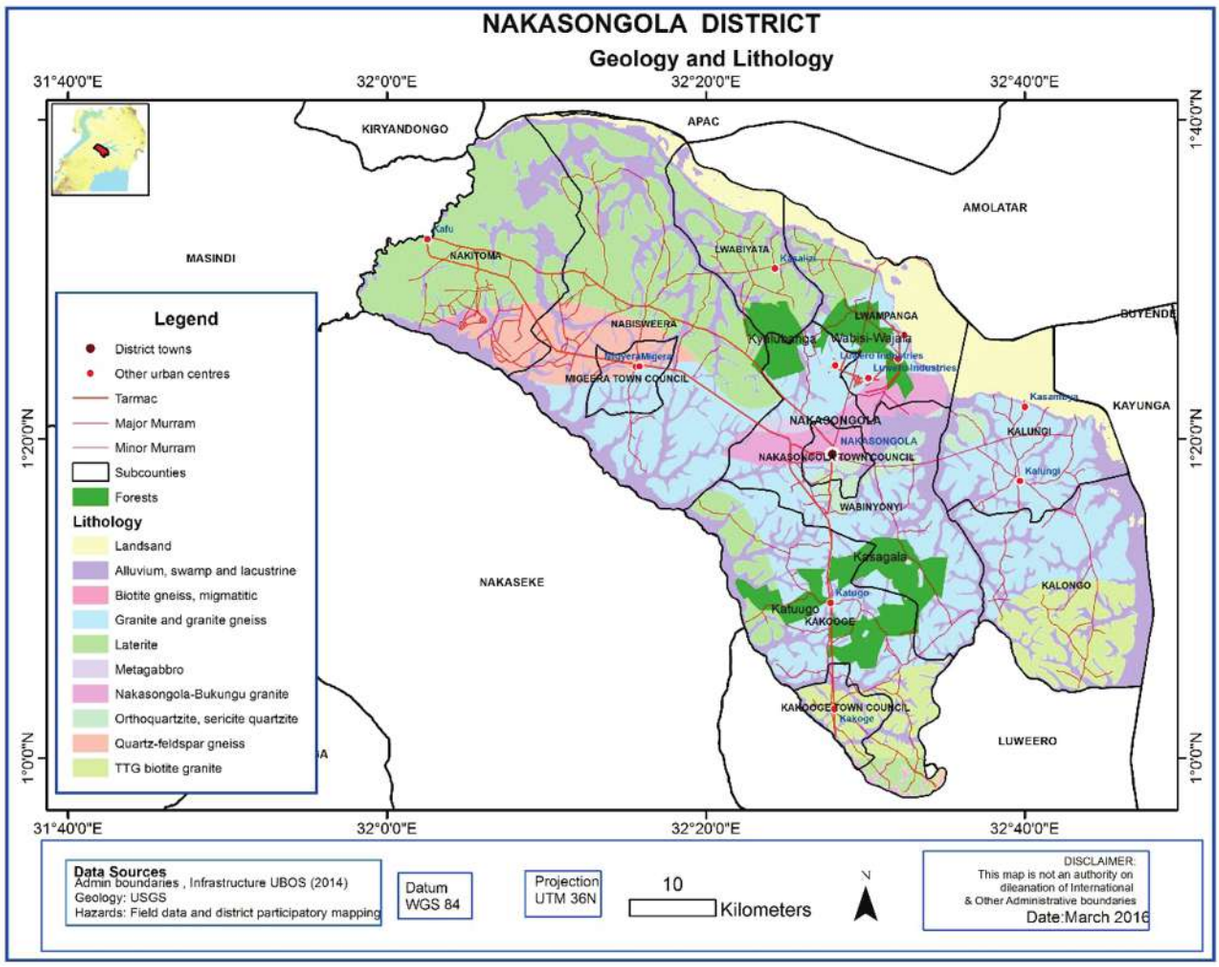

Figure 2 : Geology and lithology of Nakasongola District

2.2 Vegetation and Landuse stratification

The district covers 3,737.6 km^2 square kilometres (1,895 square miles) of which 4.6% is permanent wetland. The dominant vegetation types occupying the hillsides and hilltops include the dry acacia, moist combretum savannahs and moist thickets. The grassland savannahs are also common in open but relatively flat areas. Dominating the broad valley bottoms are the seasonal swamps, which are covered by various grass species. Papyrus swamps are limited to the few permanent swamps occurring on the out skirts of the district but mostly around Lake Kyoga. Very few remnants of woodland forests exist in the area. According to the 1991 Agriculture and Livestock census (UBOS, 2001), the total arable land in Nakasongola was estimated to be about 913 km2 but only 235km2 was under cultivation.

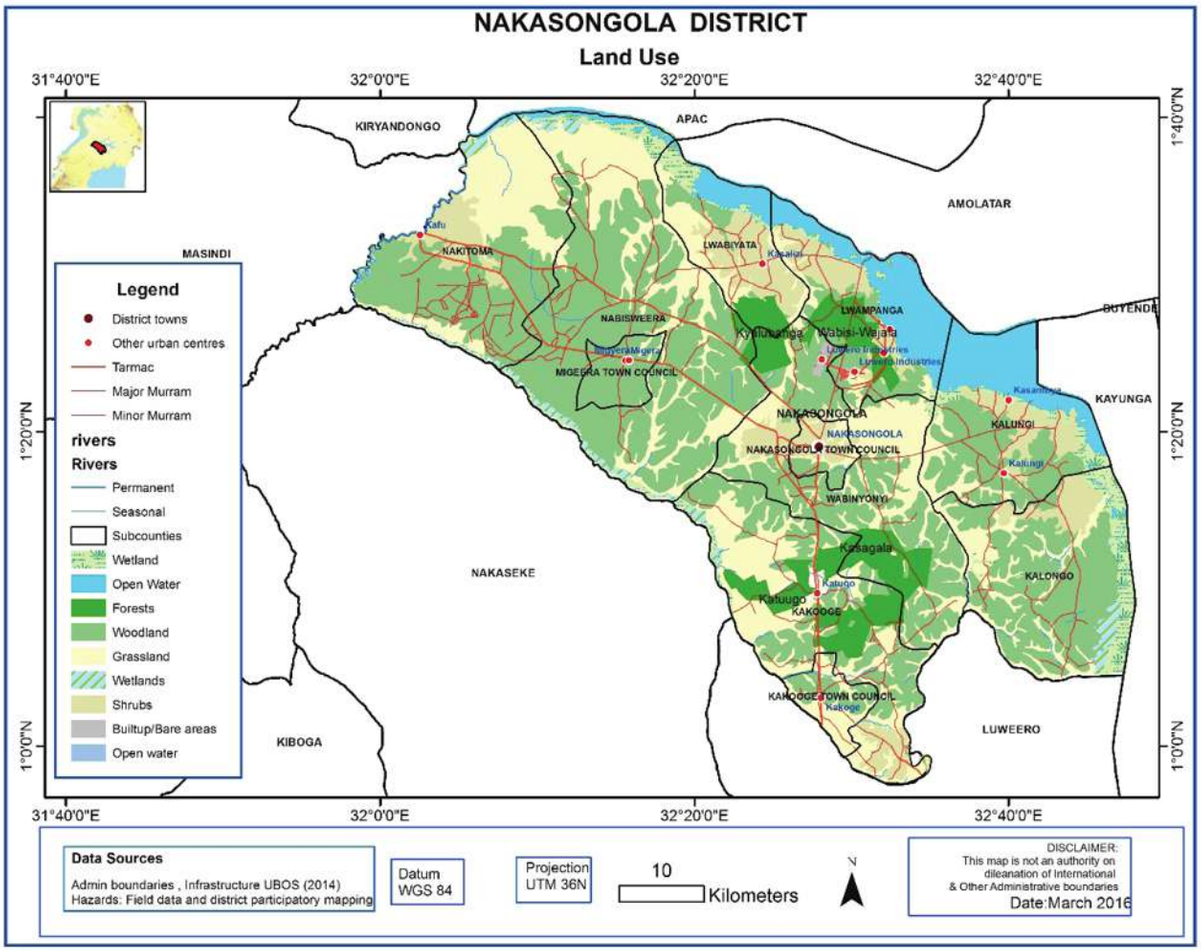

Figure 3 : Land use of Nakasongola District

2.3 Climatic Conditions

Nakasongola district is located in Uganda's cattle corridor and in terms of climatic conditions the area can be described as relatively moist, warm and dry (dry sub humid). The mean monthly rainfall is about 100 mm but the mean annual rainfall ranges from 600 to 1000 mm. Droughts are observed to be frequent thus affecting soil cover and agricultural productivity. Rainfall erosivity is moderate. The rainfall erosivity ranges from 100 to 200 and is similar to other dry land areas in the country. Occasionally, the area receives erratic torrential rains that contribute to heavy runoff and soil erosion including gullying. The mean annual maximum temperature is about 30^{O}C but the mean minimum temperature falls to about 17.5 ^{O}C.

2.4 Population and Demographic Characteristics

In 1980 it had population of about 73,966 persons. In the 1991 national census, the district population was put at 100,497. In 2002 the census that year estimated the population of 127, 064 people. In 2014 national census the population of Nakasongola District was estimated at approximately 181,863 persons. On average the annual population growth rate is 2% compared to the national which is 3.2 percent. Nakasongola District is dominated by indigenous Bantu known as Buruuli. They speak Ruruuli whose dialect is similar to that of Runyoro, Runyara, Lugwere and Lukenyi.

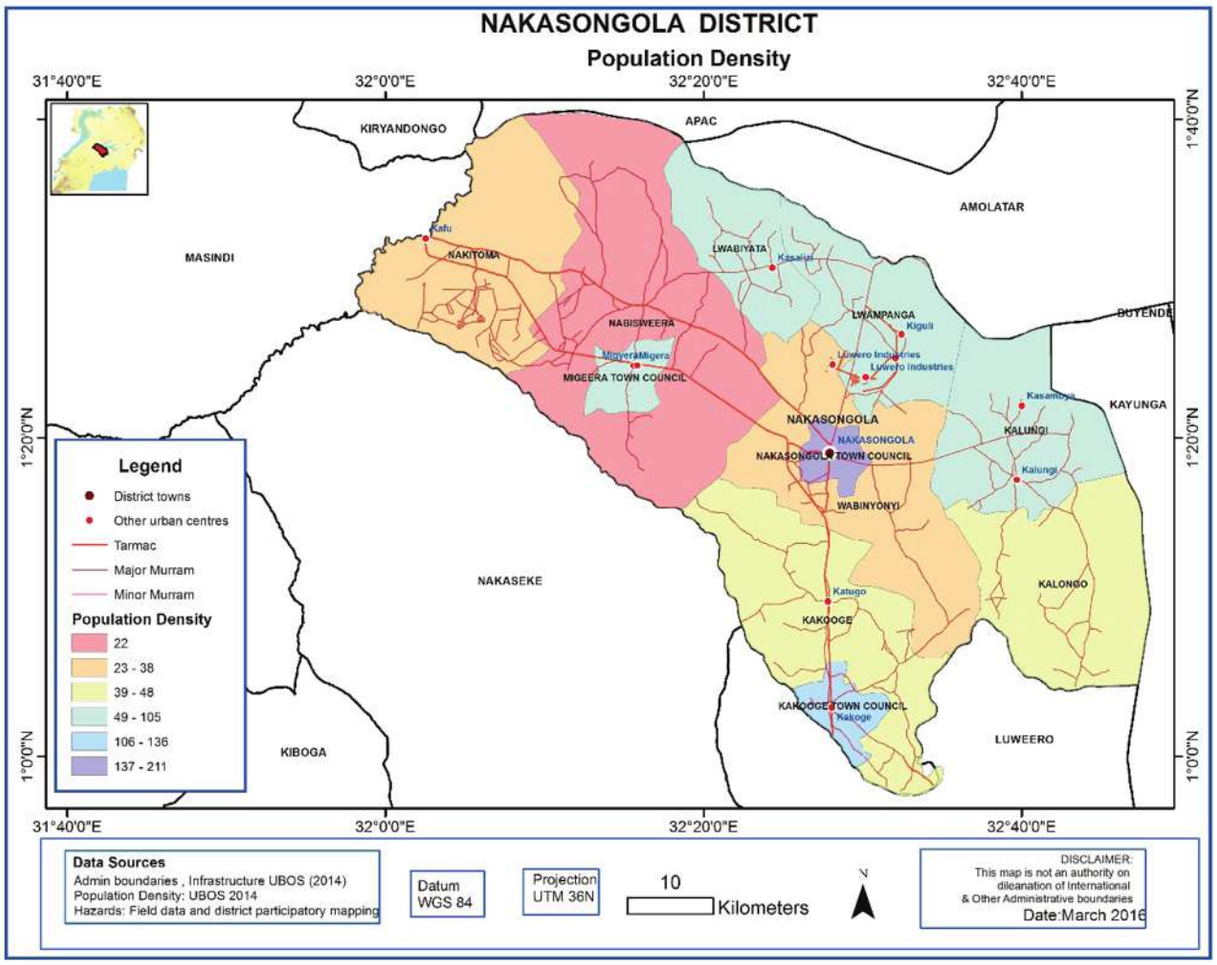

Figure 4 : Population Density of Nakasongola District

2.5 Economic activity

Agriculture is by far the most important activity in the District employing 89.9% of the People. It is however of Subsistence in nature. Livestock keeping and fishing is also being practiced by a number of people. There is also small scale trading which is mainly of retail that constitute an important source of livelihood to the people. Since the early 1990's, charcoal production emerged as a major commercial enterprise in the district, although this has caused a considerable reduction in the number of trees.

