THE REPUBLIC OF UGANDA

Kalungu District

Hazard, Risk and Vulnerability Profile

2016

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Acknowledgment

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

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

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

EXECUTIVE SUMMARY

The multi-hazard vulnerability profile outputs from this assessment for Kalungu 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).

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

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.

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).

LIST OF 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

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 moving the disaster management paradigm from the traditional emergency response focus toward one of prevention and preparedness. Contributing to the evidence base for Disaster and Climate Risk Reduction action, the Government of Uganda is compiling a national 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 andl ocal levels.

From 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 and vulnerability maps and profiles.Validation workshops were held in close collaboration with ministries, District Local Government (DLG), Development Partners, Agencies and academic/research institutions. The developed maps show the geographical distribution of hazards and vulnerabilities up to 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 Kalungu 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.”

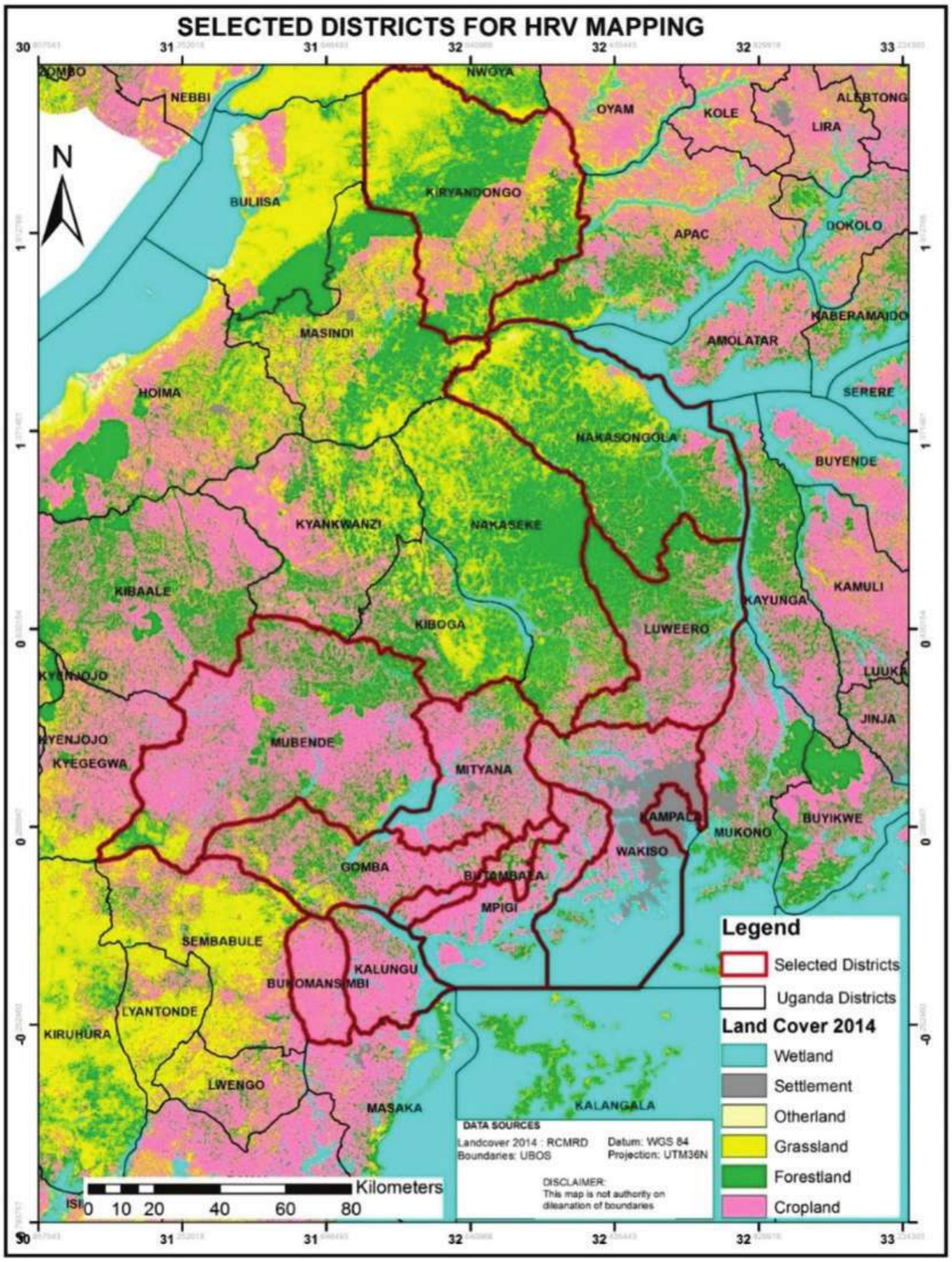

Figure 1: Location of the study area

2.0 Overview of Kalungu District

Kalungu District is located in the Central region of Uganda, South of the Equator. It is named after the 'chief town' of the district, Kalungu, where the district headquarters are located. It boarders Gomba District in the North, Butambala district to the North East, Bukomansimbi in the West, Mpigi District in the East and Masaka District in the South. The 'chief town' of the district, Kalungu, is located 21 kilometers (13 miles), by road, northeast of the city of Masaka, the largest metropolitan area in the sub-region. The coordinates of the district are: 00 06S, 31 49E. The district has only one county, 2 Town Councils, four Sub-counties and a total of 35 parishes/wards, 2 Town boards namely Mukoko and Kyamulibwa and 281 village councils.The district has a total area of about 835.97 sq kms (about 167,193 hectares). Its landscape and topography in general is rolling and undulating with vertical gully heads and valley bottom swamps including streams flowing to the lake and rivers. Most parts of the district are dotted with the hills.

2.1 Geology

No major geological studies have been carried out in the district to determine presence of minerals. However, there are indications of abundant clay and sand that can be used for glass manufacturing. The major deposits are located on the shores of Lake Victoria around Lwera area. Geological studies need to be carried out to assess the potentials. Efforts are being stepped up to have revenue mobilized and collected from these sources.

The soil texture is varied from place to place ranging from red laterite, sandy loam and loam but is in general productive. Soils are generally Ferrallitic, characterized by red colored sandy clay loams.

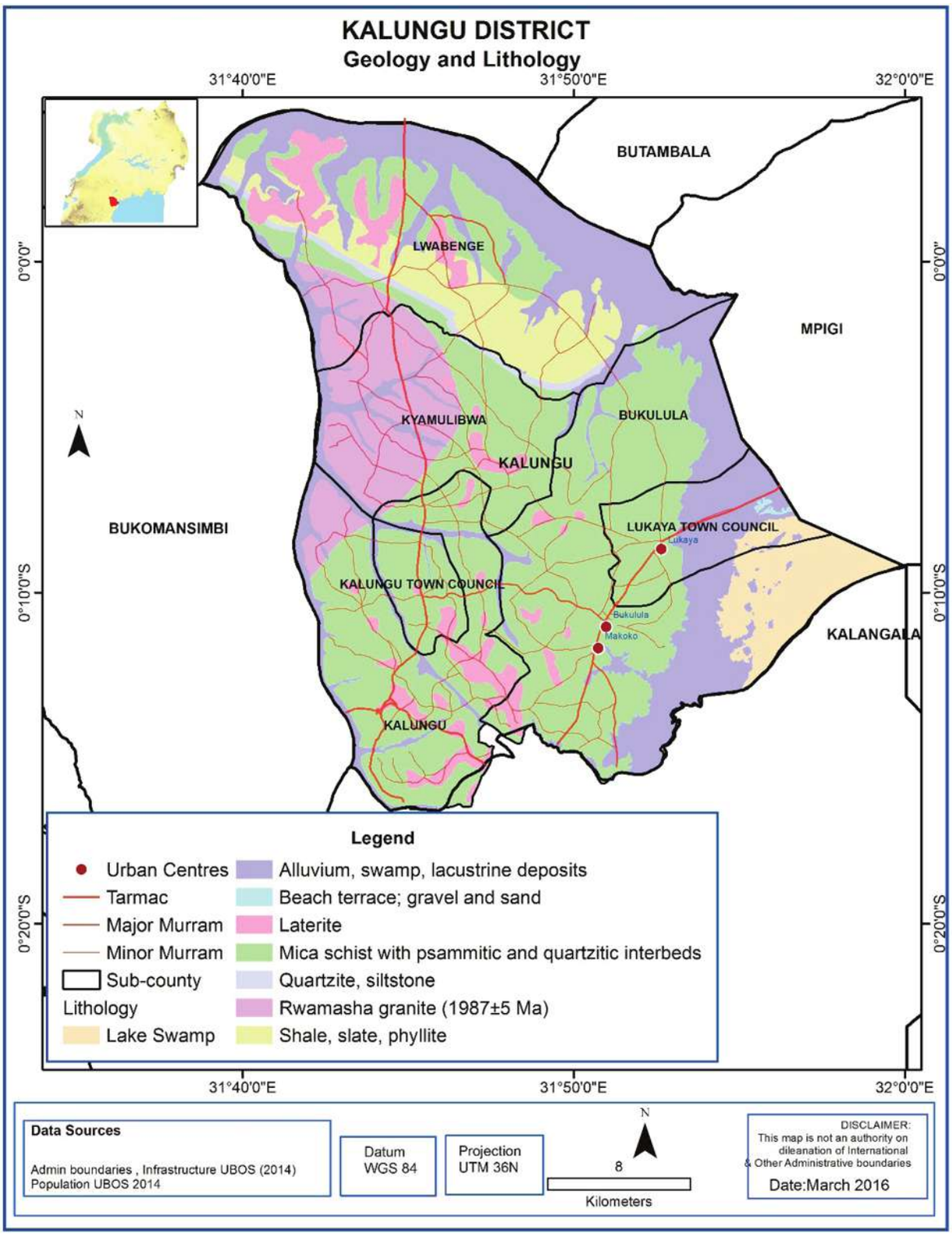

Figure 2: Geology and Lithology structures of Kalungu District

2.2 Vegetation and Landuse stratification

The District has a number of wetlands ranging from swamps, rivers, lake, grassland, open slab land, open water, permanent forested wet area, subsistence farm land, temporal wetlands, temporal wet areas (open slabs), temporal wet area (open trees), woodlands (open slabs), tropical forests.The District has both private local forests and local natural forests. There are three local forest reserves that include Kalongo local Forest reserve (17.9 ha), Nabijoka Local Forest reserves (45.4 ha) and Bugonzi Local forest Reserves (383.8 ha). The District is endowed with larger area of wetlands covering 13936 ha of total land area of 167193 ha.

