THE REPUBLIC OF UGANDA

Bukomansimbi District

Hazard, Risk and Vulnerability Profile

2016

Acknowledgement

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

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

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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

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

Since 2013 UNDP has been supporting the Office of the Prime Minister to develop district hazard risk and vulnerability profiles in the sub-regions of Rwenzori, Karamoja, Teso, Lango, Acholi and West Nile covering 42 districts. During the 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 Nakasongola, Bukomansimbi, Gomba, Mityana, Mubende, Luwero, Mpigi, Kalungu, Kiryandongo and Wakiso Districts 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."

1.5 Structure of the Report

This Report is organized into six chapters: Chapter 1 provides introduction on the assignment. Chapter 2 elaborates on the overview and the Multi-hazard, Risks and Vulnerability profiles of Nakasongola district. Chapter 3 focuses on the overview and the Multi-hazard, Risks and Vulnerability profiles of Bukomansimbi district. Chapter 4 elaborates the Multi-hazard, Risks and Vulnerability profiles of Gomba district detailing their extent and policy implications. Chapter 5 describes the Multi-hazard, Risks and Vulnerability profiles of Mityana district. Chapter 6 discusses the overview and the Multi-hazard, Risks and Vulnerability profiles of Mubende district. Chapter 7 discusses the overview and the Multi-hazard, Risks and Vulnerability profiles of Luwero district. Chapter 8 discusses the overview and the Multi-hazard, Risks and Vulnerability profiles of Mpigi district. Chapter 9 discusses the overview and the Multi-hazard, Risks and Vulnerability profiles of Kalungu district. Chapter 10 discusses the overview and the Multi-hazard, Risks and Vulnerability profiles of Kalungu district. Chapter 11 discusses the overview and the Multi-hazard, Risks and Vulnerability profiles of Kiryandongo district. Chapter 12 discusses the overview and the Multi-hazard, Risks and Vulnerability profiles of Wakiso district.