3.0 METHODOLOGY

3.1 Preliminary spatial analysis

Hazard prone areas' base maps were generated using Spatial Multi-Criteria Analysis (SMCA) basing on several 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 etc.) in a GIS environment (ArcGIS 10.2).

3.2 Stakeholder engagements and developing survey instruments

Stakeholder engagements were carried out in close collaboration with OPM's DRM team and the district disaster management focal persons with the aim of identifying the various hazards ranging from drought, to floods, landslides, human and animal disease, pests, animal attacks, earthquakes, fires, conflicts etc. Hazard, risk and vulnerability assessment was done using a stack of methods including participatory approaches such as Participatory GIS (PGIS), Focus Group Discussions (FGDs), Key informant interviews, transect drives as well as spatial and non-spatial modelling. Key informant interviews and Focus Group Discussions were guided by a checklist (Annex II).

Key Informant Interviews for District officers included: Districts Natural Resources Officers, Environment Officers, Wetland Officers, Forest Officers, Production and Marketing Officers, Veterinary Officers, Health Inspectors. At sub-county level Key informants for this assessment included: Sub-county and parish chiefs, community Development mobilizers and health workers. Focus Group Discussions were carried out in purposively selected sub-counties that were ranked with highest vulnerability. FGDs were conducted with utmost consideration to the various gender categories (women, men) with respect to age groups since hazards affect both men and women though in different perspectives irrespective of age.

Focus Group discussions and Key Informant Interviews were transcribed in the field for data collection. Case stories and photographs were documented and captured. 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 included into the multi hazard, risk and vulnerability profile maps.

3.3 Participatory mapping

The consultant worked in close collaboration and coordination with OPM in the target district to ensure that key DRR committee participate in joint mapping of hazards in the district.

The aim of the participatory mapping was to answer the following objectives:

i. Engage district and sub-district DRR stakeholders in tapping indigenous knowledge and experiences with regards to hazards
ii. Identify natural hazards caused by climatic variables e.g. floods, drought, landslides, wild fires etc and other hazards caused by humans e.g. natural resource conflicts
iii. Jointly map out individual district hazards in a higher resolution preferably at parish administrative level.

The mapping looked to answer questions on: Areas affected, types, causes, impacts, interventions and possible policy recommendation. This was done using flip charts, already prepared base maps, tables and thematic discussions, where the consultant will guide the participants in the mapping process

iv. Jointly rank the hazards' risk level in order of impact. The impact/risk as defined by IPCC will focus highly on the economic as well as physical exposure subjected by individual hazards on population/communities in the districts.

v. Risk levels of hazards were also be mapped out jointly based on frequency of occurrence. The consultant will rank and map out the magnitude and impact of the hazard on a scale of: not reported, low, medium, high. This will help inform the hazard hotspots.

In order to achieve the above stated objective, the consultant prepared basemaps for each district showing the sub county boundaries. These basemaps were filled by the communities/ district DRR stakeholders under guidance from the consultant during the participatory mapping forums at district and county level. The following formed part of the discussion questions that helped to thematically direct the participants in hazard risk and vulnerability mapping based on indigenous knowledge/ experience:

i. Which climatic hazard is most manifested in the district and what other hazards exist?

ii. While providing reasons, rank all the hazards in the district in the order of their occurrence and priority

iii. What trends on historical occurrences can be attributed to the aforementioned hazards?

iv. List down/ elaborate on the main contributors to these perceived hazards in the region

v. Which gender (Male / Female) and Age group (children <5, youth (10 - 25), middle aged (30 - 40), old (>60 years) in the societal set-up is the most affected and by what hazard.

vi. Mapping Occurrence :

vii. Which areas within the district experience these hazards (Note : each hazard was mapped separately)

viii. Mapping Risk (Risk is defined by the economic losses or physical exposure e.g death caused or directly attributed to a hazard):

For each hazard occurring in the district please rank each parish within the district on a scale of 1 – 4 in terms of the risk level the parish is exposed to the specific hazard. In this case, risk level : 1 = Not reported, 2= Low, 3= Medium and 4 = High

3.4 Fieldwork and ground truthing verification:

The consultant carried out field work in order to inform 3 key objectives: Source for evidence based on hazards and as informed by the outcome of participatory mapping. An example will be to visit a flooded prone area and get further data from the community including taking real photos of the river beds, dykes, flood plains. Source higher resolution spatial datasets from already existing DRR programs e.g. hazard forecasts and trend datasets, Gather socio-economic setup/ information on communities in this districts e.g. the major land uses and land cover types.

3.5 GIS modelling analysis

At this stage of the project, hazard delineation and risk mapping was already accomplished and the consultant carried out vulnerability mapping. The consultant used this opportunity to check the quality of each hazard and risk maps and enhance the same through map layering with socio-economic datasets acquired from field work.

The vulnerability mapping was based on the IPCC definition of vulnerability: IPPCC defines vulnerability as “the extent to which climate change may damage or harm a system”. It recognizes that the propensity for harm is not solely a function of the magnitude of the stressor (e.g. exposure to climatic extremes) but also depends on a system’s sensitivity and its ability to adapt to new climatic conditions. In essence, Vulnerability = Exposure + Sensitivity + Adaptive Capacity. The consultant hence developed composites of vulnerability hotspots profiles/ maps at district level by categorizing different GIS layers of the districts separately into the following key classes:

a)-Exposure Layer: This layer will comprise of climatic variables specifically:

i. Long term average precipitation (1984 - 2014)
ii. Long term temperature average (1984 - 2014)
iii. Long term Coefficients of variability for precipitation (1984 - 2014)
iv. Flood Risk (obtained from participatory mapping)
v. SPI based Drought Risk data (Source: GeoClim) as well as drought risk data obtained from participatory mapping)

The consultant used datasets obtained from local meteorological stations (source: Uganda Meteorological Authority) to develop the climatic composite for exposure layer, however in the event where data was lacking , the consultant accessed proxy datasets from satellite observations like the Climate Hazard Group Infra-Red Precipitation and Station rainfall estimates (CHIRPs) datasets which is multi temporal covering over 30 years and at 5kilometer spatial resolution, as well as Temperature data from moderate Imaging Spectro- Radiometer Satellite observations MODIS which has a consistent monthly average temperature estimates from the year 2000 at 250meters resolution.

b) - Sensitivity Layer: Sensitivity explains the magnitude or extent to which the stressors mainly climatic variables (Exposure layer) have on the ecosystem. The GIS layers were used to form the Sensitivity composite that were determined largely by the varying ecosystems, societal and ecological disparities from district to district and this came up from the participatory mapping. Despite this, the consultant envisaged that the following layers will cut across different districts for this layer: land conflicts, environmental degradation, road accidents, lightning, bush fires, landslides, vermins, crop diseases, humn diseases, soil erosion, earth quakes, strong winds and landslides.

c) - Adaptive Capacity Layer: This layer informs on the ability of an ecosystem or community to bounce back from an extreme climatic event (hazard). Again, the GIS layers used to form this layer composite were determined largely by the varying ecosystems, societal and economic disparities from district to district and this was identified during participatory mapping. Despite this, the consultant envisaged that the following layers will cut across different districts for this composite; market access and poverty index.
The final vulnerability hotspots map for each district was developed by summing up the 3 composite layers (exposure, sensitivity and lack of adaptive capacity layers) then dividing by 3. This was then normalized to a scale of 0 – 100 after which the vulnerability hotspot layer were indexed into 4 scores as follows not reported, low, medium, high.

Further GIS data processing and statistical analysis were carried out using statistical package R Statistics. The consultant assembled and organized all datasets derived from the project into an organized spatial database that is compatible with ArcGIS 10.2.

The normalized rasters for each vulnerability component were summed up using the equal weighted sum and then normalized to generate the exposure, sensitivity and lack of adaptive capacity rasters. The overall vulnerability raster was developed by adding the exposure, sensitivity and adaptive capacity layers and normalizing the output. The maps are represented in vulnerability classes of 1 (not reported), 2 (low), 3 (medium) and 4 (High). The use of equal interval maps with set categories means that areas included in each class vary depending on the underlying statistical distribution of the components. The maps can be used to understand the components of vulnerability in a given location (how each component contributes to the overall score); and to identify areas of relatively higher exposure, sensitivity, lack of adaptive capacity, and overall vulnerability that may require interventions.

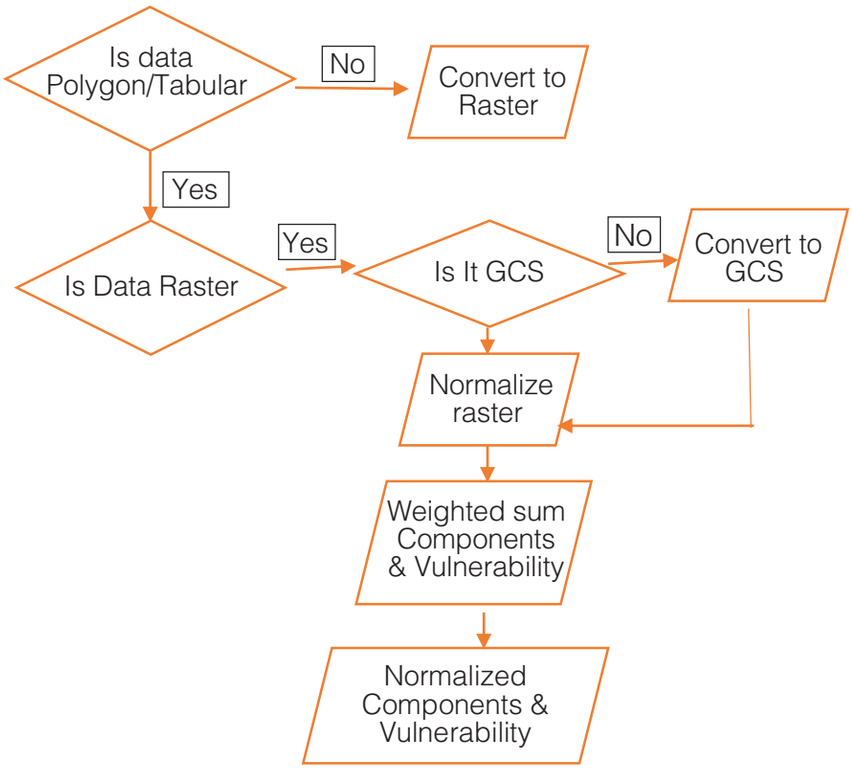

Figure 5 : Data conversion work flow

3.6 Regional Stakeholder Workshop for Data verification and validation

In collaboration with OPM, a five days regional data verification and validation workshop was organized by UNDP in Masaka 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.

4.0 RESULTS FROM MULTI-HAZARD RISK, VULNERABILITY MAPPING

The following hazards were identified in their order of priority and importance.

4.1 Drought

Nakasongola is located in the cattle corridor which is generally a dry area. The entire Nakasogola is prone to droughts experiencing serious water problem shortages as the water table is low and at the apex of the dry seasons, animals get emaciated and start dying off. People have resorted to wakingup very early in the morning at around 3am to feed the animals on wet grass and when it has cooled down. During these dry periods, people tend to move their livestock towards river kafu for water but they are encountered by crocodiles which eat their animals. People are being trained in the areas of adaptation such as growing of early maturing plants and disease resistant varieties. Others include resitricted movement of cattle, pasture improvement, water harvesting, small scale irrigation and water and soil conservation methods.