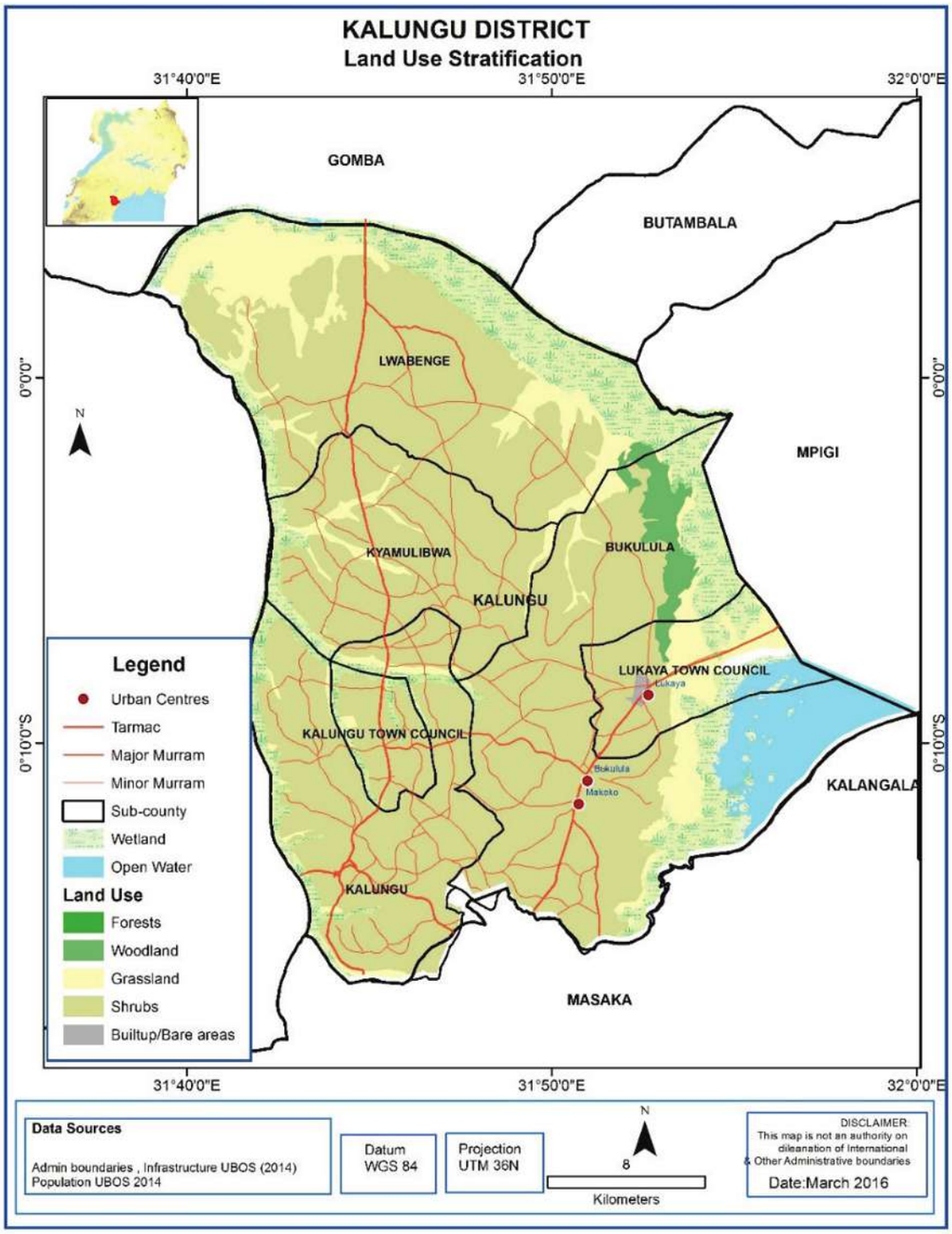

Figure 3: Land use stratification of Kalungu District

2.3 Climatic Conditions

The Climate of Kalungu District is almost semi-arid in areas of Lwabenge, some parts of Kyamulibwa and Kalungu sub-counties. The rainfall pattern is bimodal having two seasons with dry spells between July and August, and January to March. The months of March, April and May receive relatively heavy rainfall which are not well-distributed. The second season occurs in the months of September to December. Generally, Kalungu District is dry, with Lwabenge Sub-county being the driest.

2.4 Population and Demographic Characteristics

The total population of Kalungu District was 160,684 according to (2002 PHC) and 184,131 (2014 PHC). At a growth rate of 1.14 percent per annum, the population is projected to be 404,163 in 2020. The population is disaggregated as follows: 78,508are males (48.8%) and 82,179females (51.2%). The District has a rich cultural heritage and diversity in ethnicity. The majority of the people are Baganda (81.0%), Banyarwanda (7.5%) followed by Banyankole (3.3%), the rest are small tribes. Most of the tribes practice Buganda cultures.

The population density basing on the 2014 census is 192 persons per sq km. Kalungu District have 35,560 households with an average household size of 4.5. The population of the district is younger with children (below 18 years) constituting about 51.0% of the total district male population and 49.0 of the total district female population. The youth constitute of 18.5 percent, of which 54.1 percent are females.On the other hand, the elderly constitute of 6.3 % of the population of Kalungu District.

Available statistics indicate that only 8.1 percent of the households in the district use electricity for lighting, 10.8 percent have no latrines, 47.5 percent stay in temporary houses, 17 percent stay in grass thatched houses and only 24.5 percent live in permanent houses (2002 Population and Housing Census). This indicates the level of development at which the district is. On the other hand, majority of these households (78.4 percent) depend on subsistence farming.

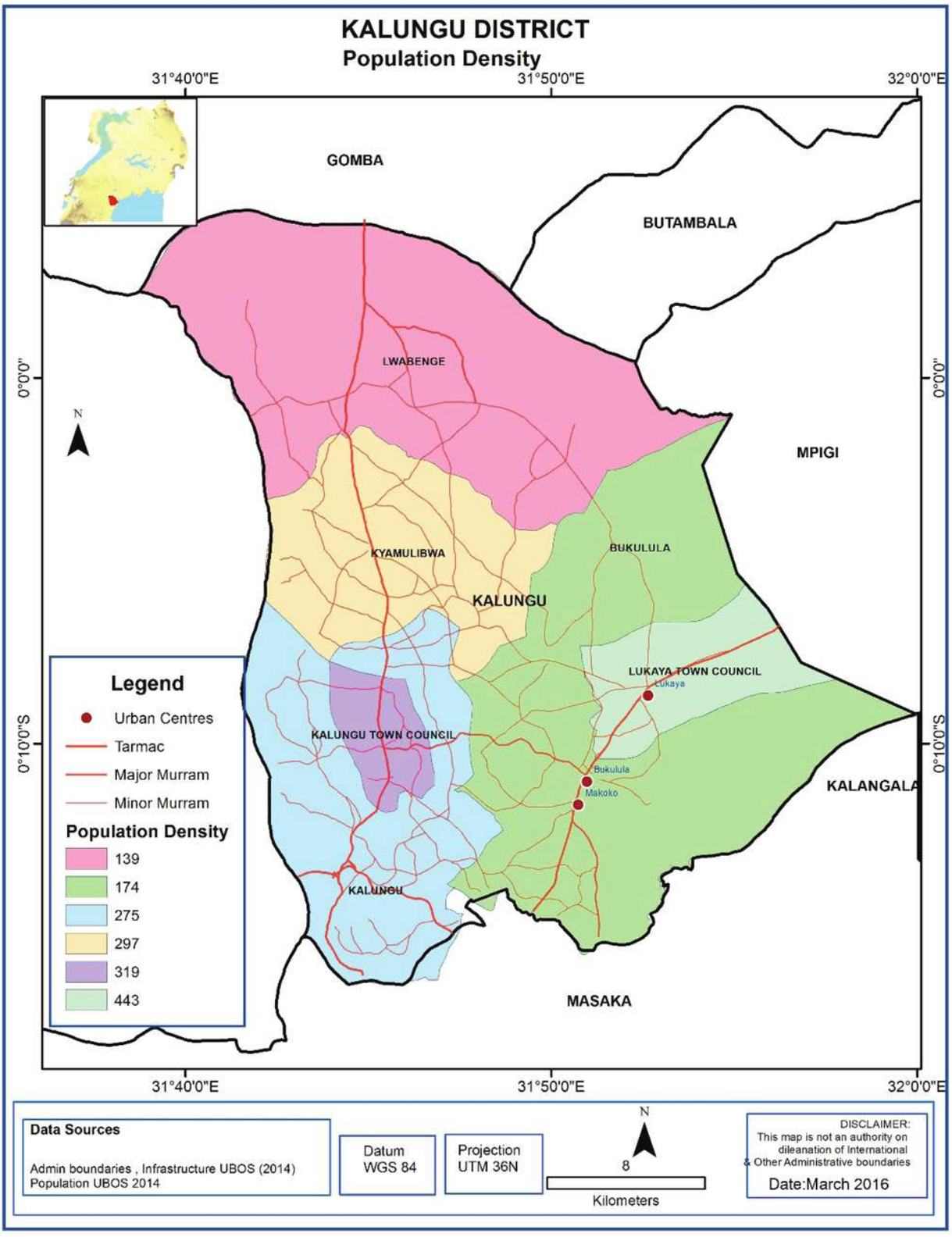

Figure 4: Population Density of Kalungu District

2.5 Main economic activities

Agriculture, livestock farming and fishing in Lake Victoria and the marshes of the Katonga River, constitute the main economic activities in Kalungu District.

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 Field work 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 modeling 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.

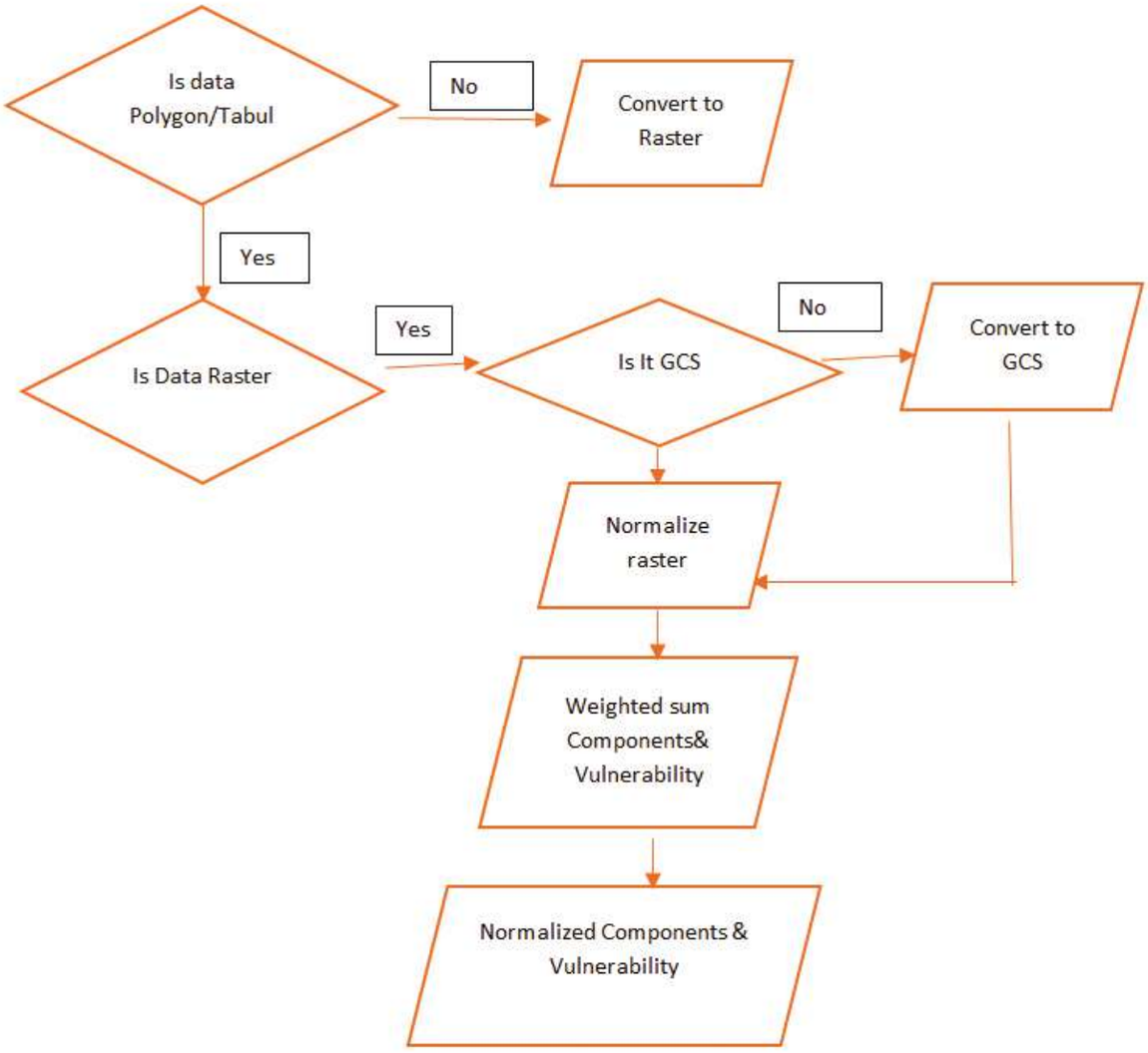

Figure 5: Data conversion work flow

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 Crop pests and diseases

Major crop pests and disease identified were Coffee wilt, coffee twig bora, Bananana bacterial wilt, fruit flies and cassava mosaic. Although with new varieties, cassava mosaic has been seen to be reducing. The burden of crop pests and diseases is all over the district. This is mainly attributed to many new diseases which have come up as a result of climatic change e.g. Banana Bacterial Wilt Disease, Coffee Wilt Disease and Black Coffee Borer etc. Slow adoption of control measures due to inadequate extension coverage and high cost of agro-chemicals were also highlighted.