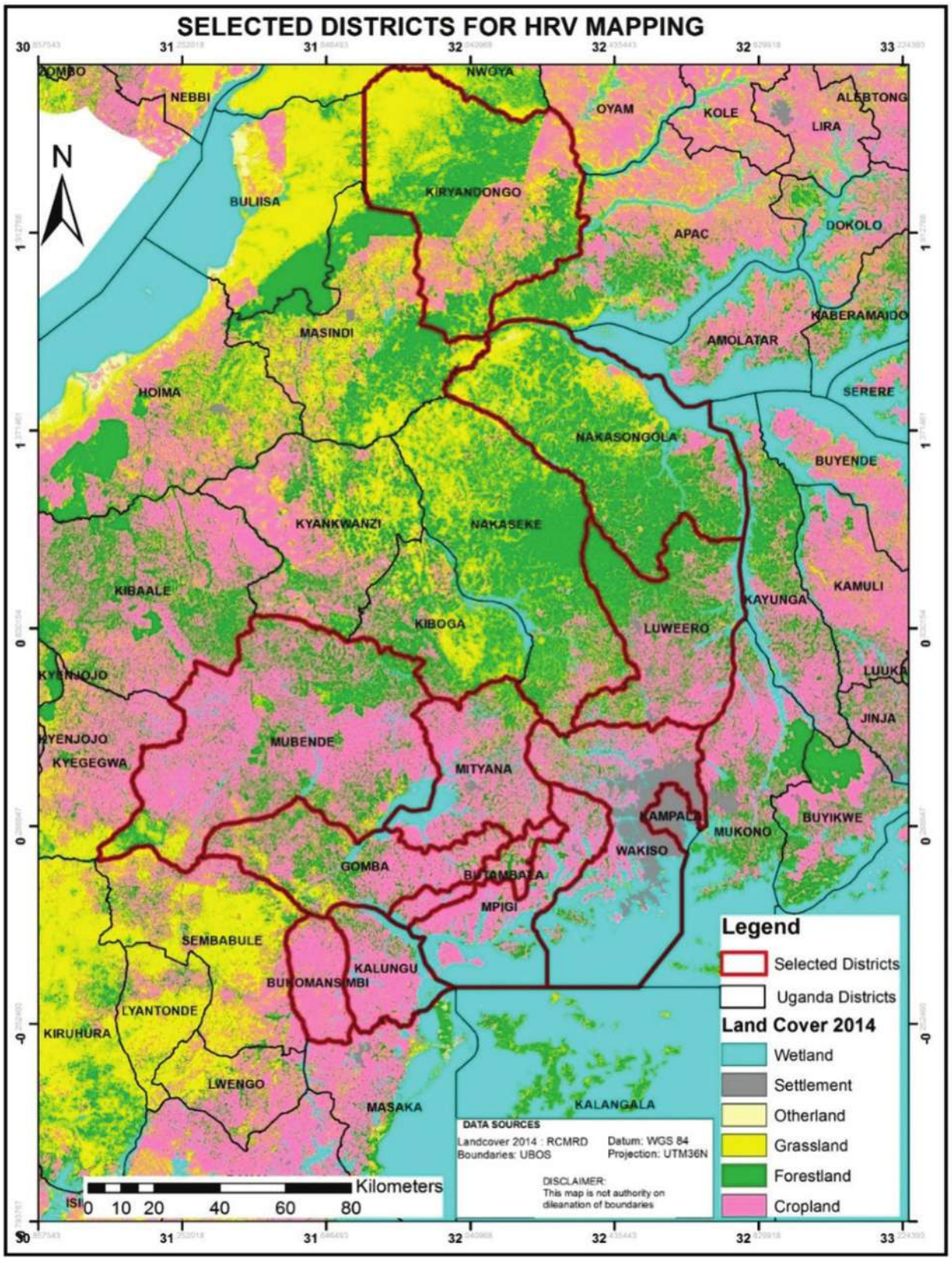

Figure 1: Location of the study area

2.0 Overview of Bukomansimbi District

Bukomansimbi District is located about 37 kms, away from the equator towards the south and lies between 00 25 south, and 340 east, having an average altitude of 1150m above sea level. The district boarders with Sembabulee district in the northwest, Mpigi in the north, Masaka in the west and south, and Kalungu District in the east. Bukomansimbi District is a newly created district split from the greater Masaka. It started operating officially on 1st July 2010. The district is comprised of two counties, 4 rural sub-counties of Kibinge, Bigasa, Kitanda, Butenga and newly created Bukomansimbi Town Council. There are 24 parishes and 254 village councils. The district has a total land area of about 589.93sq kms. The District has a rich cultural heritage. The total population of Bukomansimbi District was 151,075 people according to 2014 census. It has also diversity in ethnicity. 77 percent of the people are Baganda followed by Banyankole who are 9 percent, Banyarwanda 8 percent and the rest are small tribes. Most of the tribes practice Buganda cultures. The landscape and topography in general is rolling and undulating with vertical gully heads and valley bottom swamps including streams flowing to lakes and rivers. Most parts of the district are dotted with the hills.

2.1 Geology

On mineral resources, 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. There are a number of stone quarries and clay deposits that are used for providing construction materials. Efforts are being stepped up to have revenue mobilized and collected from these sources.

Bukomasimbi district's rock composition conforms to the rest of the southern Buganda geological layout. Old pre-Cambrian rocks mainly of quartzite schists and phyllites and granites constitute much of Bukoto County where the Municipality is situated. The soils are generally clay in nature, which tends to have low permeability. On the slopes there are rich brown loam soils while in the valleys black clays dominate. The peri-urban land of the bukomansimbi town is mainly fertile loamy soil that supports cultivation of cereals, legumes, and various types of temperate crops, fruits, coffee and Banana. 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 coloured sandy clay loams.