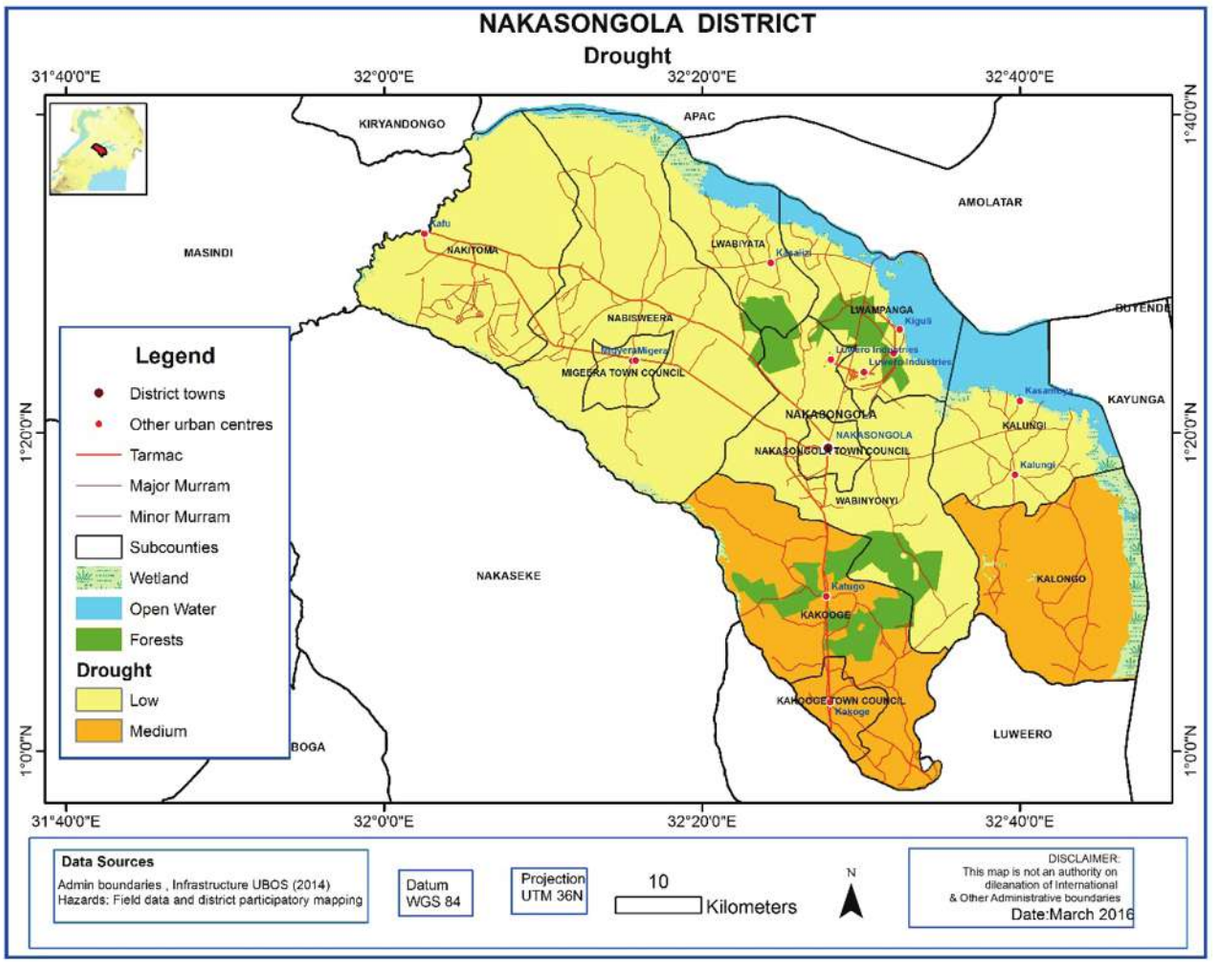

Figure 6 : Drought in Nakasongola District

4.2 Human disease outbreaks

Human disease out breaks in Nakasogola are still dominated by malaria as the major killer disease, followed by respiratory infections especially in under-fives (related to weather), HIV&AIDS is at a prevalence of 6.9% although among fishing communities and soliders it can be quite high; diarrhea and dysentery due to poor sanitation and lack of clean safe water, typhoid, brucellosis and hepertis B. The government is giving mosquito nets through the village health teams, immunization and vaccinations campaigns to mitigate outbreak of some of the diseases. Kansiira, Nalukonge, Kikkoge, Lwampanga, Kiwembi, Kikoiro, Zengebe, Kazwama, Kisenyi, Irima, Namungolo were noted as hotspots. Human disease outbreaks were attributed to Unhygienic conditions and practices, Low mosquito net usage, Presence of stagnant waters along the lakeshores, Careless lifestyles, Divergent cultures and breakdown of health systems.

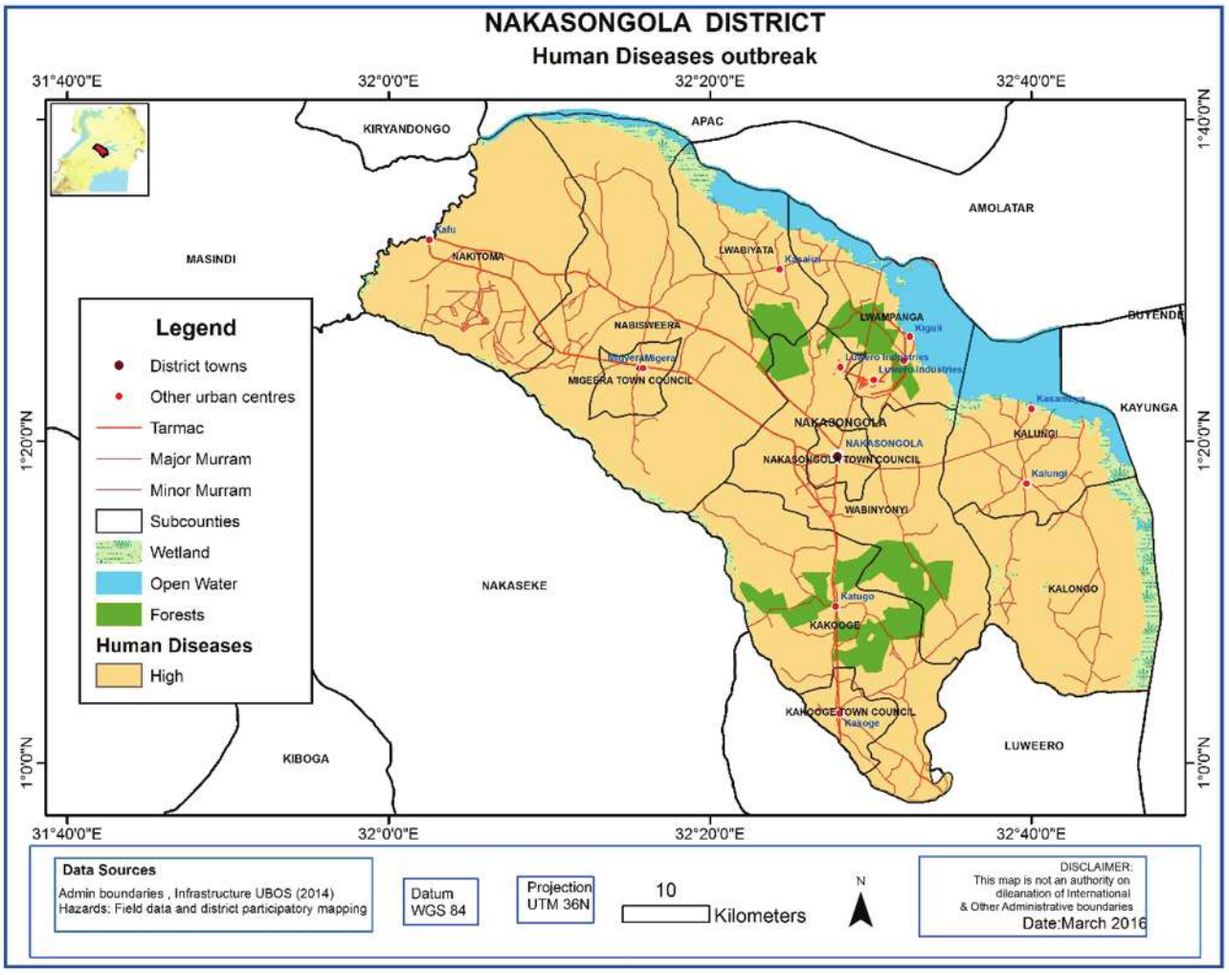

Figure 7 : Human Diseases in Nakasongola District

4.3 Livestock pests and diseases

Major livestock pests and diseases identified include; Foot and mouth disease that strike at least every 3years cost of the vaccine and model of spread of this disease have made it difficult to control the disease leaving quarantine as the only option. Others include lumpy skin disease, African swine fever, tick borne diseases, new castle in poultry, trypanomiasis and tse tse fly infestations along river Lugogo and sezibbwa which causing Nagana. Nabiswera, Nakitoma, Wabinyonyi, Kalungi and Kalongo Sub Counties were noted as hotspots.

The increasing cases of livestock pests and diseases were attributed to Counterfeit drugs and acaricides on markets, Roaming of animals in search of water, failure to enforce stringent measures for disease control and overstocking.

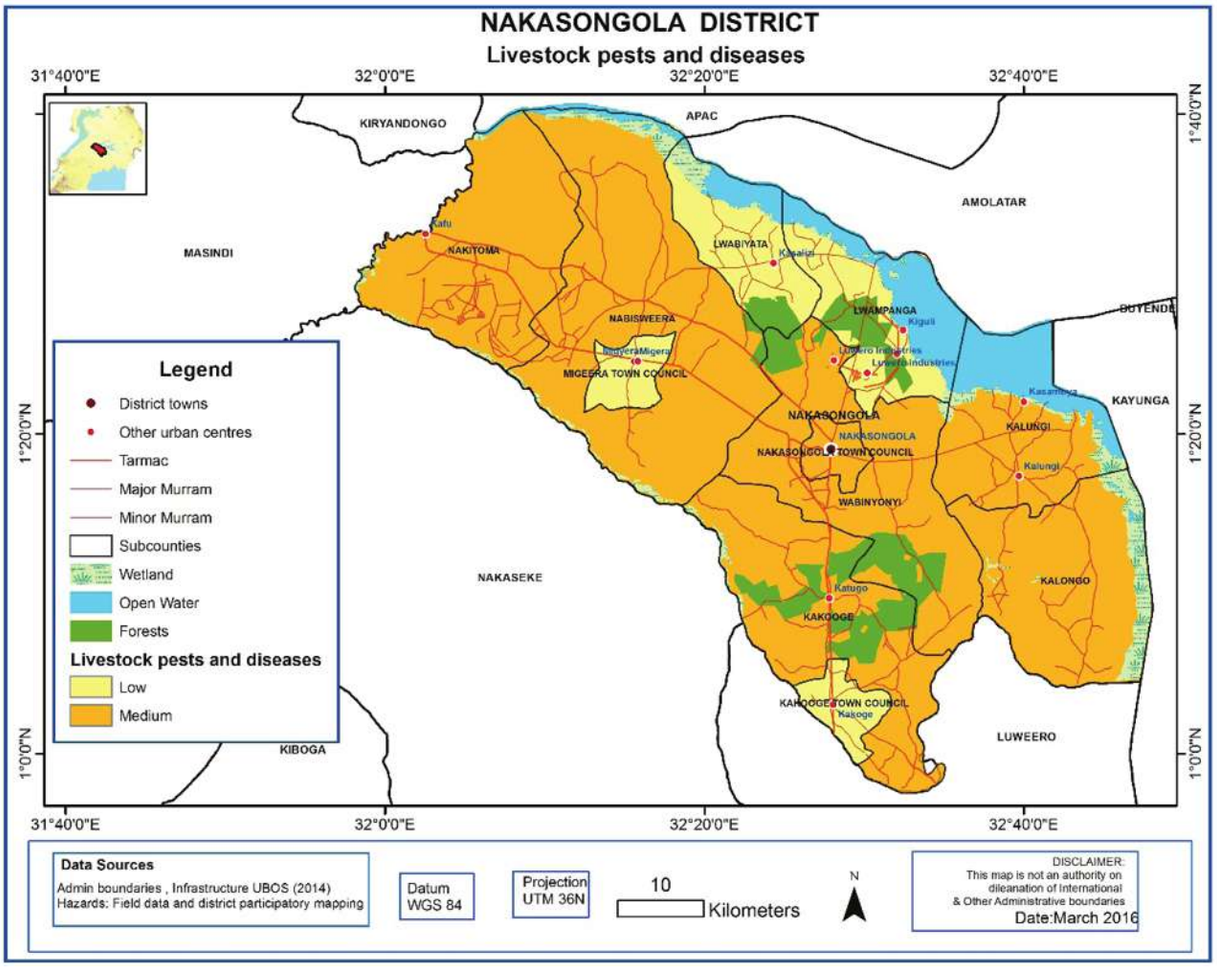

Figure 8 : Livestock pests and Diseases in Nakasongola District

4.4 Crop pests and diseases

Major crop pests and diseases identified within the district are; cassava brown stripe which spreads very fast and cassava mosaic which affect the entire district. Banana weevils and coffee wilt affect mostly the southern part of the district. Maize strike and ground nut rosette are also a challenge within the district. It was also noted that they are affected by the giant caterpillar loppers which normally come at the end of the dry spell. Limited presence of resistant varieties, failure by farmers to observe field hygiene and Uncontrolled movement of crops materials were noted as major reasons for the persistence of crop pests and diseases.