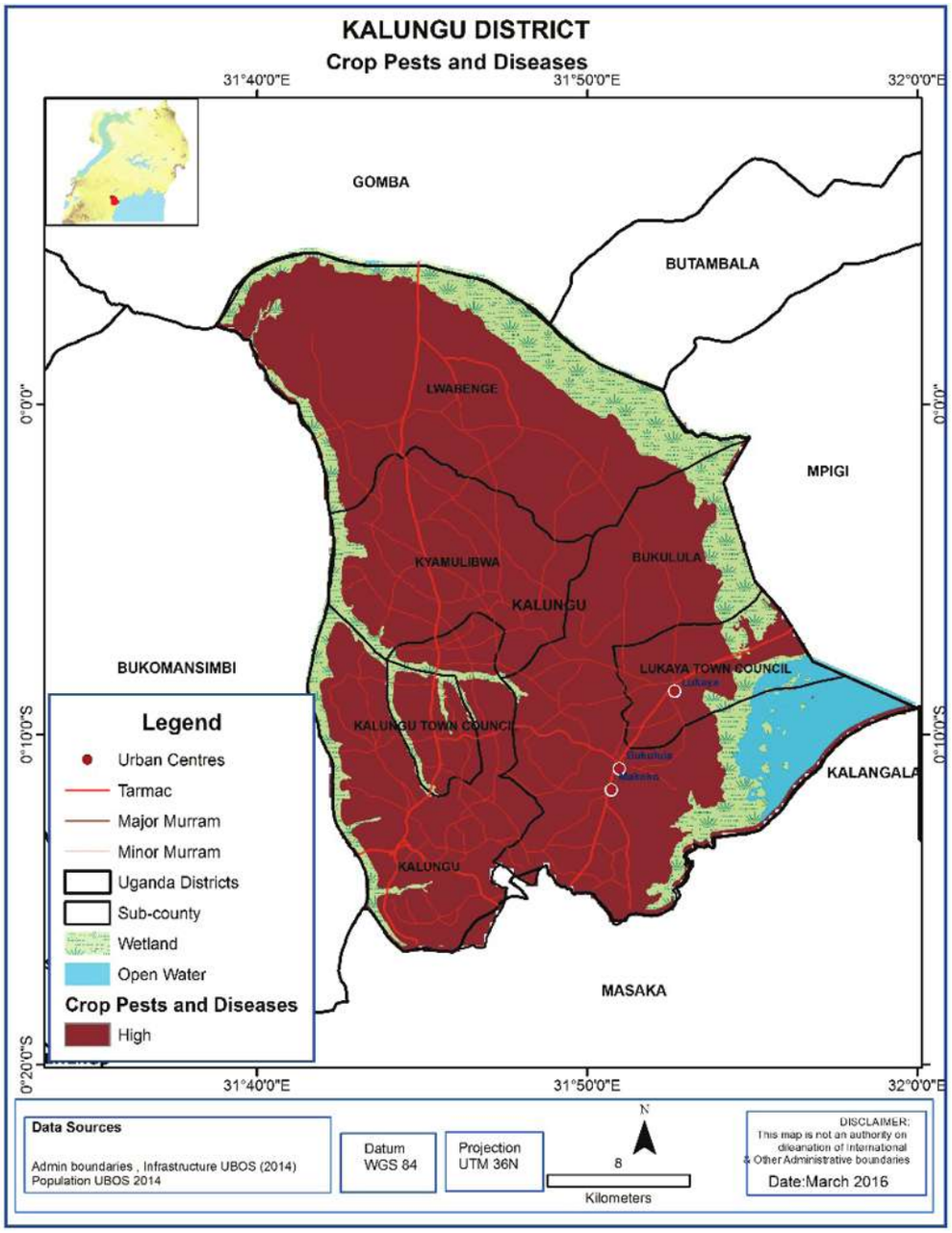

Figure 6: Crop pests and diseases in Kalungu District

4.2 Livestock pests and diseases

Kalungu is prone to foot and mouth disease with outbreaks occurring regularly. This has serious economic implications as animal movements are quarantined. Lwabenge Sub County is mostly hit. Kalungu is also one of the major pig producers in the greater masaka region. However, farmers are challenged by regular outbreaks of African swine fever which wipes out the entire herds. This was attributed to uncontrolled movements of pigs by traders who move from farm to farm as they buy pigs spreading the virus. The other key factor why the disease has become endemic is that there are wild bush pigs that habour the virus and continue to be the source of new outbreaks. The entire district is affected by pests and diseases. Inability of farmers to afford the required control and treatment chemicals, few extension staff, uncontrolled movement of animals and laxity of farmers to use available control measures were highlighted as the main challenges to control livestock pests and diseases.

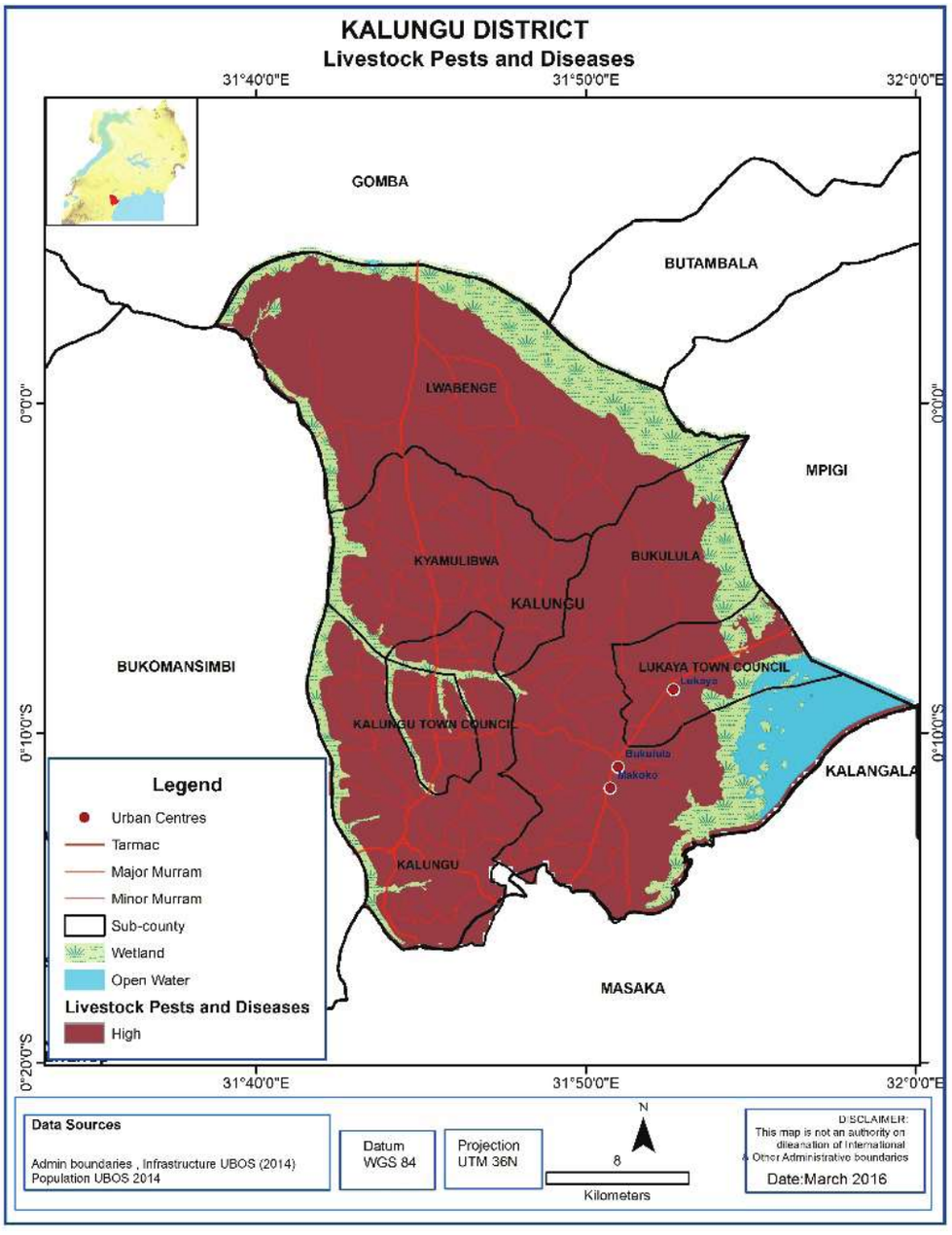

Figure 7: Livestock pests and diseases in Kalungu District

4.3 Environmental degradation

Encroachment of wetlands for sand mining, conversion of wetlands to farms and eucalyptus plantations was noted as a major threat to the environment in Kalungu. Brick lying in wetlands was observed to be a threat too. The issue of sand mining especially in Lwera area has become a serious problem, impacting on roads as well. Because sand miners mine near the roads and broke water ways and whenever it rains you get serious problems with over flooding which further weakens the roads as vehicles continue to pass.

Sand mining in unsustainable manner and without protective gears presents a serious threat. Miners need to follow and adhere to strict environmental laws and safety. For instance they are leaving behind pits full of water which can be very dangerous especially to children as well as becoming breeding habitats for mosquitoes. Stone quarry at Kyakunda without protective gears or any safety measures also present a big risk to workers.

It was also noted that there were many child workers on the site. Kyamulibwa, Kalungu, Bukulula and Lukaya Town Council were featured as the hotspots. Search for productive areas during dry spells; Search for Fuel wood; Scarcity of land for settlements; Urbanization; Mining activities; brick making were noted as the main contributors of environmental degradation in these hotspot areas.

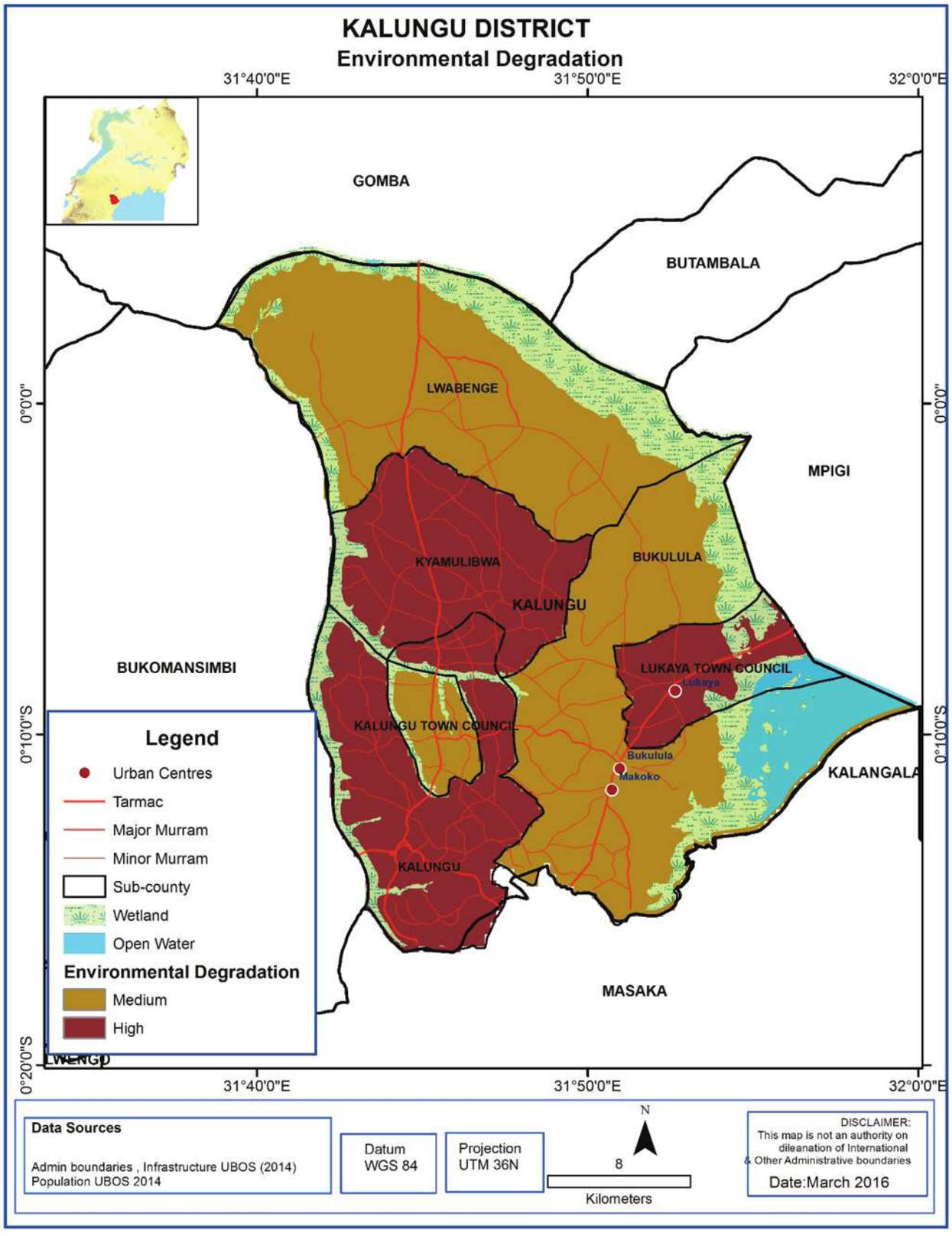

Figure 8: Environmental Degradation in Kalungu District

4.4 Human diseases outbreaks

Malaria still remains the major killer disease in the district although there are several interventions being done including distribution of ant-malarial drugs and mosquito nets. It was also noted that HIV& AIDS is a big threat with prevalence of 13% way above the national average near the areas close to landing sites and in Lukaya Sub County a place popular for truck drivers one of the most vulnerable populations. Lukaya is also prone to water borne diseases such as typhoid and diarrhea because of the contaminated water sources. Hypertension and diabetes were also found to be some other increasing diseases within the district. Poor hygiene; Low latrine coverage; risky sexual behaviors of truck drivers and fishermen were noted to be responsible of the increased occurrence of disease burden. Lwabenge, Lukaya Town council and Kalungu town council were highlighted as the hotspots.

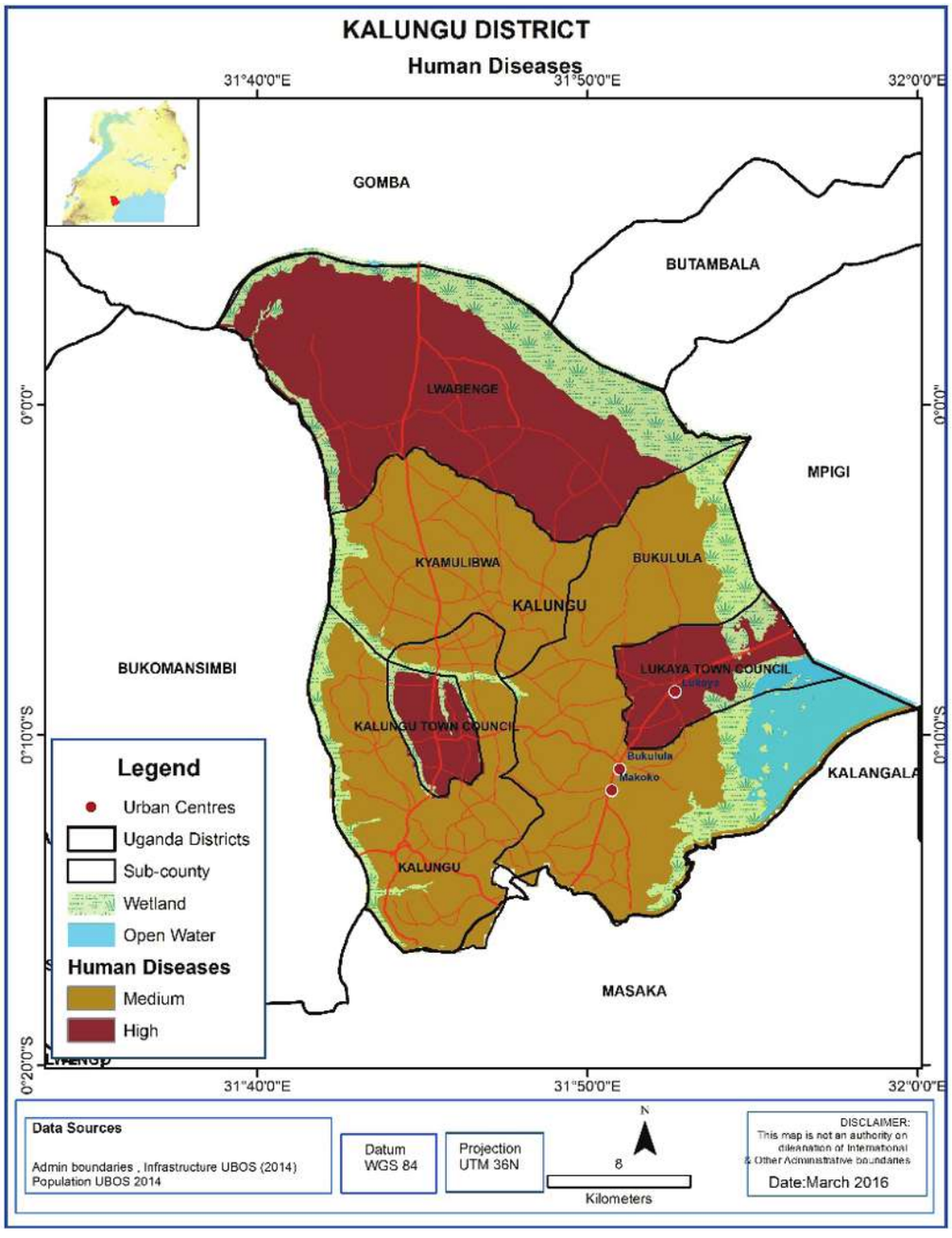

Figure 9: Human diseases in Kalungu District

4.5 Droughts

Kalungu literary means ‘like a desert’ and that is where its name was derived. The entire Kalungu is prone to prolonged droughts as it is located within the cattle corridor. However, sub counties of Lwabenge, Bukululа, Kalungu and Lukaya are heavily hit, with planted crops drying up prematurely an issue prevailing hunger within the district.

These places are also water stressed and in a dry season, streams dry up and finding water can be very challenging. Lukaya is prone to water borne diseases as most water sources are contaminated. Encroachment on Lukaya town council and Kalungu sub county wetlands could be responsible for the increase of such dry spells.

To mitigate the impacts of such prolonged dry spells, water harvesting is being encouraged by building valley tanks and household tanks. Sensitization of the communities to plant of early maturing crops and drought tolerant crops is also being done. And demo-mini irrigations have been put up to sensitize the public on how to cope with the challenge of prolonged dry spells.

Lwabenge and Lukaya were noted as hotspots. Lwabenge is in the dry cattle corridor and Lukaya T.C. is naturally in a rain shadow. The dry spells are mainly due to climate change which is a result of manmade activities.

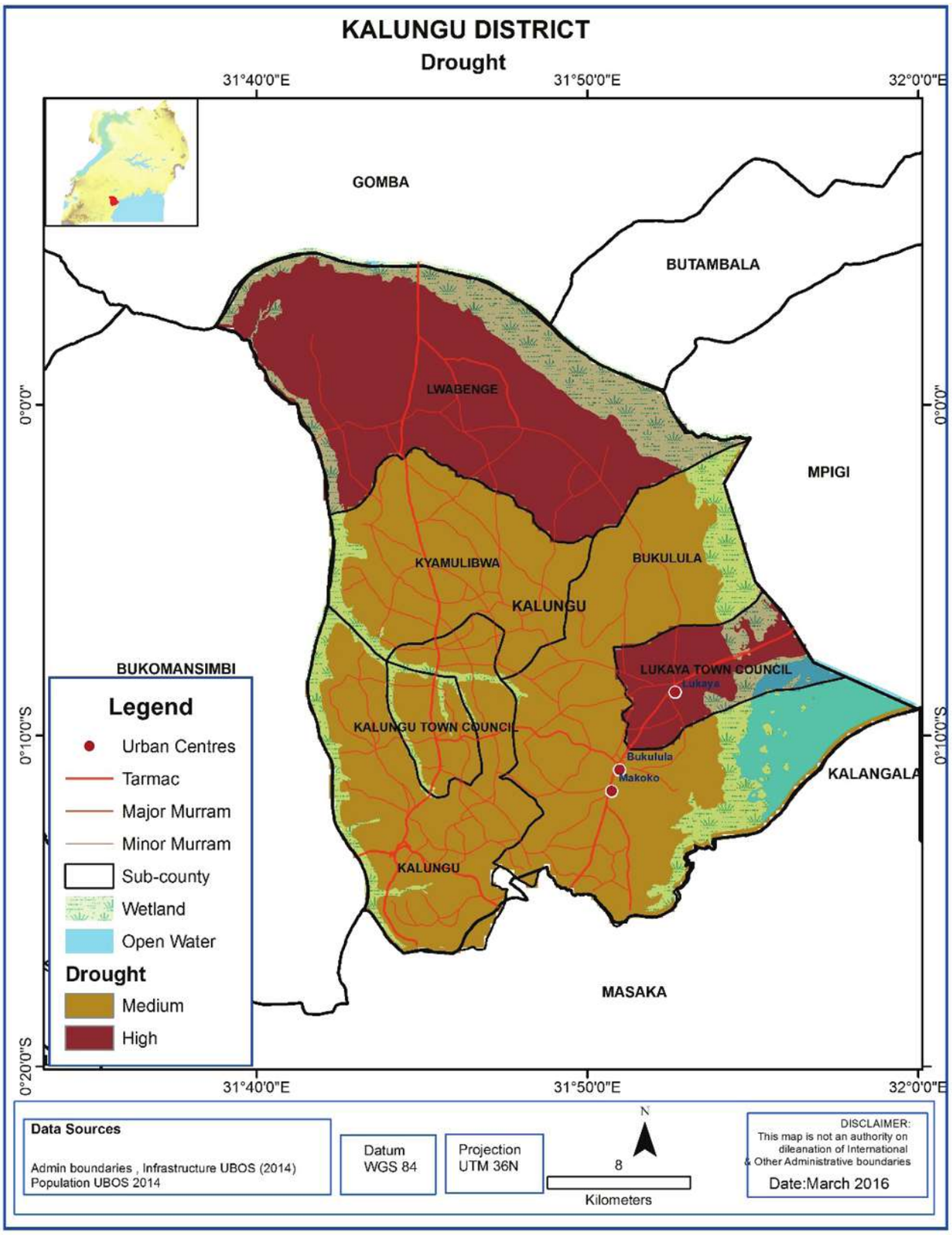

Figure 10: Drought in Kalungu District

4.6 Road accidents

Road accidents were also noted to be high especially in Lukaya town council. The volume of traffic is high at Lukaya and therefore need proper control to minimize on accidents. Some surface roads are also not good for example in Bukulura were vehicles skid. The incidence is very high during heavy rains in the months of March-May and September to November. According to police reports, on average one fetal accident every month is reported and three serious accidents and four minor accidents. Regular deployment of traffic officers on the road, sensitization of road users on traffic rules and regulations and establishment of road strips and humps were suggested as major control measures. Lukaya Town council (areas in Lwera along the Kampala – Masaka main road), Bukulula (Mukoko, Kabaale Bugonzi) and Kalungu Sub county (Kitante) were noted as hotspots. Over speeding, sharp corners. Design of the road (slippery surface especially when it rains); very narrow roads; poor road etiquette and drunken driving were observed to be the continual causes of these accidents.