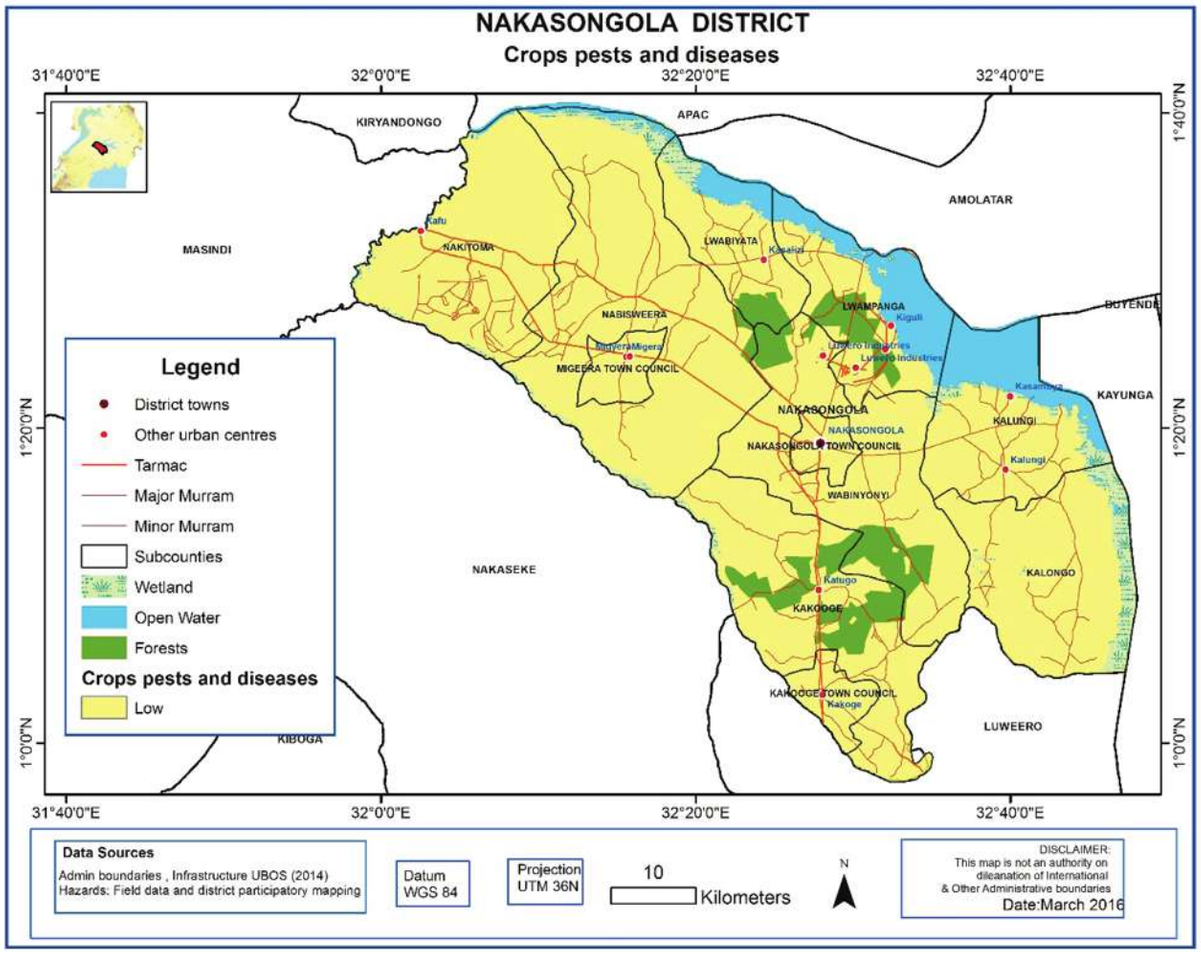

Figure 9 : Crop pests and Diseases in Nakasongola District

4.5 Environmental degradation

Nakasogola has lost 90% of its forests especially to charcoal production. This deforestation is driving soil erosion within the district which is becoming a big threat as you see stretches of bare grounds were soils have been washed a way to only remain the underground rock. Wetland encroachment was also noted with people increasingly running to wetlands with the increasing dry spells for cultivation which continues to result in siltation. Also livestock keepers have always used these wetlands for watering their animals and therefore encroachments by farmers has started to fuel conflicts between the farmers and livestock keepers. Some of the strategies being done to mitigate and adapt to the situation include, creating awareness, restoration by planting new trees although they are not planting indigenous trees and the rate of removal still exceeds the rate of replacement. Nalukonge and Migeera in Nabiswera, Wanzogi and Kyangogolo were noted as the hotspots. Indiscriminate cutting of trees especially for charcoal, poor farming practices like use of fire, Overstocking and thus overgrazing, encroachment on sensitive ecological areas such as wetlands and forest reserves, Laxity of community structures for monitoring and bad politics were highlighted to be responsible for the increasing environmental degradation within the district.

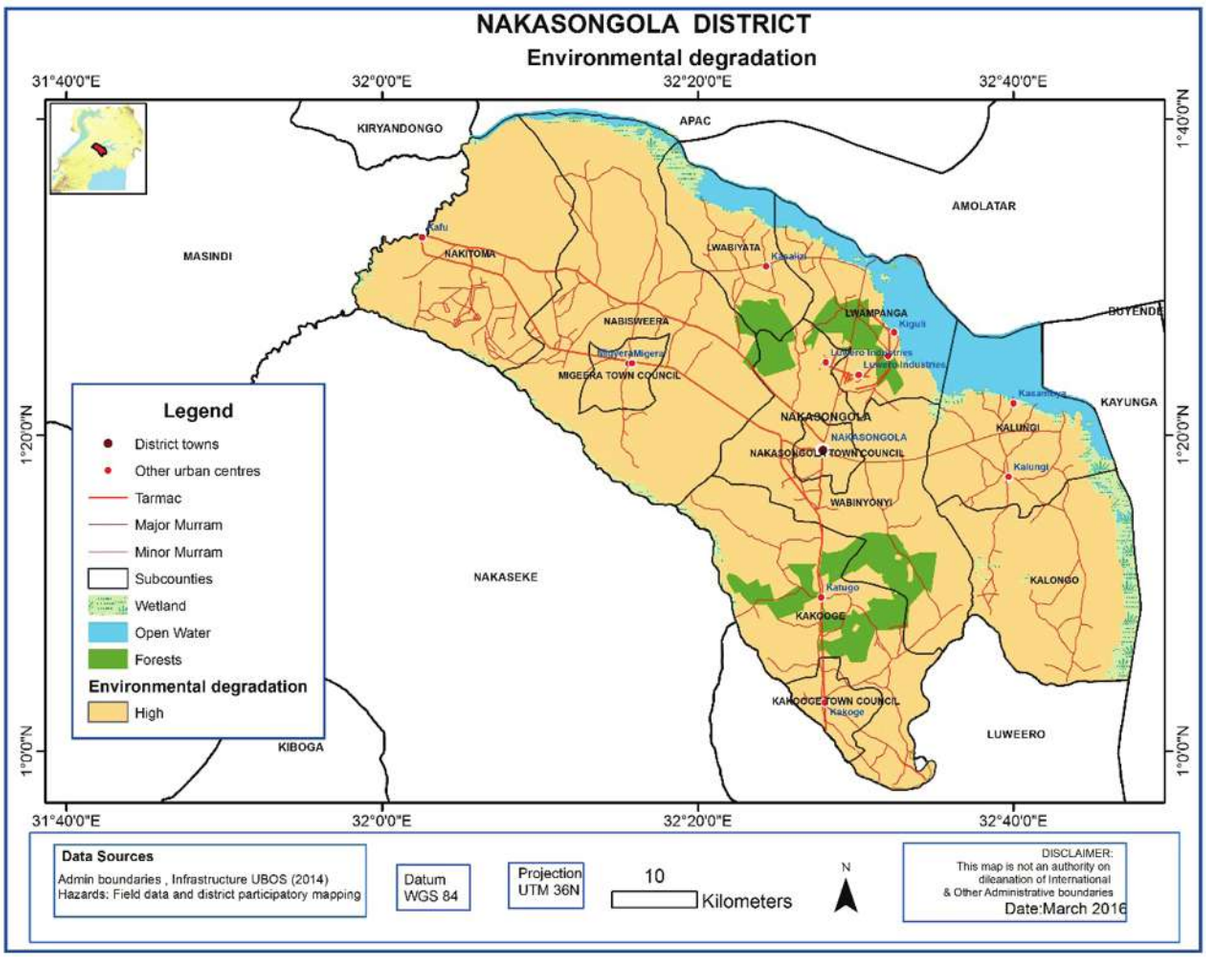

Figure 10 : Enviromental degradation in Nakasongola District

4.6 Road accidents

The district being on the high way, rates of accidents are very high and the second leading cause of death within the district. All the sub counties along the high way are heavily affected. Hotspots were identified at Nakitoma, Migeera, Namaasa, Ssasira, Wabigalo, Kyankonwa, Katuugo, Kyabutaika and Kakooge. Over speeding, narrow roads, indiscipline by drivers and other road users, Livestock crossing of highways at non-designated spots yet without any signs, absence of parking space for vehicles that breakdown on road, Vehicles in poor mechanical conditions and absence of humps or adequate signage on the road to warn motorists were noted as the causes of road accidents.

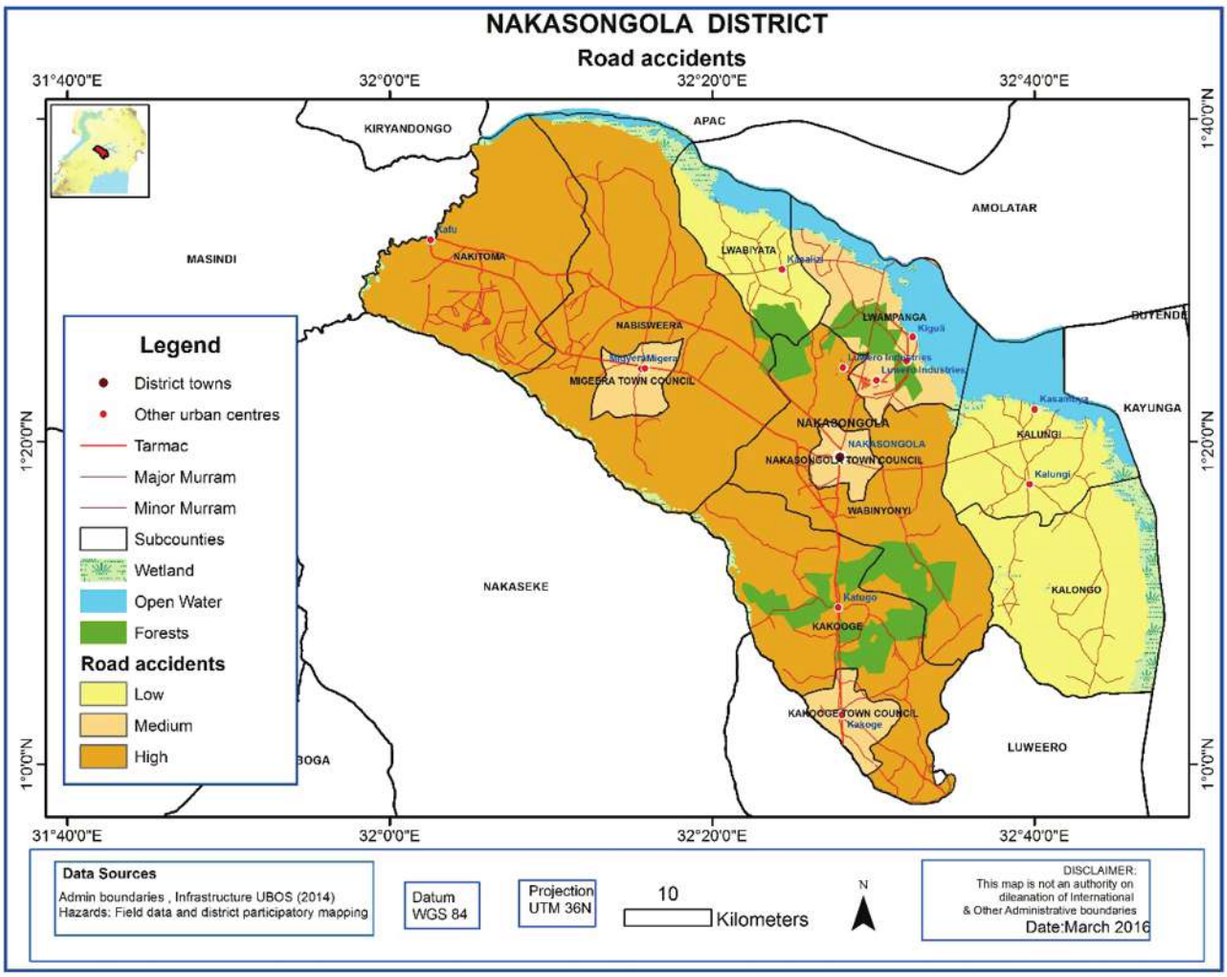

Figure 11 : Road accidents in Nakasongola District

4.7 Bush fires

Bush fires are a common occurrence especially during the dry seasons as a way to control ticks and also have fresh grass for the cows. However there is increasing fires fueled by land conflicts which are becoming a big threat. For examples there are a number of occasions were people have lost their forest plantations due to these malicious fires. Hotspots were identified in Nabiswera, Kalungi Wabinyonyi, Kakooge S/Cs and Nakasongola Town Council. These fires are mainly attributed to cultural beliefs, Wildlife hunters and Saboteurs.