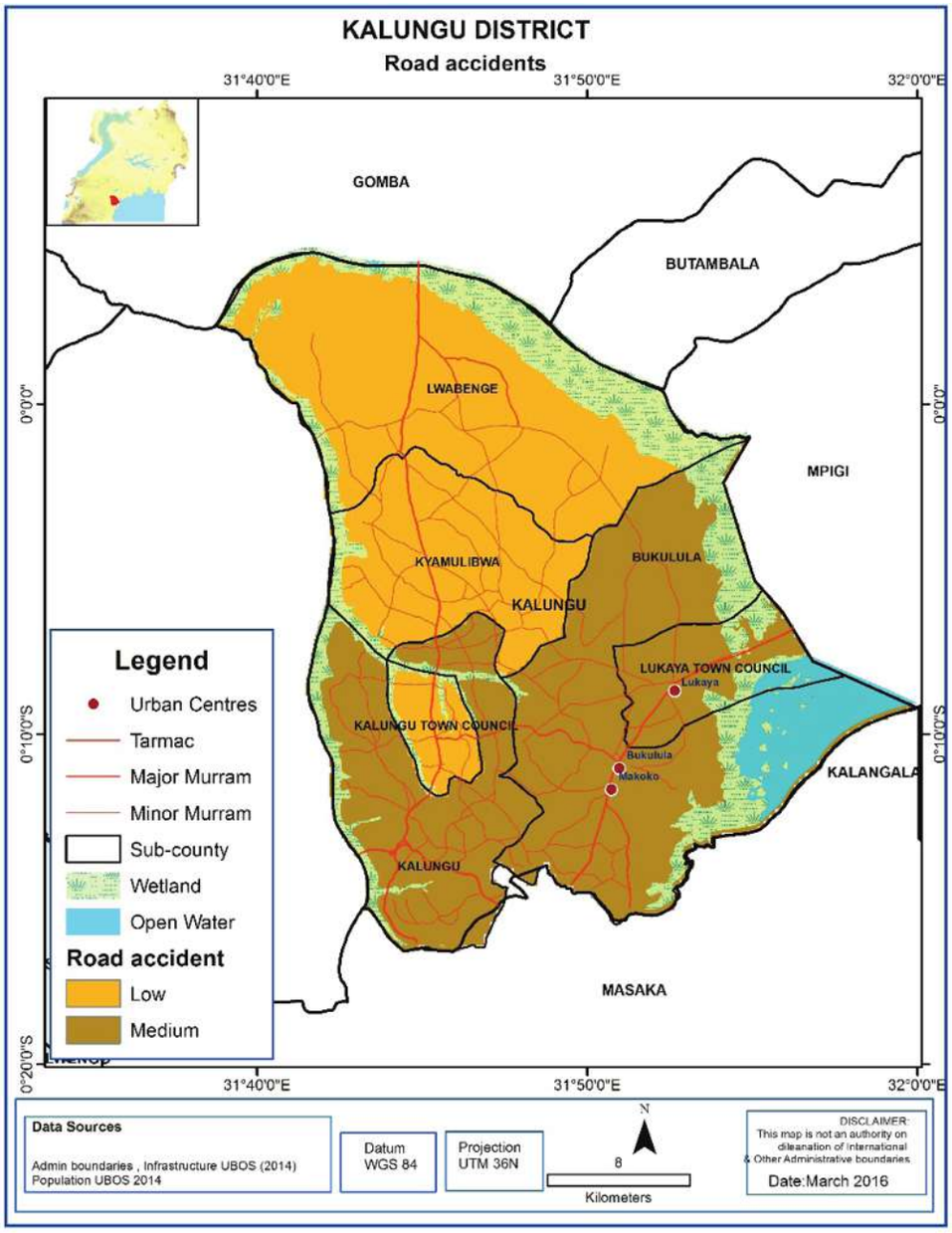

Figure 11: Road accidents in Kalungu District

4.7 Land conflicts

Poor land tenure system was highly regarded as the major cause for land wrangles. Lwabenge Sub County was noted to be highly affected by land wrangles while in other sub counties land conflicts are relatively low. Ignorance, delayed development and demarcation of allocated public land coupled with high rate of settlement by migrants in the area. Hotspots in Lwabenge, are Bugomola & Bwesa Parishes.

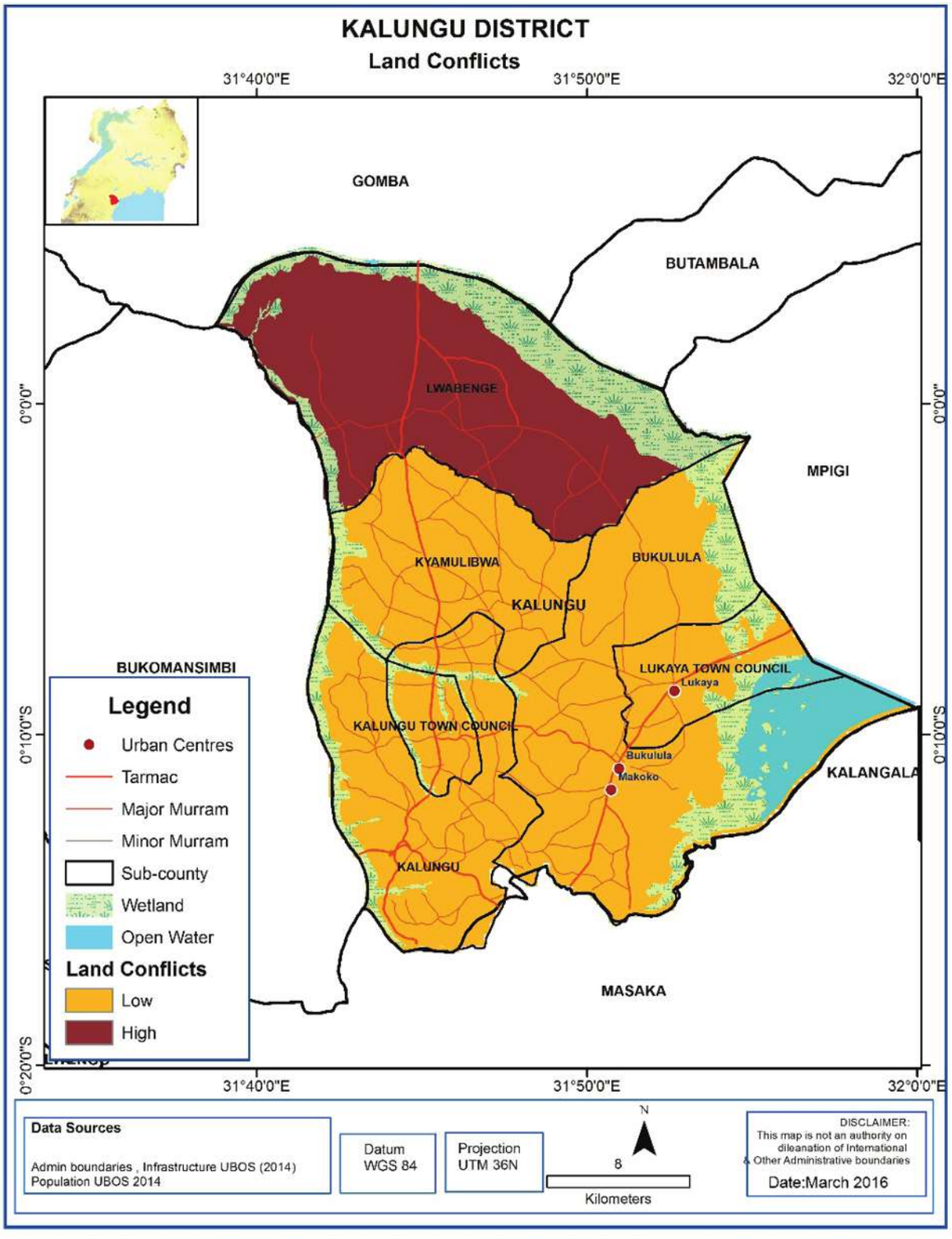

Figure 12: Land conflicts in Kalungu District

4.8 Floods

Floods are known to occur in Lukaya town council, Kalungu Sub County and in Lwabenge subcounty around muguba swamp, kabuki swamp and Katoga River and swamp. Severity of these floods depends on the amount of rains. These floods come during the heavy rains of September and November. Poor physical planning in Lukaya town council and encroachment of wetlands especially in Lwera area is responsible for the increased flooding impacts. A physical structural plan for Lukaya town and enforcement of existing policies and regulations on wetlands will help built residence of these communities from floods. Hotspots were noted in Lukaya town council, areas adjacent to Lwera, and low lying areas in centre of Lukaya central Ward. Increased unplanned Human settlement and activities in wetlands and low lying areas continue to affect natural drainage resulting in flooding.

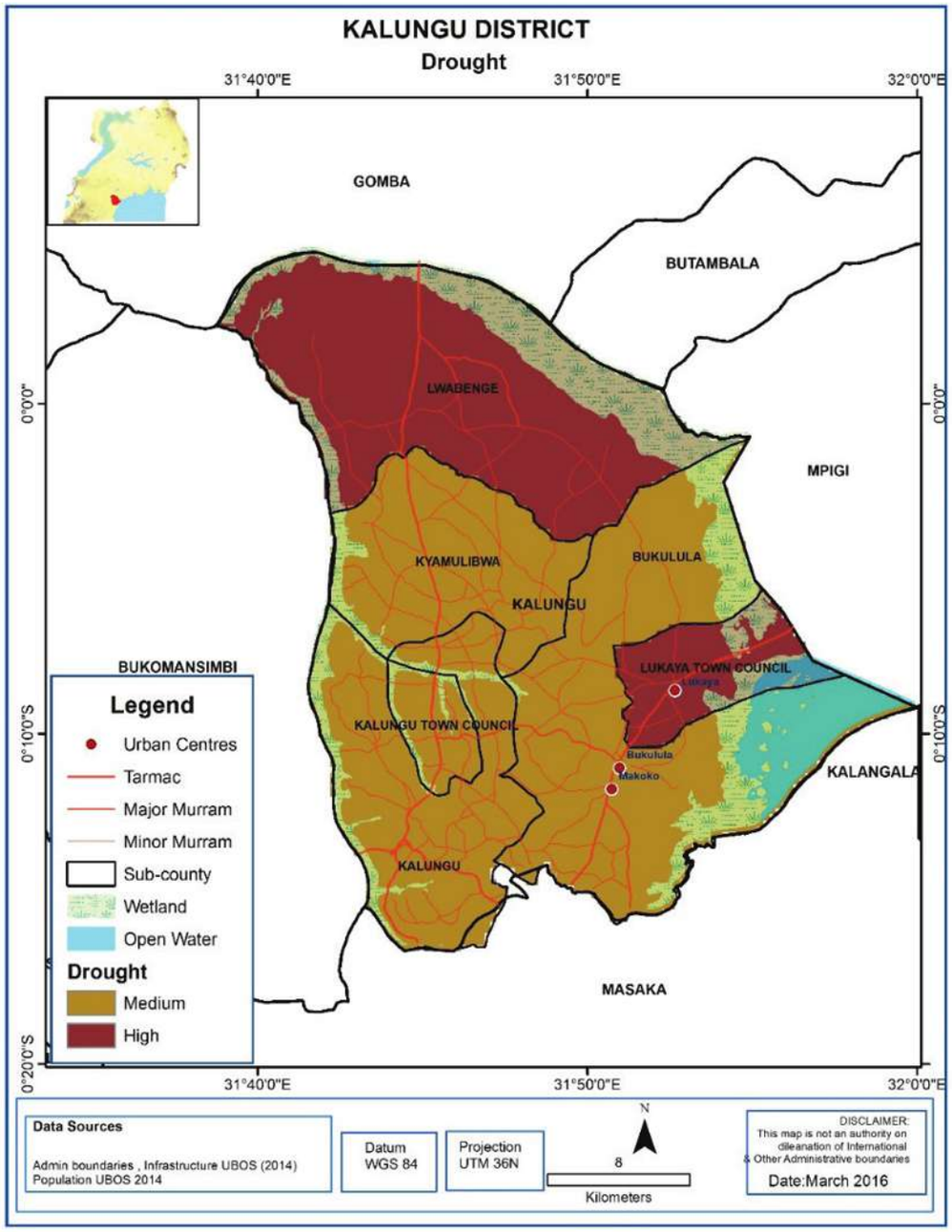

Figure 13: Drought in Kalungu District

4.9 Vermin's and wild animals

It was noted that vermins are persistent close to major wetlands such as the Katoga swamp. Most of the vermin's are monkeys from degraded forest fragments and bush pigs in the wetlands. Stray dogs in towns were identified as a challenge with cases of rabies being reported. Encroachment on wildlife habitats was noted to be resulting in increased vermin problems. Lwabenge Sub-county, Bugomola and Bwesa parishes were noted as hotspots.

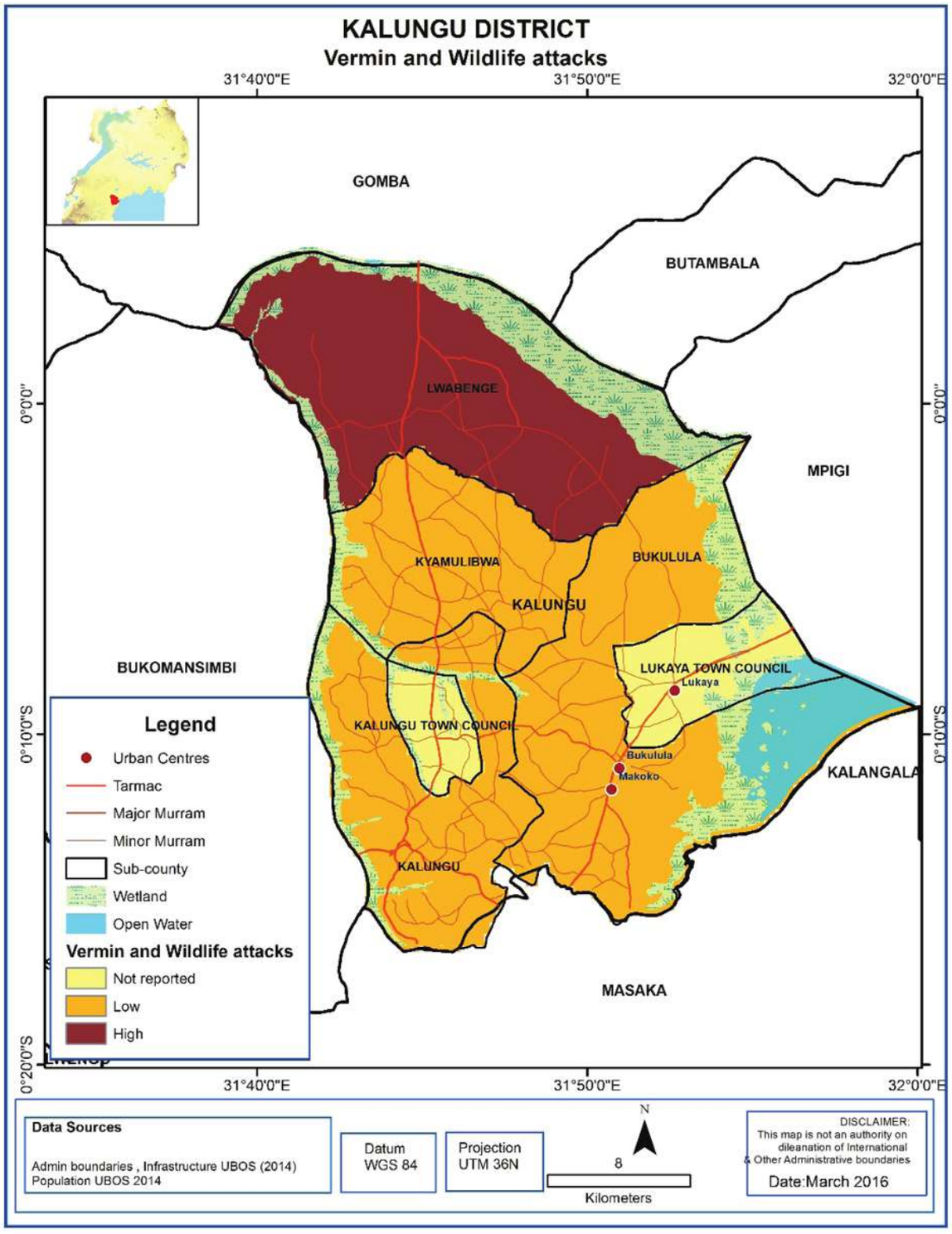

Figure 14: Vermin and Wildlife attacks in Kalungu District

4.10 Soil erosion

Soil erosion was observed to be affecting the entire district although at low levels. Poor methods of farming and environmental degradation were noted to be the main cause.

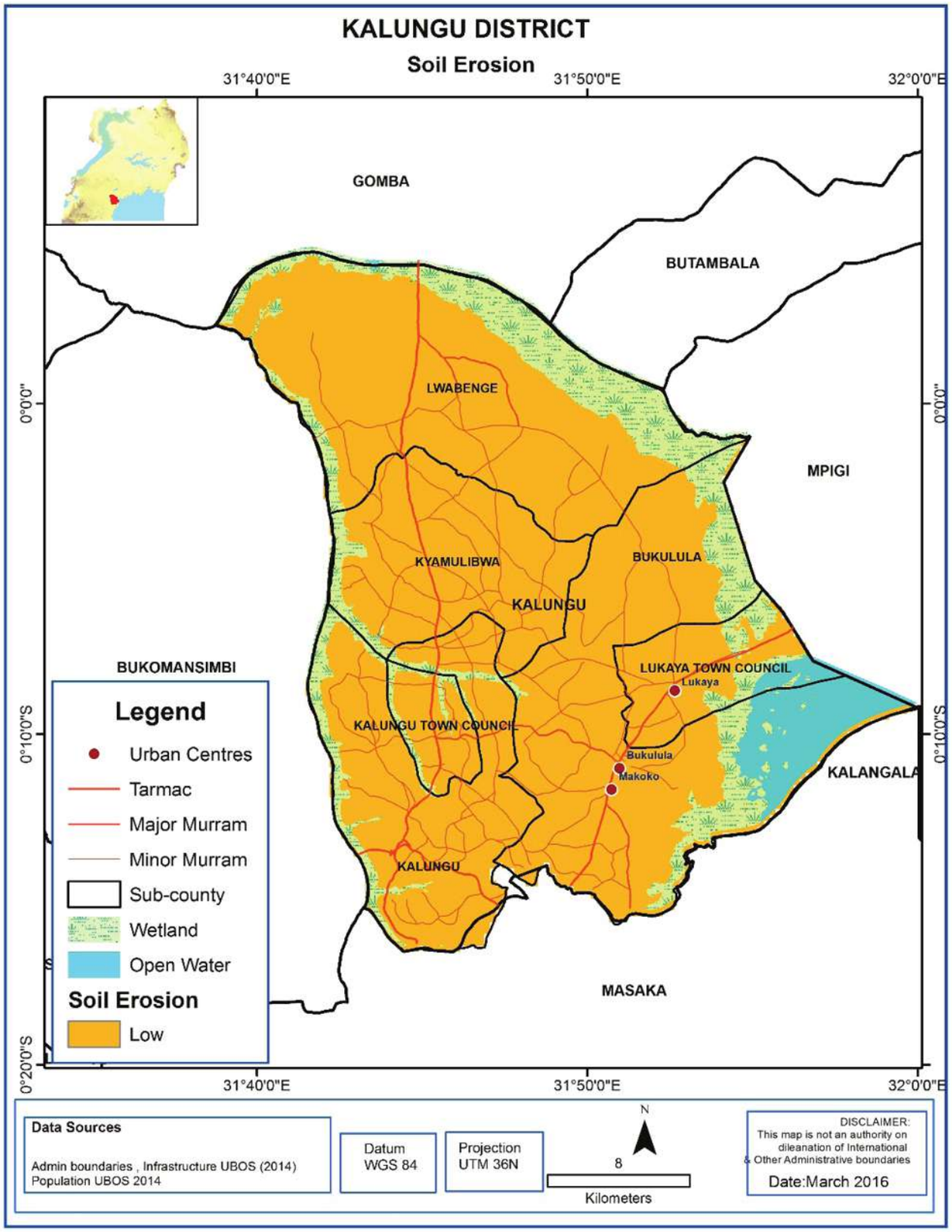

Figure 15: Soil Erosion in Kalungu District

4.11 Strong winds, hailstorms and lightning.

It was noted that incidences of strongwinds are relatively low in the district with exception of Lukaya where you they get medium winds occurring at the end of a dry seasons. Strong winds occurrences are due to minimal protection in terms of windbreaks. Kalungu and Lwabenge are prone to hailstorms. A combination of winds and hailstorms togather with minimal protection in terms of windbreaks. Results in severe damange.Occurrences of lightning are relatively low with occurences in Lwabenge and Kalungu Sub County being the most prone.

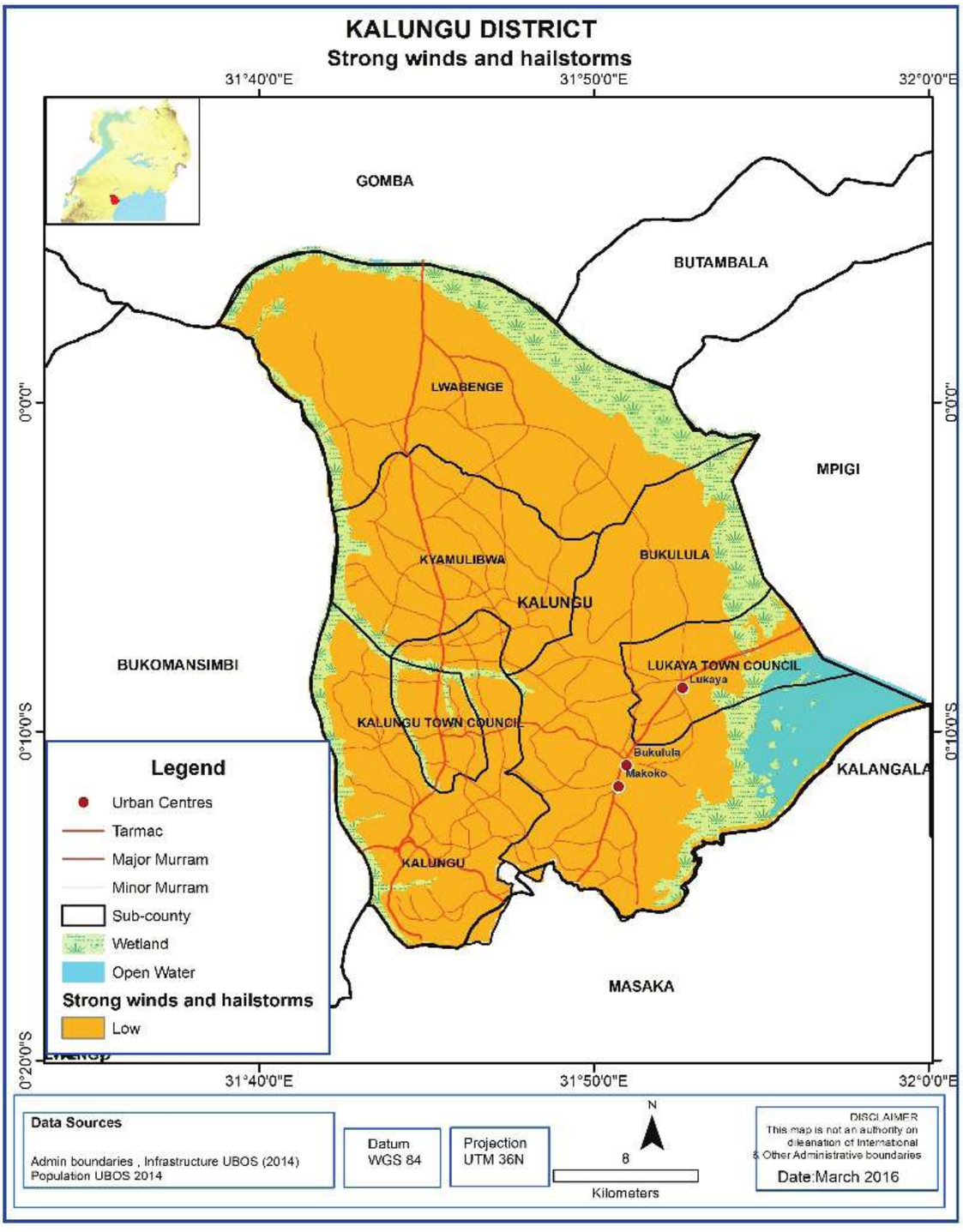

Figure 16: Strong winds and hailstorms in Kalungu District

4.12 Bush fires

Bush fires are only used during preparation of land for agriculture. Although such fires are becoming common in wetlands as people increasingly encroach on wetlands. They are also used to regeneratae pastures.