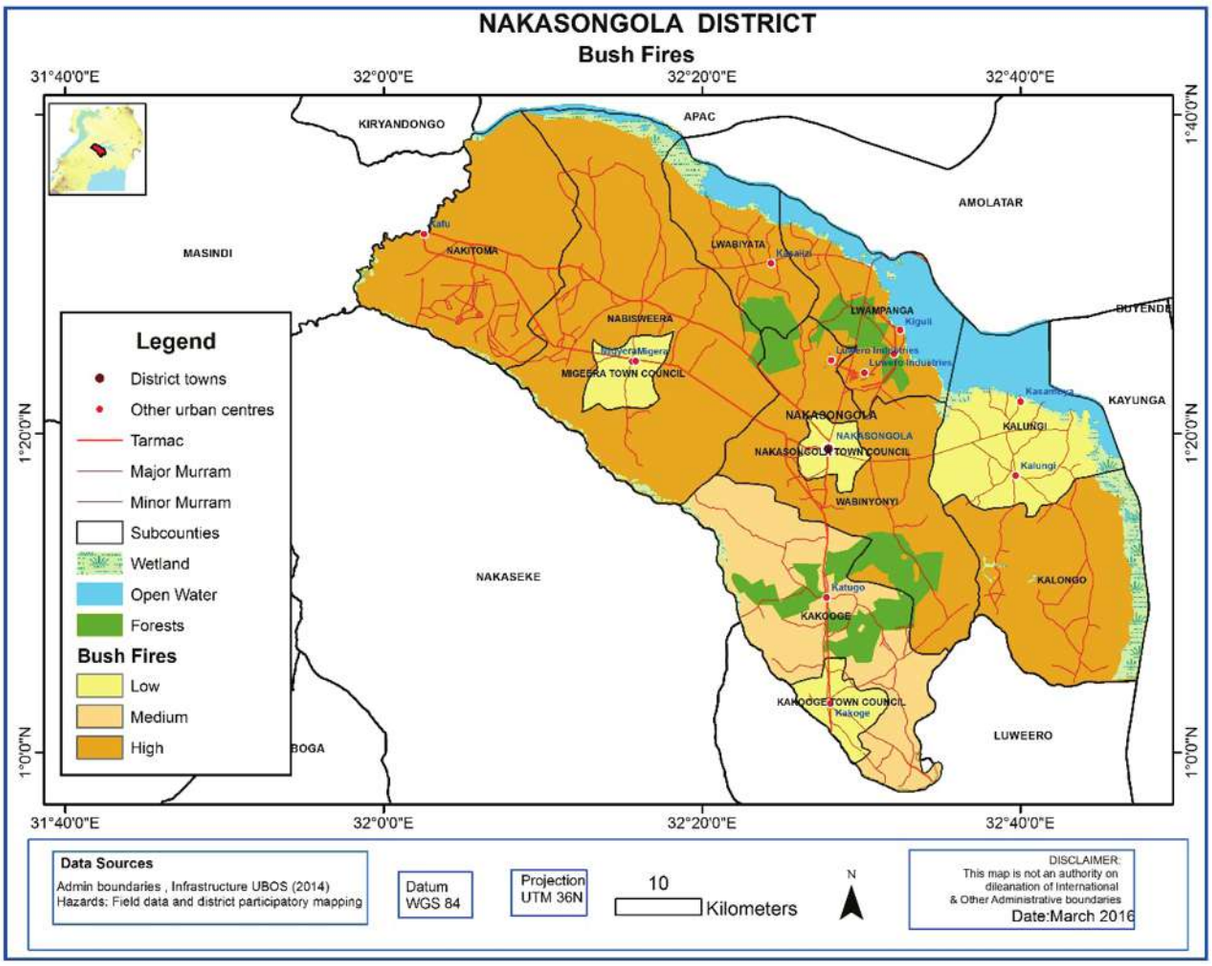

Figure 12 : Bush Fires in Nakasongola District

4.8 Floods

Sub-counties close to the lake shores are prone to flooding especially along the lake shores of Kyoga. Kalungi, Lwapanga, Nakitoma floods from river Kafu and Lugogo River which floods every year. People in these areas keep moving away with schools being cut off. This also extends the territory of crocodiles and hippos within the water coming to areas were people have been living. In 1998 and 1999, there was severe displacement of the entire shore line. Kisenyi, Kazwama, Lwampanga, Kikoiro were noted as the main hotspots. This was mainly attributed to degradation of lakeshores, raising water levels of the lake and flat nature of landscape and yet it's along the shores.

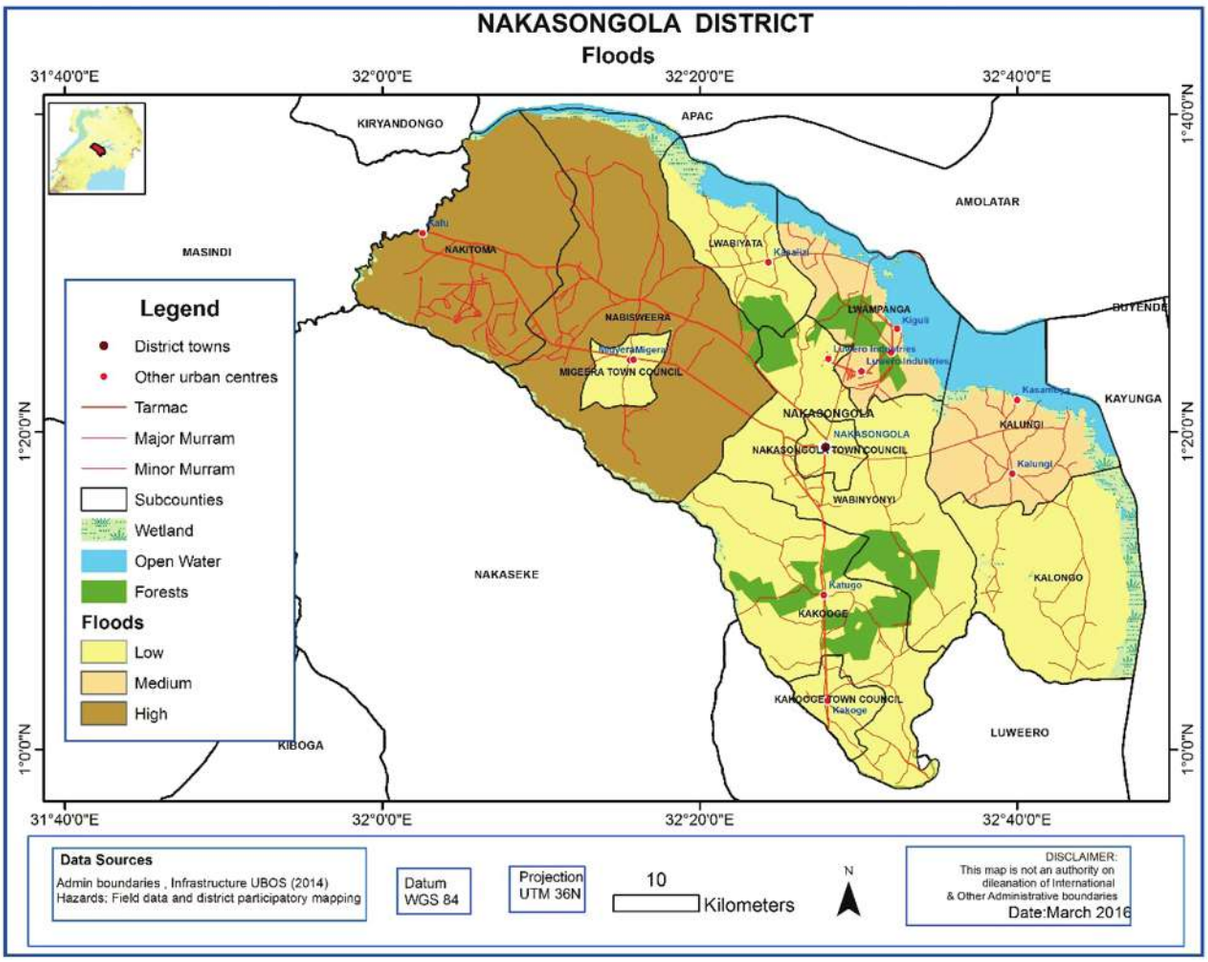

Figure 13 : Floods in Nakasongola District

4.9 Land conflicts

Land conflicts are common in the entire Nakasogola attributed to poor land tenure system and absentee land lords. However, as a way to curb these, strategies have been laid out which include mediations through local leaders, the district land committee, state house land committee, police units and courts of laws. Land conflicts also fuel burning of bushes and forest plantations especial in a dry season. Colonial injustices in land allocation, high poverty levels thus less capacity to purchase land, bad politicking, Land fragmentation and increased land use demands were noted to be responsible for fueling land conflicts within the districts.

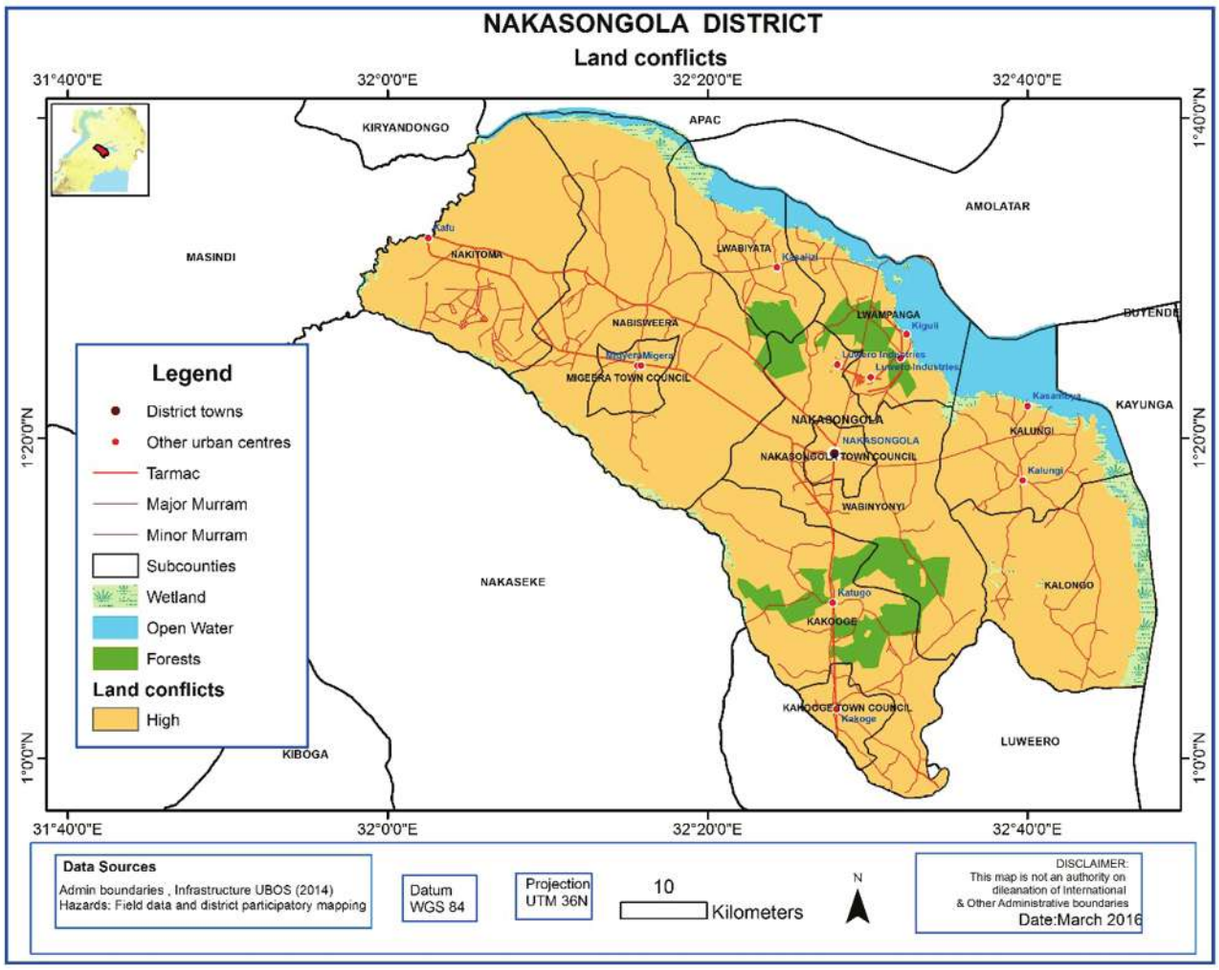

Figure 14 : Land conflicts in Nakasongola District

4.10 Vermin and wildlife animal attacks

Crocodiles are the major threat to livestock especially during the dry seasons as farmers move their cattle close to water were crocodiles are. Crocodiles in rivers and valley tanks are increasing becoming a threat. For instance in 2015, a woman fetching water was eaten by a crocodile. Hippos also attack people especially at the lake shores. Monkeys and bush pigs are the major vermins within the district. Kasozi parish was noted as the main hotspot. Proximity to the Rhino Sanctuary, Loss of wildlife habitats and Lack of community will to participate in vermin control were identified as the main reasons for increasing wildlife vermin's and problem animal attacks.