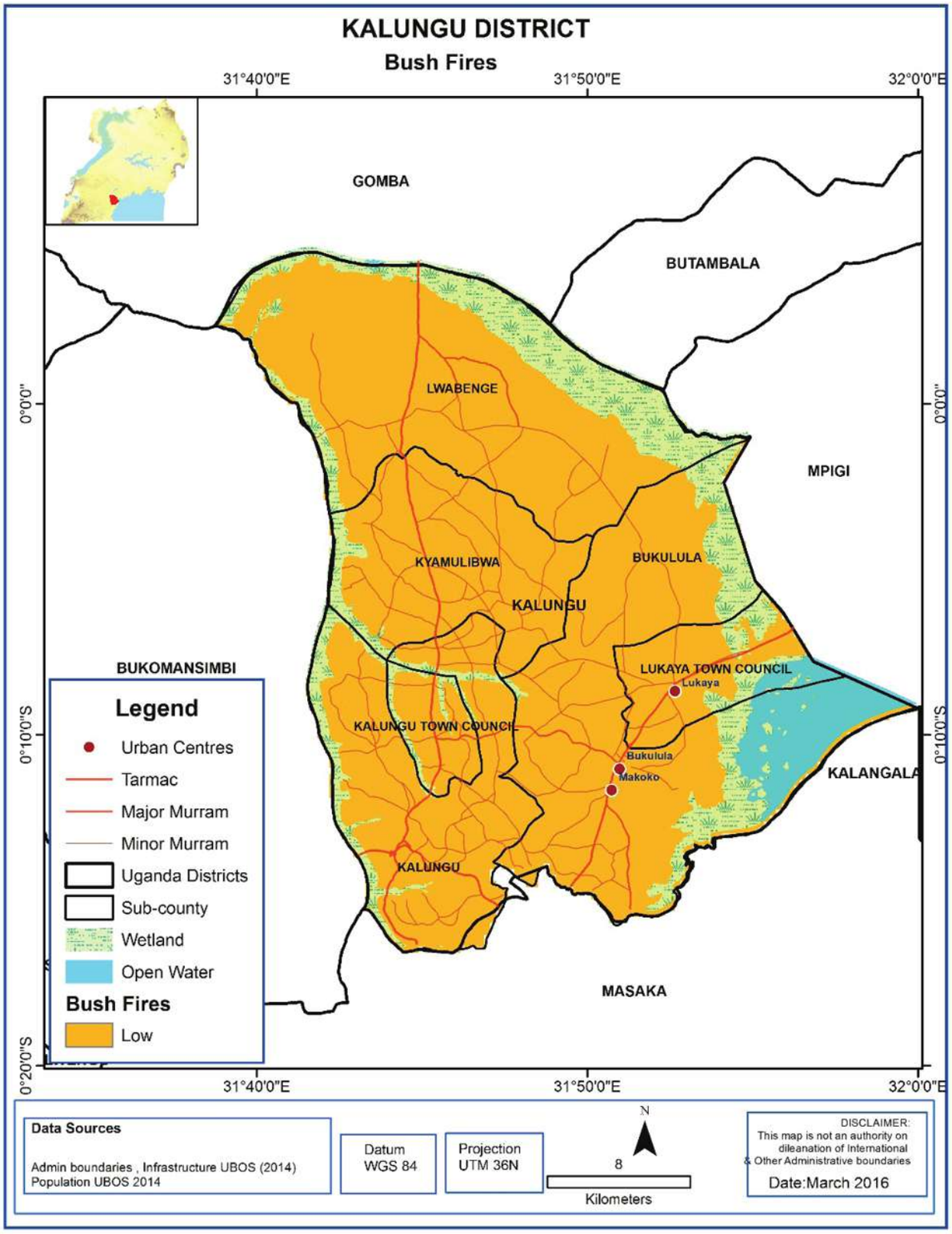

Figure 17: Bush fires in Kalungu District

5.0 Coping Strategies

Table 1: Coping strategies of Kalungu district

Hazard	Coping strategies Kalungu
Crop Pests and diseases	• Training and Sensitization of farmers on control measures • Establishment of community structures for enforcement of control measure
Livestock pests & diseases	• Sensitization and now veterinary extension workers have been recruited to intensify sensitization.
Environmental degradation	• Enforcement of environmental policies and regulations • Training on forest management systems • Tree planting and restoration of degraded forest reserves • Environmental impact assessment
Human Disease outbreaks	• Sensitization • Care and treatment • Counselling and testing
Drought	• Timely cropping. • Popularization of drought resistant and early maturing crop varieties • Promoting water harvesting technologies. • Constructed two valley tanks for water for production
Road accidents	• Humps especially in Lukaya • Enforcement of traffic laws and regulations by traffic police.
Land conflicts	• Conflict resolution by area land committees and RDCs office. • Sensitization on the land act • Registration of land titles.
Floods	• Development of a structural plan
Vermin and wild life animal attacks	• Ant-vermin control campaigns – Destruction of vermin by local hunters
Erosion	• Training of farmers on improved farming practices • Demonstration of soil and water conservation measures in Mabuye, Bukulula Sub County. • Restoration of some affected areas in Kasaali & Kabale-Bugonzi parishes in Bukulula Sub County
Hailstorms	• Tree planting
Lightning	• Tree planting • Sensitization on usage of lightning arresters
Bushfires	• Sensitization on negative effects of bush burning.

6.0 District Vulnerability Analysis at District level

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

6.1 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.

PPTCV + AVGPPT + AVGTEMP + FLOOD + DROUGHT = **EXPOSURE**

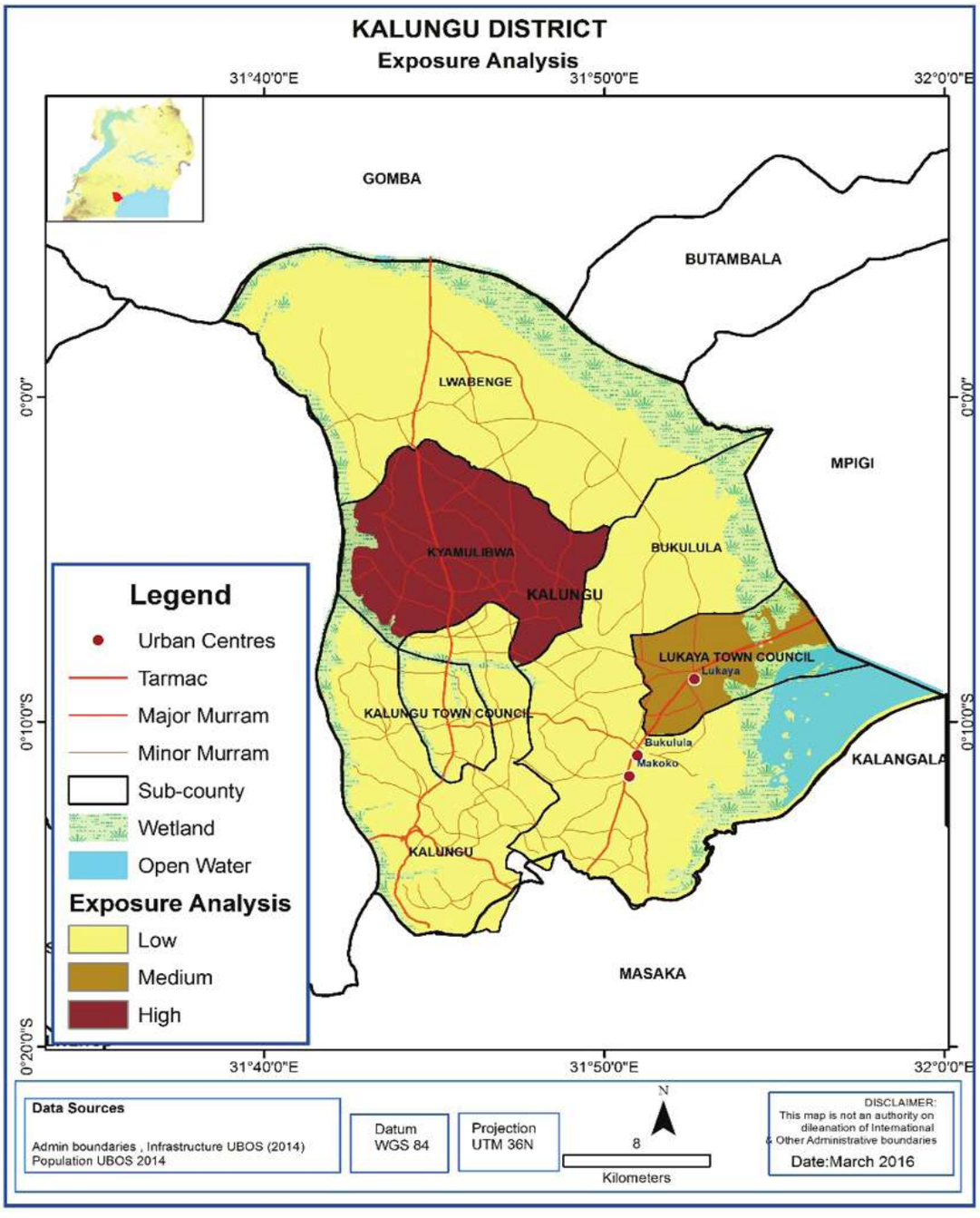

Figure 18: Exposure of climatic conditions in Kalungu District

Drought and decreases in annual average precipitation and increasing annual temperatures leading to contributed to the level of vulnerability to climate stressors in Kalungu with Lwabenge being highly affected.

6.2 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.

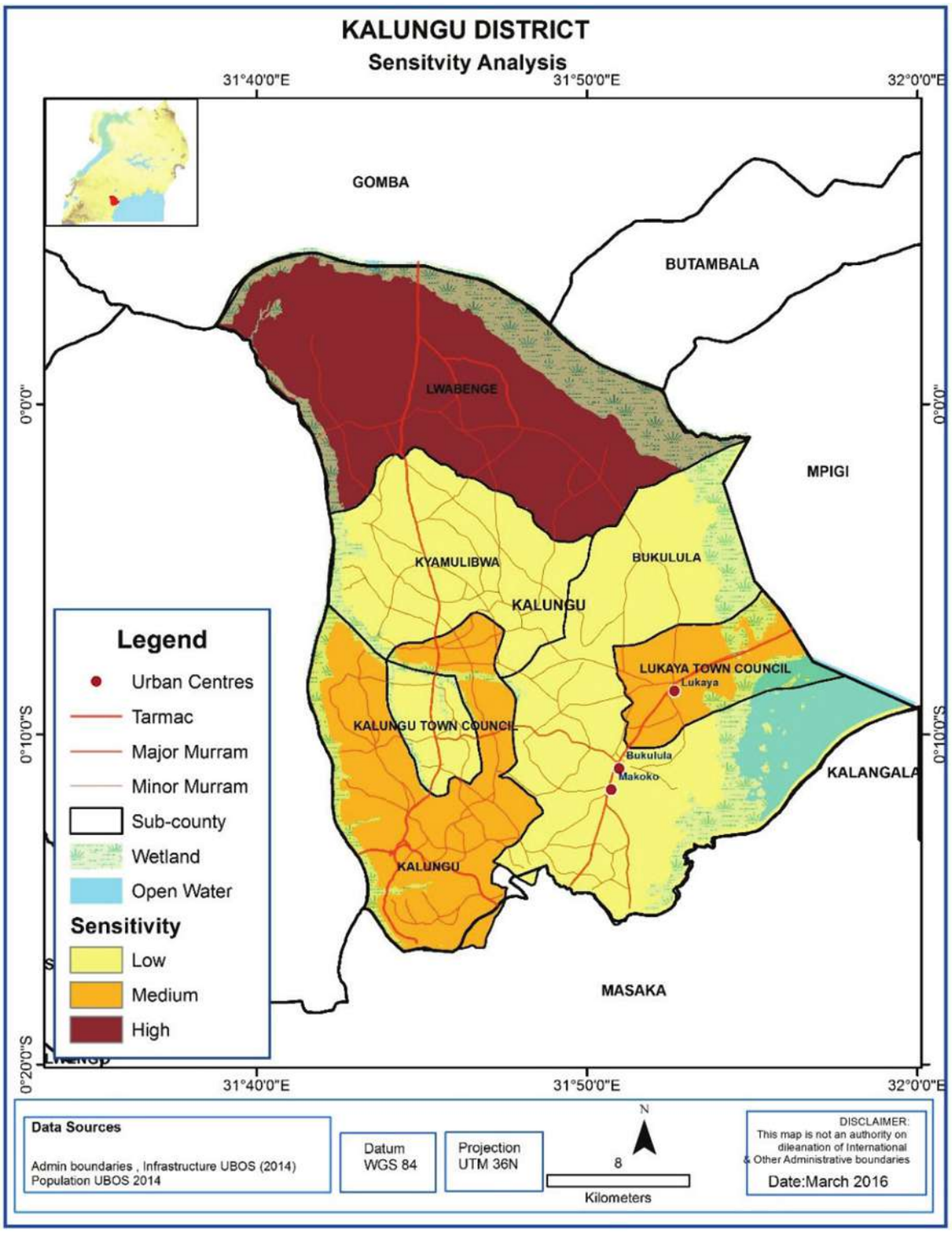

Figure 19: Sensitivty of stressors in Kalungu District

In Kalungu, Lwabege is most sensitive to the stressors with human diseases, vermin pests and environmental hazards greatly influencing the sensitivity layer.