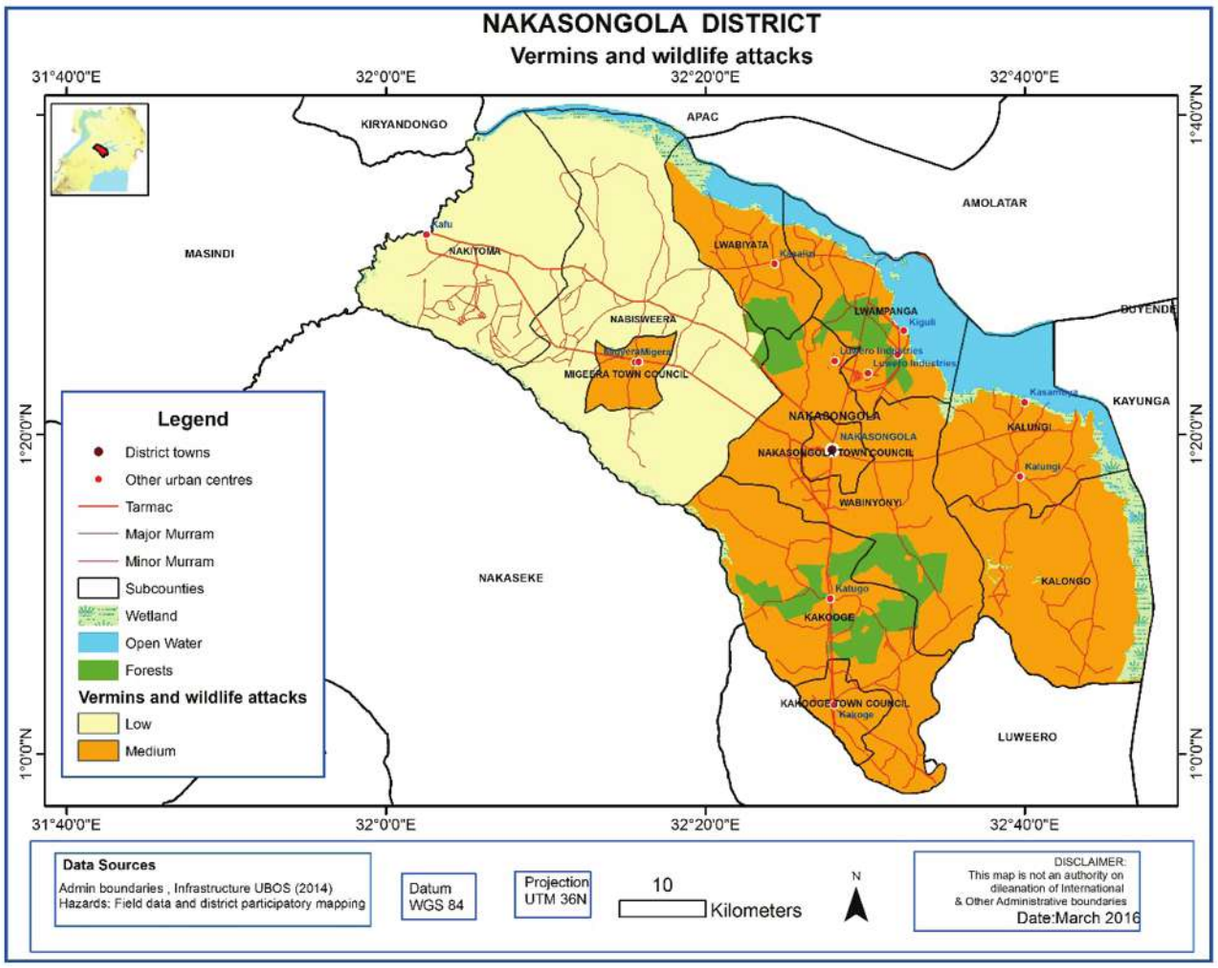

Figure 15 : Vermin and wildlife animal attacks in Nakasongola District

4.11 Strong winds, Hailstorms and Lightning

Incidences of strong winds are a common phenomenon blowing off roof tops. Nabiswera, Lwabyata, Lwampanga and kalungi sub counties are heavily affected. In Lwampanga and kalongo there were deaths from hailstorms in 2015. Lightning quite often also strike cows. Kyangogolo, Lwabiyata, Kateebe, Kisenyi were noted as the hotspots. This is mainly attributed to complete loss of wind breakers (Trees) and Loss of lakeshore vegetation.

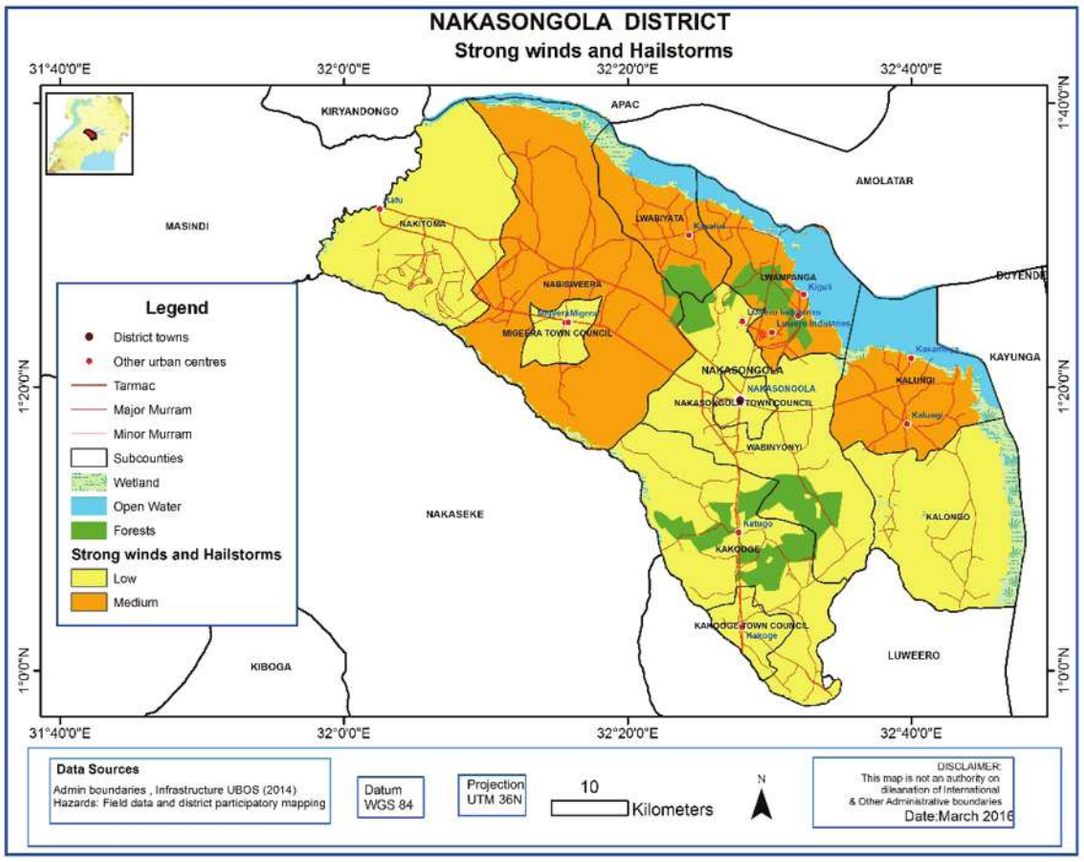

Figure 16 : Strong winds and Hailstorms in Nakasongola District

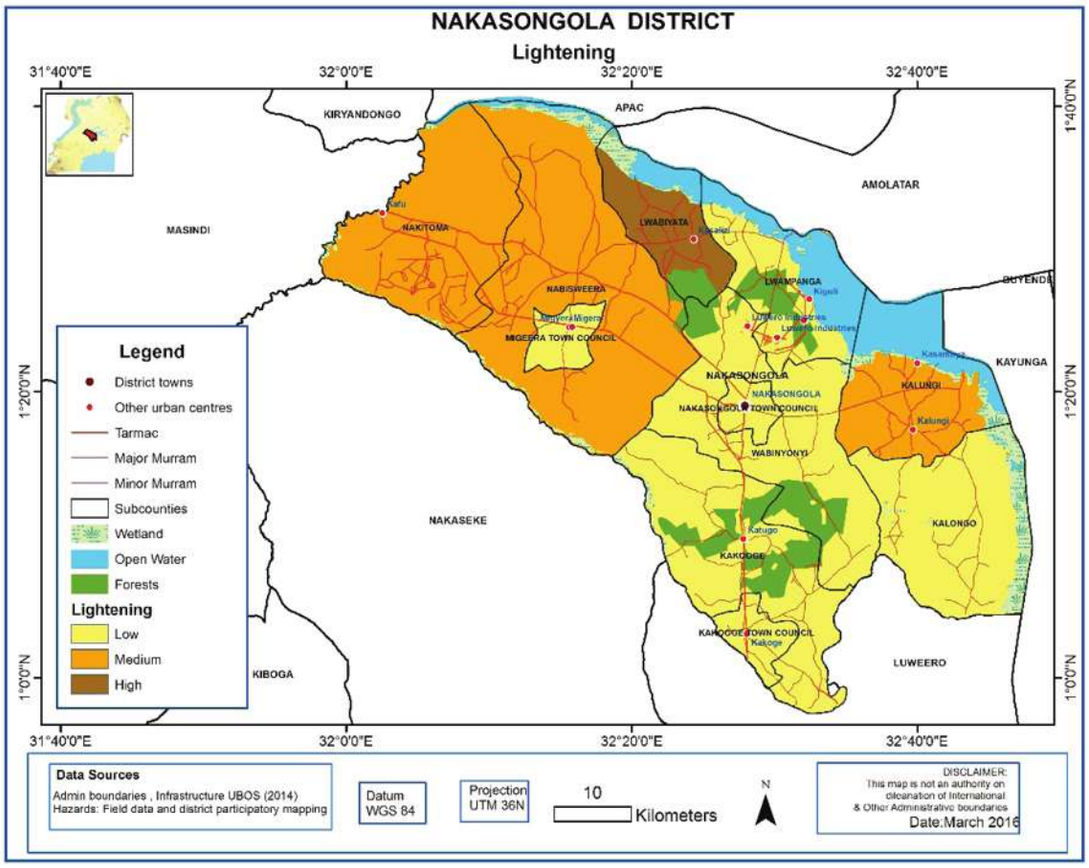

Figure 17 : Lightning in Nakasongola District

4.12 Soil erosion

Because of deforestation, Nakasogola is increasily becoming prone to erosion and in Nabiswera Sub County erosion is high. Nabiswera, Nakitoma and Kalungi Sub counties were noted as major hotspots. Poor farming practices, Overgrazing, Overstocking of livestock, Uncontrolled vegetation removal especially for charcoal and termite infestation were noted to be responsible for the continued erosion within the district.

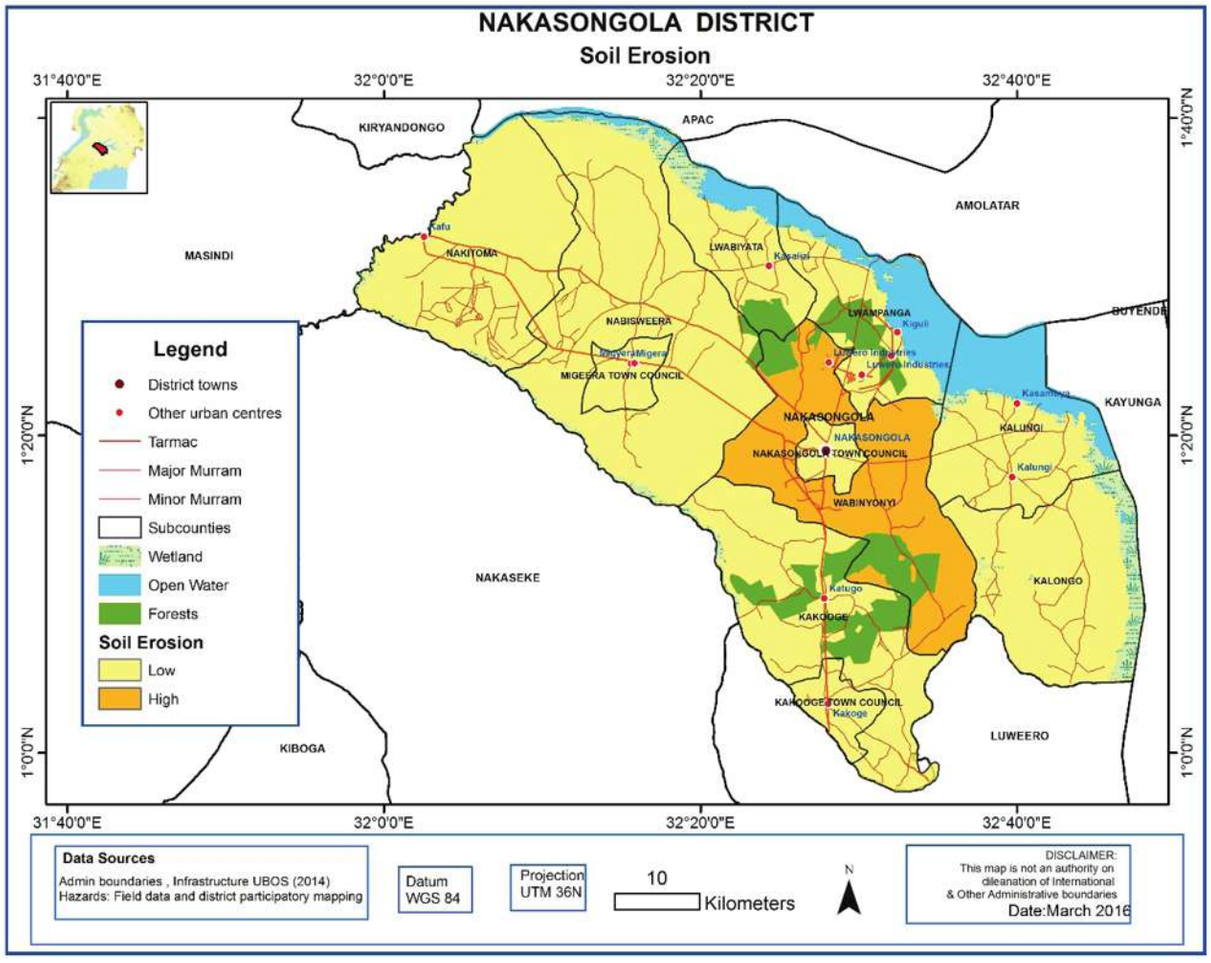

Figure 18 : Soil erosion in Nakasongola District

4.13 Gender and age group most affected

Table 1: Gender and age group most affected

Hazard	Gender & Age Group Affected most
Drought	Women and Children
Human diseases	Pregnant mothers, Children
Livestock pests and Diseases	Farmers
Crop pests and Diseases	All farmers
Environmental Degradation	Women
Road accidents	Passengers Health staff
Bush fires	Livestock farmers
Floods	Fishermen Crop farmers
Land Conflicts	Women Children
Vermin and Wildlife attacks	Women
Winds and Lightning	Women and Children
Soil Erosion	Farmers

5.0 DISTRICT VULNERABILITY ANALYSIS

For vulnerability assessment, this study utilised the second conceptualization which as outcome vulnerability, which "represents an integrated vulnerability concept that combines information on potential climate impacts and on the socio-economic capacity to cope and adapt." The IPCC framework builds on this, in that vulnerability is considered to be a function of exposure to climate impacts, including variability and extremes, and the sensitivity and adaptive capacity of the system being exposed. The three components can further be expanded on as follows:

- Exposure (E) - the size of the area and/or system, sector or group affected and the magnitude of the stressor.
- Sensitivity (S) - the characteristics of a system or population and the governance/market structures that influence the degree to which it is affected by stressors.
- Adaptive capacity (A) - capacities of the system, sector or group to resist impacts, cope with losses and/or regain functions.

Table 2 : Indicators utilised by vulnerability component

COMPONENT	DATA	SOURCE
Exposure	Precipitation Coefficient of Variation	CHIRPS blended satellite- station precipitation
	Average Precipitation	CHIRPS blended satellite- station precipitation
	Average Temperature	MODIS Land surface Temperature
	Flood frequency	Participatory mapping at District Level
	Droughts	Participatory mapping at District Level
Sensitivity	Landslides	Participatory mapping at District Level
	Winds and hailstorms	Participatory mapping at District Level
	Crop pests	Participatory mapping at District Level
	Livestock Diseases	Participatory mapping at District Level
	Human Diseases	Participatory mapping at District Level
	Land Conflicts	Participatory mapping at District Level
	Bush fires	Participatory mapping at District Level
	Environmental hazards	Participatory mapping at District Level
	Vermin pests	Participatory mapping at District Level
	Road Accidents	Participatory mapping at District Level
	Soil Erosion	Participatory mapping at District Level
	Strong winds	Participatory mapping at District Level
	Earthquake	Participatory mapping at District Level
	Lightning	Participatory mapping at District Level
Lack of Adaptive Capacity	Market Access	Joint Research Centre
	Poverty Index	Multi Criteria Poverty Index from DHS

5.1 Exposure Analysis

The exposure analysis involved the combination of the precipitation coeficient of variation (PPTCV), average precipitation (AVGPPT), average temperature (AVGTEMP), flood and drought layers.

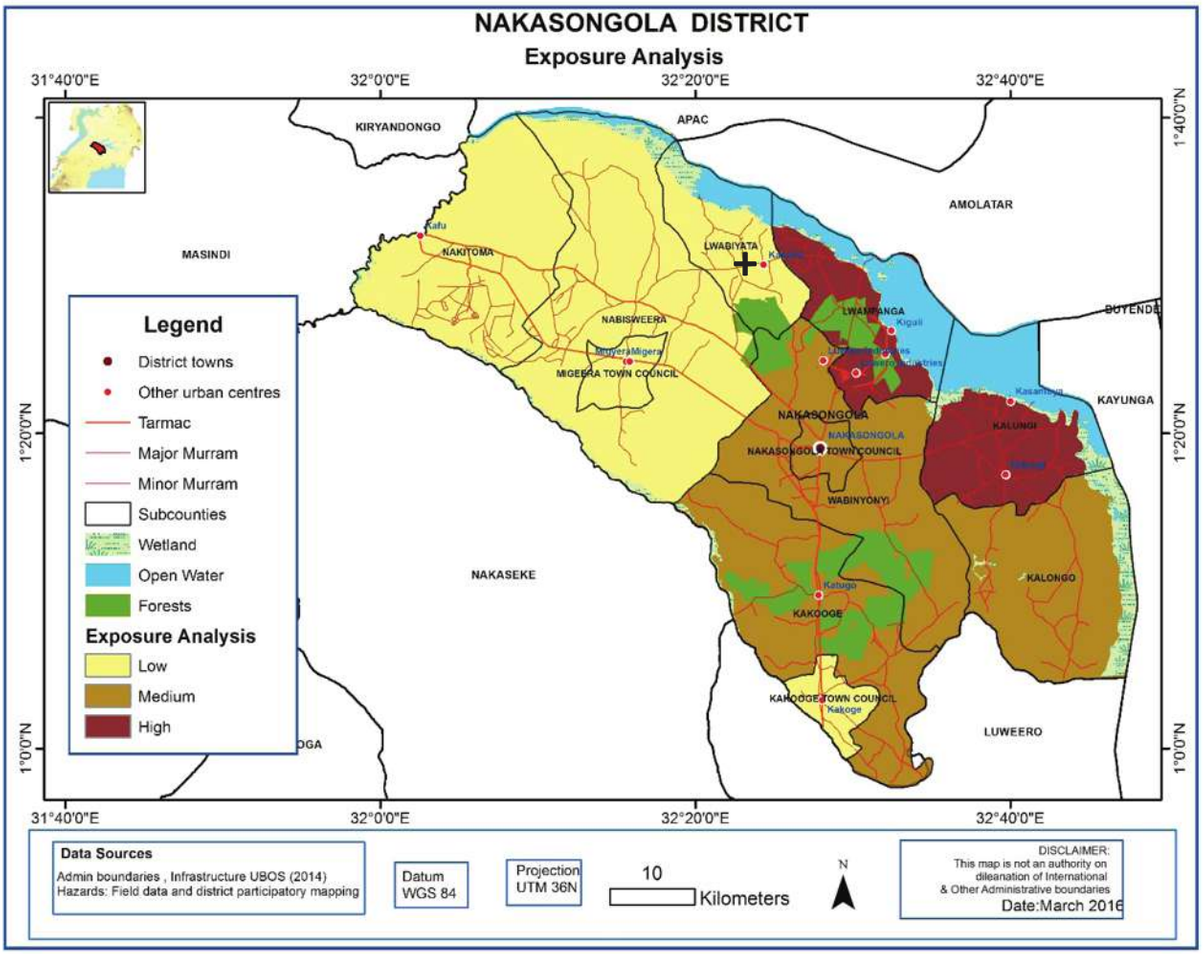

Figure 19 : Exposure of climatic conditions in Nakasongola District

Low Average annual precipitation and high annual average temperatures in Nakasongola contributed highly to the exposure of the area with Lwampanga and Kalungi highly vulnerable to climate stressors.

5.2 Sensitivity Analysis

The exposure analysis involved the combination of the follwing layers ; land conflicts, environmental degradation, road accidents, lightning, bush fires, landslides, vermins, crop diseases, humn diseases, soil erosion, earth quakes, strong winds and landslides.

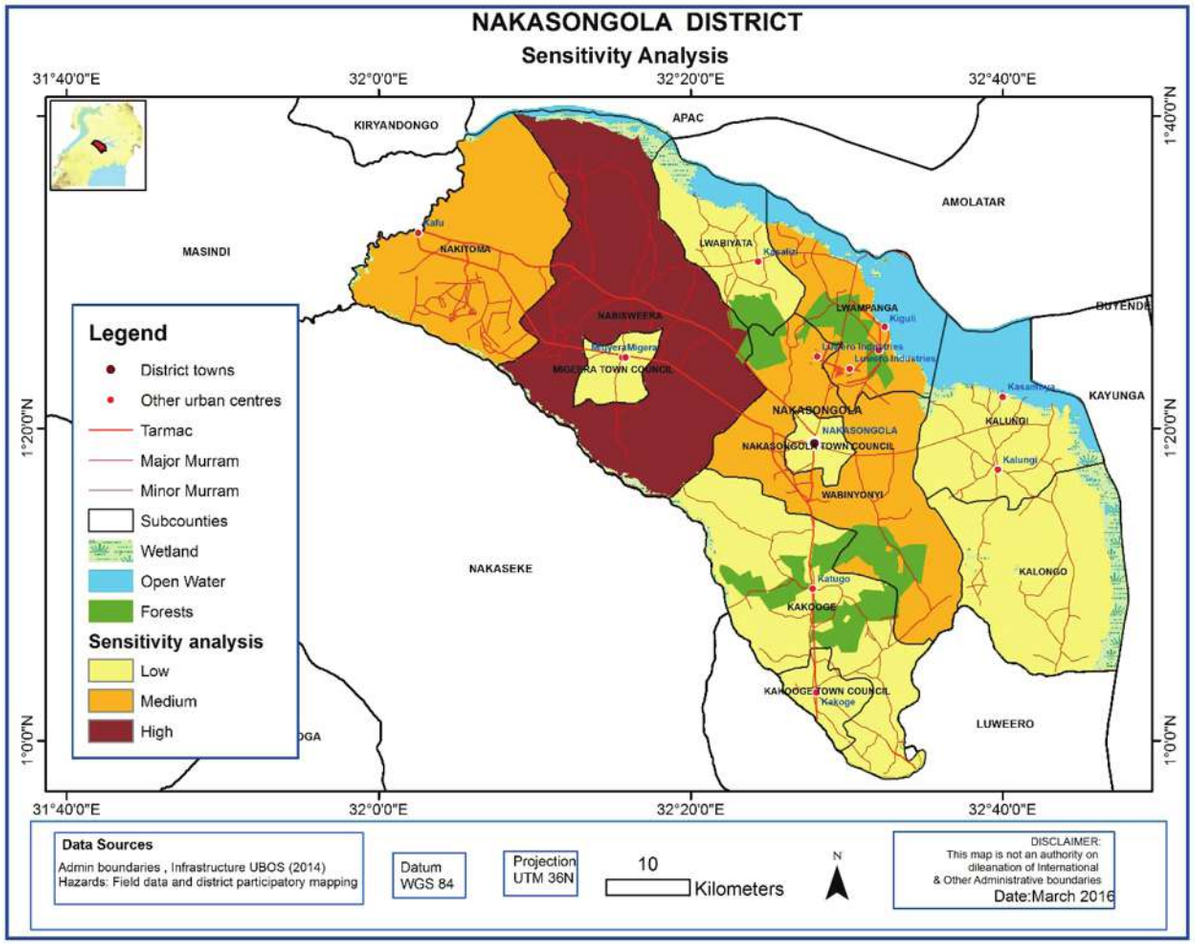

Figure 20 : Sensitivty of stressors in Nakasongola District

Vermin pests, accidents and bush fires are the main hazards influencing the sensitivity of Nakasongola. Nabisweera emerged as the most vulnerable sub county to the different hazards.

5.3 Lack of Adaptive Capacity

The lack of adaptive capacity was analyzed using the market access and poverty index.

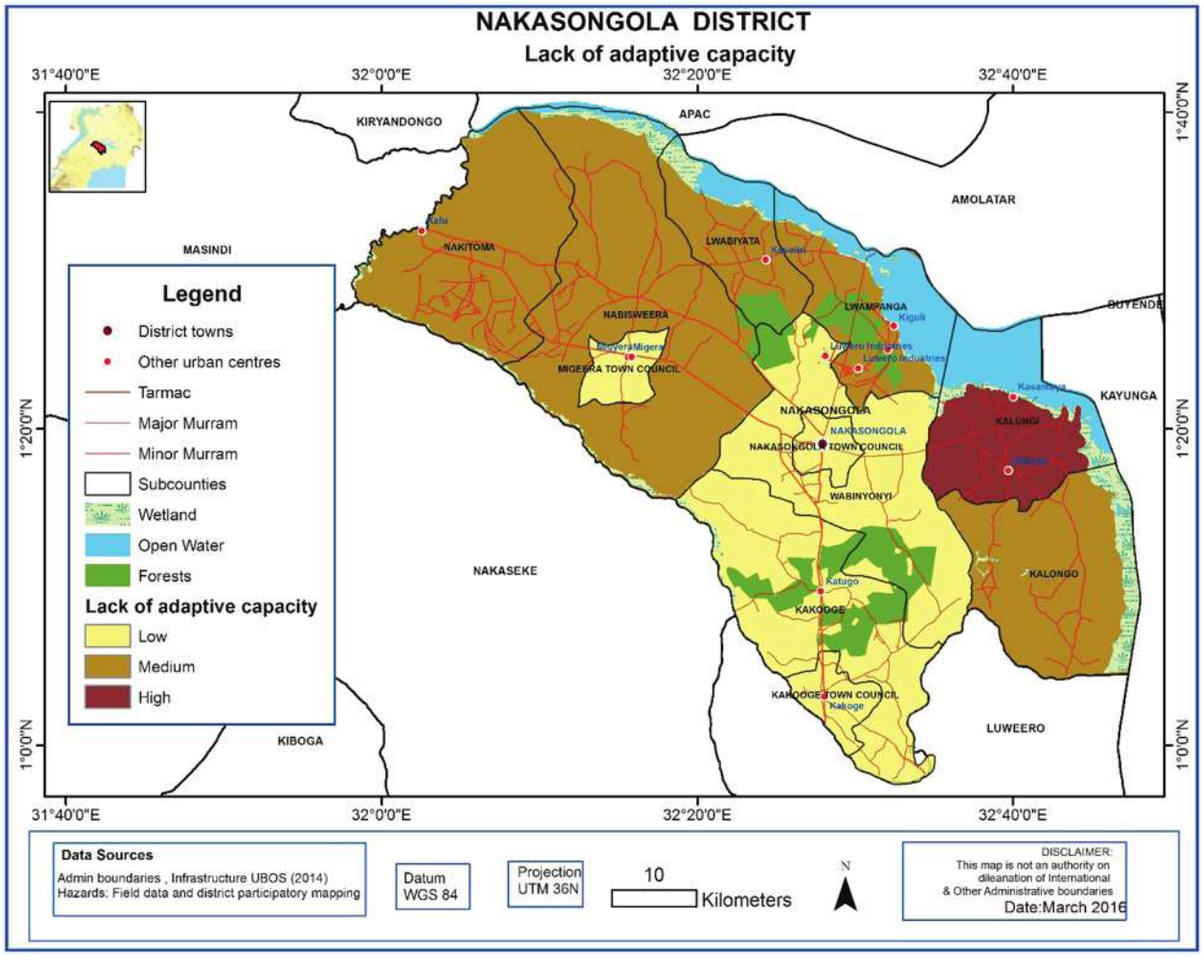

Figure 21 : Lack of adaptive capacity in Nakasongola District

Levels of poverty influenced the adaptive capacity of Nakasongola with Kalungi being the sub county with the lowest capacity to adapt to climate stressors and hazards.