6.3 Lack of Adaptive Capacity

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

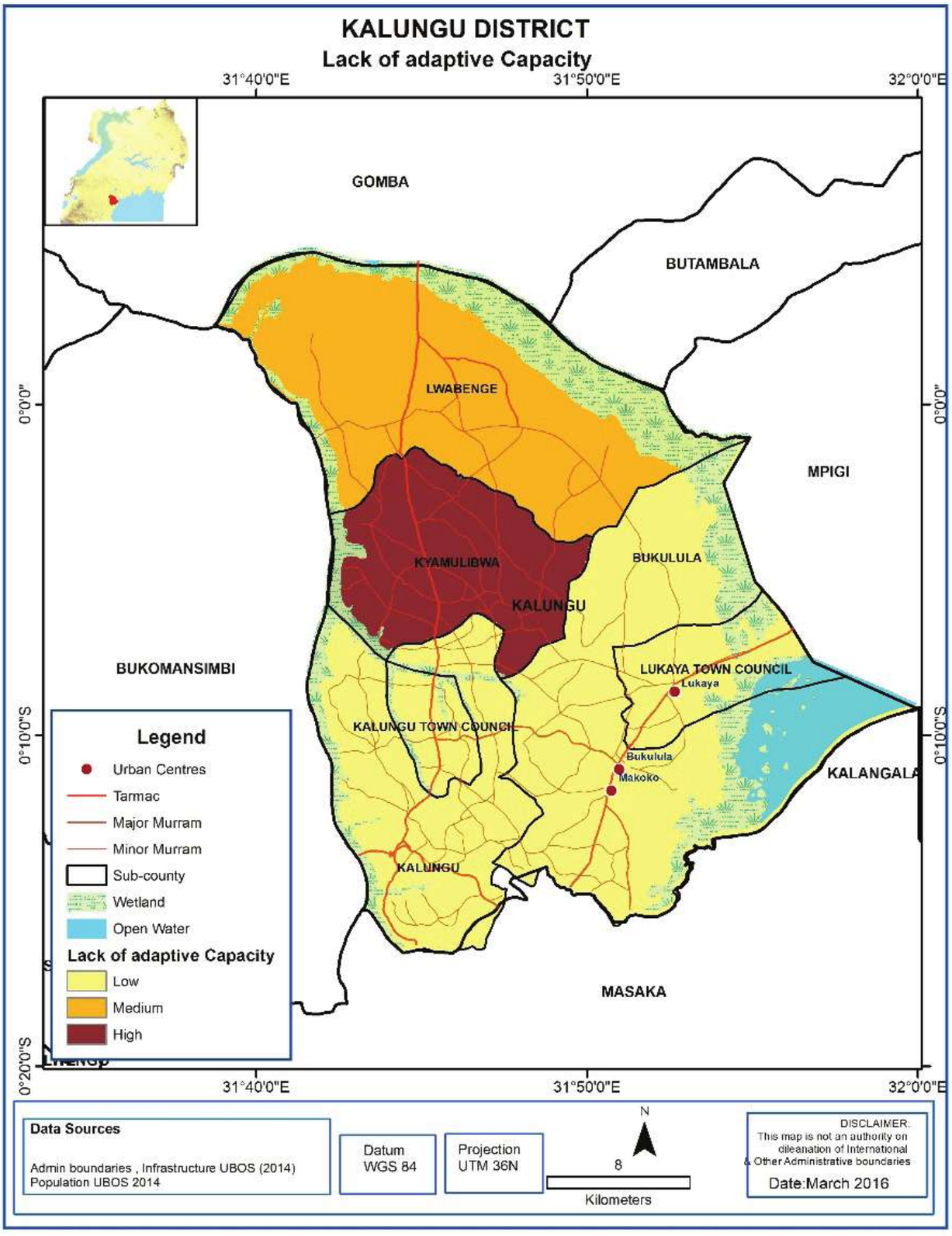

Figure 20: Lack of adaptive capacity in Kalungu District

Both layers contributed to the adaptive capacity layer with with Kyamulibwa lacking the adaptive capacity to cope with the stressors

6.4 Vulnerability Assessment

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

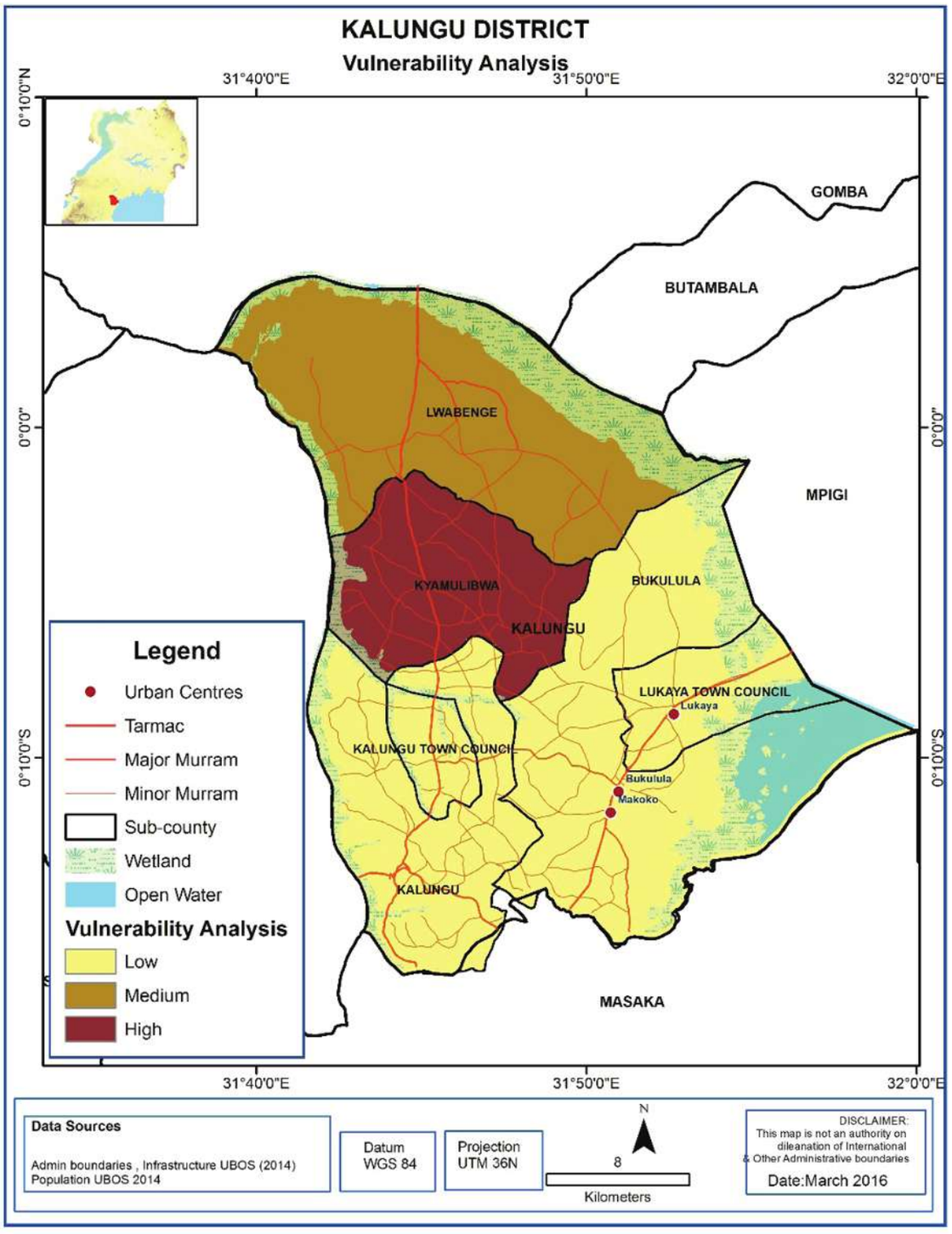

Figure 21: Vulnerability assessment of Kalungu District

Exposure and sensitivity layers influenced the overall vulnerability of Mpigi with Kituntu and Nkozi Displaying the highest overall vulnerability to climate stressors and hazards while lacking the capacity to adapt.

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
- Massive sensitization and mobilization in all LLGs
- Introduction of disease & pest resistant varieties
- Research on other control measures

Livestock pests & diseases
- Increased enforcement of veterinary regulations.
- Introduce phased approach of demonstrating pest and disease control using veterinary drugs.

Environmental degradation
- Massive tree planting campaigns
- Restoration of degraded wetlands
- Environmental impact assessment before any development activity takes place
- Lobbying and advocacy
- sensitize communities on alternatives sources of livelihoods
- Enforcement of environmental policies and regulations

Human Disease outbreaks
- Advocacy
- Counselling and testing

Drought
- Pump and distribute water from River Katonga.
- Introduce and popularize agro forestry technologies like; tree planting, soil and water conservation measures, water harvesting, fuel saving stoves etc.

Road accidents
- More strict enforcement of traffic laws
- Continuous Sensitization of road users
- Humps in additional areas.
- Construct wider roads.

Land conflicts
- Registration of land titles.
- Sensitization and training of area land committees and other relevant bodies.
- Adjudication of conflicts in courts of law.

- Popularize land laws and regulations in the local language.

Floods
- Construction of a master drainage system for the area
- Sensitization

Vermin and wild life animal attacks
- Recruit and deploy a technical staff.
- Plan and implement routine control and management activities

Erosion
- Duplication of demonstrations on soil and water conservation in other LLGs.
- Continued training of farmers on improved farming practices.
- Popularize agro-forestry technologies

Hailstorms
- Continued tree planting

Lightning
- Continued Tree planting
- Continued Sensitization on usage of lightning arrestors.

Bushfires
- Continued Sensitization on negative effects of bush burning.
- Legislations to regulate bush farming.

Annex I: Hazard risk assessment in sub-counties within the district

Kalungu District						
Sub-county						
Hazard	Lwabenge	Kyamulibwa	Bukulula	Lukaya TC	Kalungu TC	Kalungu
Floods	L	L	L	M	L	L
Drought	H	M	H	H	M	H
Erosion	L	L	L	L	L	L
Strong winds	L	L	L	L	L	L
Hailstorms	L	L	L	L	L	L
Lightning	L	L	L	L	L	L
Crop pests and Diseases	H	H	H	H	H	H
Livestock pests and Diseases	H	H	H	H	H	H
Human disease outbreaks	H	M	M	H	H	M
Vermin and Wildlife animal attacks	H	L	L	N	N	L
Land conflicts	H	L	L	L	L	L
Bush fires	L	L	L	L	L	L
Environmental degradation	M	H	M	H	M	H
Earthquakes and faults	N	N	N	N	N	N
Road accidents	L	L	M	M	L	M

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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