5.4 Vulnerability Assessment

The vulnerability assessment is a result of combination of the exposure, sensitivity and lack of adaptive capacity layers.

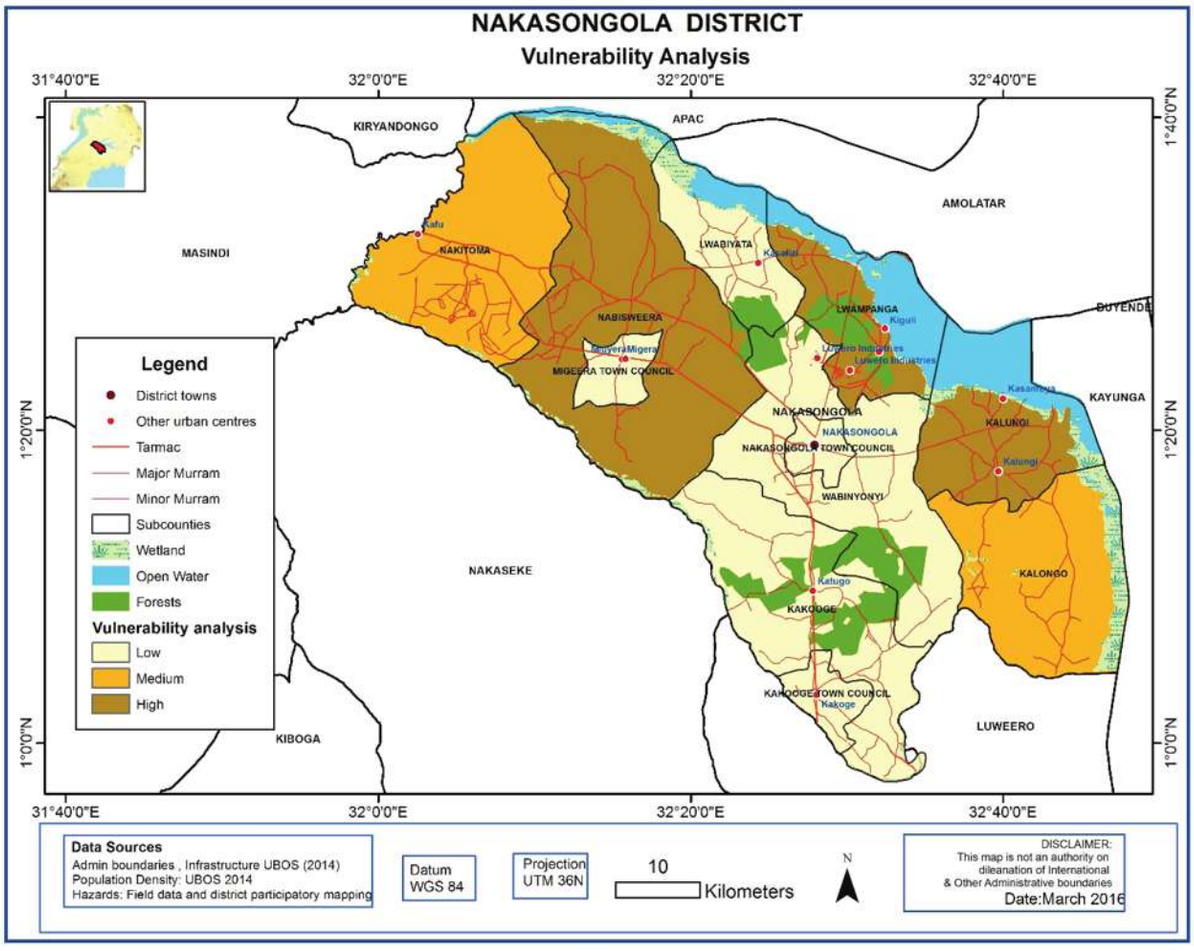

Figure 22: Vulnerability assessment of Nakasongola District

The sensitivity and exposure layers had the greatest influence on the overall Vulnerability of Nakasongola. Nabisweera, Lwampanga and Kalungi exhibited high vulnerability since they are highly sensitive to different hazards and climate stressors.

6.0 COPING STRATEGIES

Table 3 : Coping strategies of Nakasongola district

Hazard	Copying strategies
Drought	• Training/ sensitizations • Tree planting • Promoting alternative livelihood options • Increasing water sources
Human diseases	• Increased awareness through outreach programs • Use of community structures such as VHTs to promote health issues • Increased recruitment of health staff to all facilities
Livestock pests and Diseases	• Training and sensitizations • Provision of more water sources to curb animal roaming • Train farmers in disease diagnosis and treatment • Encouraging reduction of stocks while improving of breeds • Encourage timely spraying of ticks and control of tsetse flies
Crop pests and Diseases	• Training and sensitizations • Increased extension services to farmers • Regular plant clinics • Promoting of resistant / tolerant varieties • Using of recommended agro-chemicals
Environmental Degradation	• Sensitizations and trainings • Promoting tree planting and management of natural regeneration • Enforcement of environmental laws and regulations • Development of community resources management plans
Road accidents	• Installation of adequate and clear signage • Deployment of traffic police to enforce traffic rules • Presence of an ambulance though quite inadequate • Treatment and provision of first aid to victims
Bush fires	• Sensitizations • Enforcement of laws and regulations

Floods	• Sensitizations especially through the DDMC • Enforcement of the protection zone requirements • Conducting of EIAs for any project in such areas
Land Conflicts	• Sensitizing communities about land laws • Lobbying and advocacy for land fund to secure security for tenants against landlords • Promoting land consolidation and succession plans • Encouraging fencing off among the different land use types to avoid confrontations
Vermin and Wildlife attacks	• Awareness creation on what vermin is and responsibilities of stakeholders • Vermin hunting by District vermin control unit • Scare and trapping of vermin
Winds and Lightning	• Promoting tree planting and management of natural regeneration • Sensitization of schools administrators to install lightning arrestors • Incorporated lightning arrestors a mandatory requirement in all institutional blocks constructions within the bills of quantities
Soil Erosion	• Provision of advisory services to farmers • Encourage tree planting through distribution of tree seedlings • Community sensitizations • Research on termites
Population Density	• Sensitizations on birth control methods • Close monitoring by leaders to avoid social distortions that come with increased populations

7.0 GENERAL CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

Over all it was acknowledged that identifying hazards, risks and vulnerable communities is important in the planning process to know which areas require agent attention to address vulnerability. It was also noted that hazard and disaster management should be mainstreamed with a special policy regarding preparedness at all the levels at the district departments to the lower local governments in order to effectively respond to these hazards. Finally, with these hazards profiled it is possible to approach Development partners to assist in intervening or supporting the district in putting up mitigation measures.

7.2 Recommendations

Crop Pests and Diseases

- Ordinances/ byelaws on movement of planting materials.
- Registration and certification of agro-chemical dealers.
- Enhance budget support for certification, plant clinics and extension service delivery

Environmental Degradation

- Include Environment among the grant-aided sectors.
- Recruitment and enhance capacity for Environmental staff.
- Strengthening the financial and technical capacity environment committees.
- Putting in place a District Environmental Ordinance (On-Going).
- Provide more tree seedlings and support to energy saving technology access.
- Strengthening compliance to environmental laws enforcement.

Livestock Pests and Diseases

- Enhance budget support for certification and extension service delivery.
- Regulating private service providers in a bid to control quality of services.
- Provision of constant power supply for Cold chain.
- Increasing stock for ant-rabbies vaccines at health centers

Land Conflicts

- Constituting area land committees.
- Human Disease Outbreak
- Improve stock outs and other consumables.
- Rehabilitation of health centers and improvement of staff houses.
- Budget enhancement for health centers

Road Accidents

- Sensitization and enforcement on Traffic High way code for all road users.
- Installation of road signs and marking.

- Installation of warning signs at black spots.
- Involvement of communities in maintenance of road signs.

Drought
- Enhance budget support for drought tolerant/ climate adaptation and resilient measures.
- Enhance budget support for water harvesting and simple irrigation technologies.

Floods
- Di-silting of streams along wetlands.
- Sensitization of communities along wetlands catchment areas on proper wetland use and good farming practices.
- Implementation of land fund policy

Soil Erosion
- Budget support to carry out the sensitizations.

Vermin and Wild life animal attack
- Budget support for vaccination and sensitization.
- Enforcement.

Strong Winds
- Intensification of tree planting throughout the district especially where there is severe degradation.

Hail storms
- Dissemination of information on weather forecasts

ANNEX I : HAZARD RISK ASSESSMENT IN SUB-COUNTIES WITHIN THE DISTRICT

Sub-county											
Hazard	Nakitoma	Nabiswera	Lwabyata	Nakasongola TC	Wabinyonyi	Lwampanga	Kalungi	Kalongo	Kakooge	Migera TC	Kakooge TC
Floods	H	H	L	N	L	H	H	L	L	N	N
Drought	H	H	H	H	H	H	H	M	M	H	M
Erosion	L	H	L	H	M	L	L	L	L	H	L
Strong winds	L	H	H	L	L	H	H	L	L	L	L
Hailstorms	N	N	N	N	N	H	N	M	L	N	L
Lightning	M	M	N	N	N	N	M	N	N	N	N
Crop pests and Diseases	H	H	H	H	H	H	H	H	H	H	H
Livestock pests and Diseases	H	H	M	H	H	M	H	H	H	M	M
Human disease outbreaks	H	H	H	M H	H	H	H	H	H	H	H
Vermin and Wildlife animal attacks	H	H	M	M	M	M	M	M	M	M	M
Land conflicts	H	H	H	H	H	H	H	H	H	H	H
Bush fires	H	H	H	M	H	H	H	H	L	M	M
Environmental degradation	H	H	H	H	H	H	H	H	H	H	H
Earthquakes	N	N	N	N	N	N	N	N	N	N	N
Road accidents	H	H	N	L	H	L	N	N	H	L	L

N= Not reported, L = Low, M= Medium, H= High

ANNEX II : FIELD DATA COLLECTION QUESTIONNAIRE

DATA COLLECTION

FOCUS GROUP DISCUSSION GUIDE FOR DISTRICT DISASTER RISK MANAGEMENT FOCAL PERSONS

Interviewer Team Name(s)	**District:** **Sub- county:**	**GPS Coordinates**	
		X:	
		Y:	
		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.

Hazard risk assessment

1. Which crops are majorly grown in your area of jurisdiction?
2. Which domestic animals are dominant in your area of jurisdiction?
3. List down/ elaborate on the major contributor’s hazards in the region.
4. Which gender (Male and female) and age group (children≤5, youth10-25, middle aged 30-40, old (>60years) in the societal set-up is the most affected and by what hazard.
5. What challenges are faced by farmers in your area of jurisdiction?

6. Have you experienced any of the following (risks and disasters) in the last 10 years?
    - Floods, Droughts, Landslides, rock falls and erosion
    - Strong winds, hailstorms and lightning
    - Crop pests and diseases
    - Animal pests and diseases
    - Human diseases and out breaks
    - Vermin and wildlife animal attacks
    - Land conflicts
    - Bush fires
    - Environmental degradation
    - Earthquakes and faults road accidents

7. How often do you experience such?

8. Which sub-counties have been most affected?

9. As a way of ranking from (1-5) for not reported, Low, Medium, High and Very high, rank sub-counties that have been most affected?

10. What impacts have been caused by the above hazards?

11. List the above hazards in their order of importance on how they are affecting you?

12. What strategies are being adopted by communities to cope with the above hazards?

13. Is there any relevant government's interventions focusing on mitigating the above challenges?

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THE REPUBLIC OF UGANDA

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

With support from:

United Nations Development Programme

Plot 11 Yusuf Lule, Road, Nakasero
P. O. Box 7184, Kampala, Uganda
Tel: (+256) 417 112 100
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