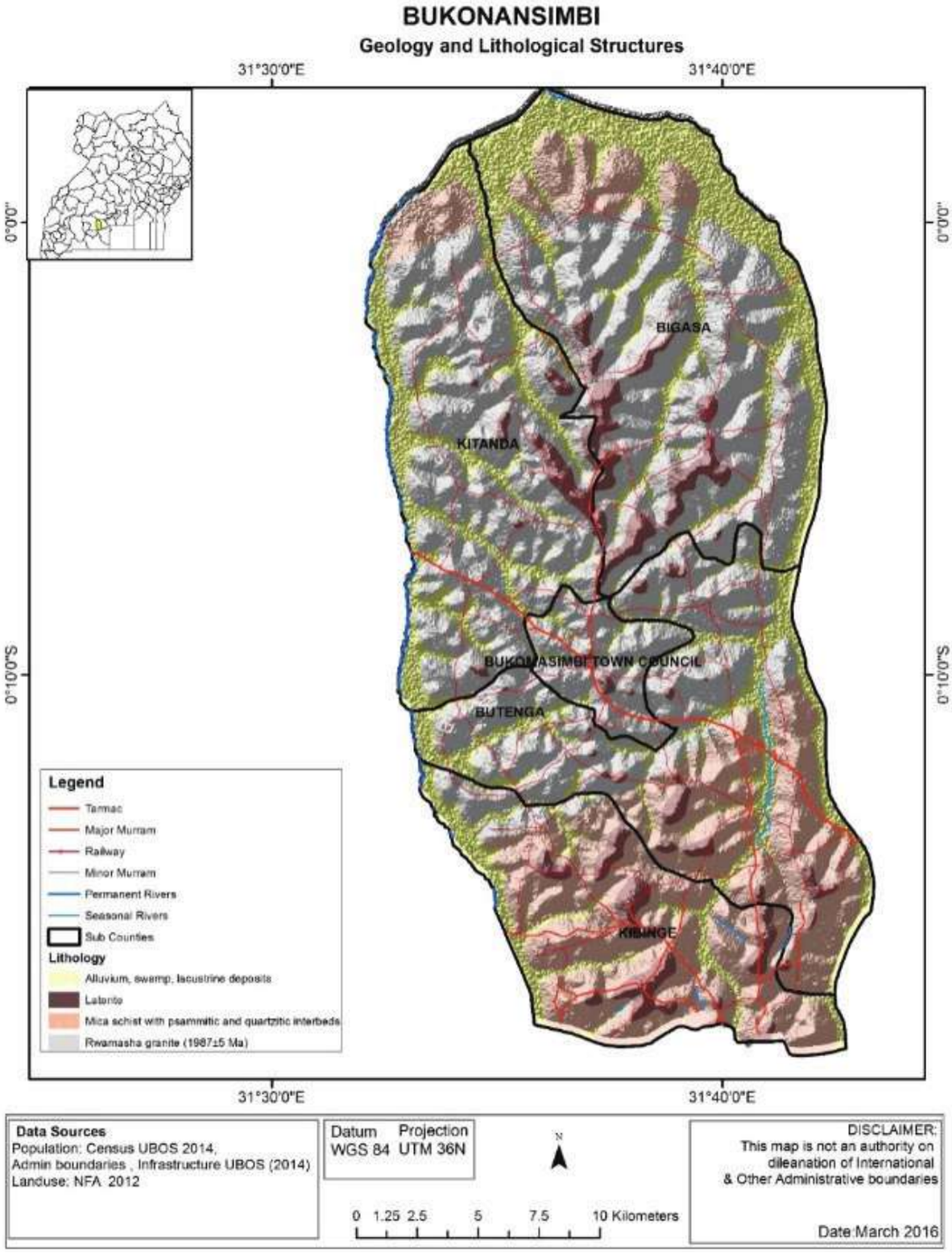

Figure 2: Administration units and Geomoprphology of Bukomansimbi District

2.2 Vegetation and Landuse stratification

The total geographical area of the district is about 589.93sq km. 60008 hectares of land is under cultivation. The small portion is covered by wetlands and marshlands.The district doesn't have gazetted forests but has private owned forest plantation. According to National Biomass Study Technical Report, 2003, Bukomansimbi has Hardwood plantations 1,252ha, softwood plantations 56ha, Woodland 5,120ha, Bush lands 9,056ha, Grasslands 89,834ha, Wetlands (papyrus) 8,331ha, Subsistence farmlands 225,677ha, Built up areas 945ha, Commercial 369ha, Water 112,967ha.

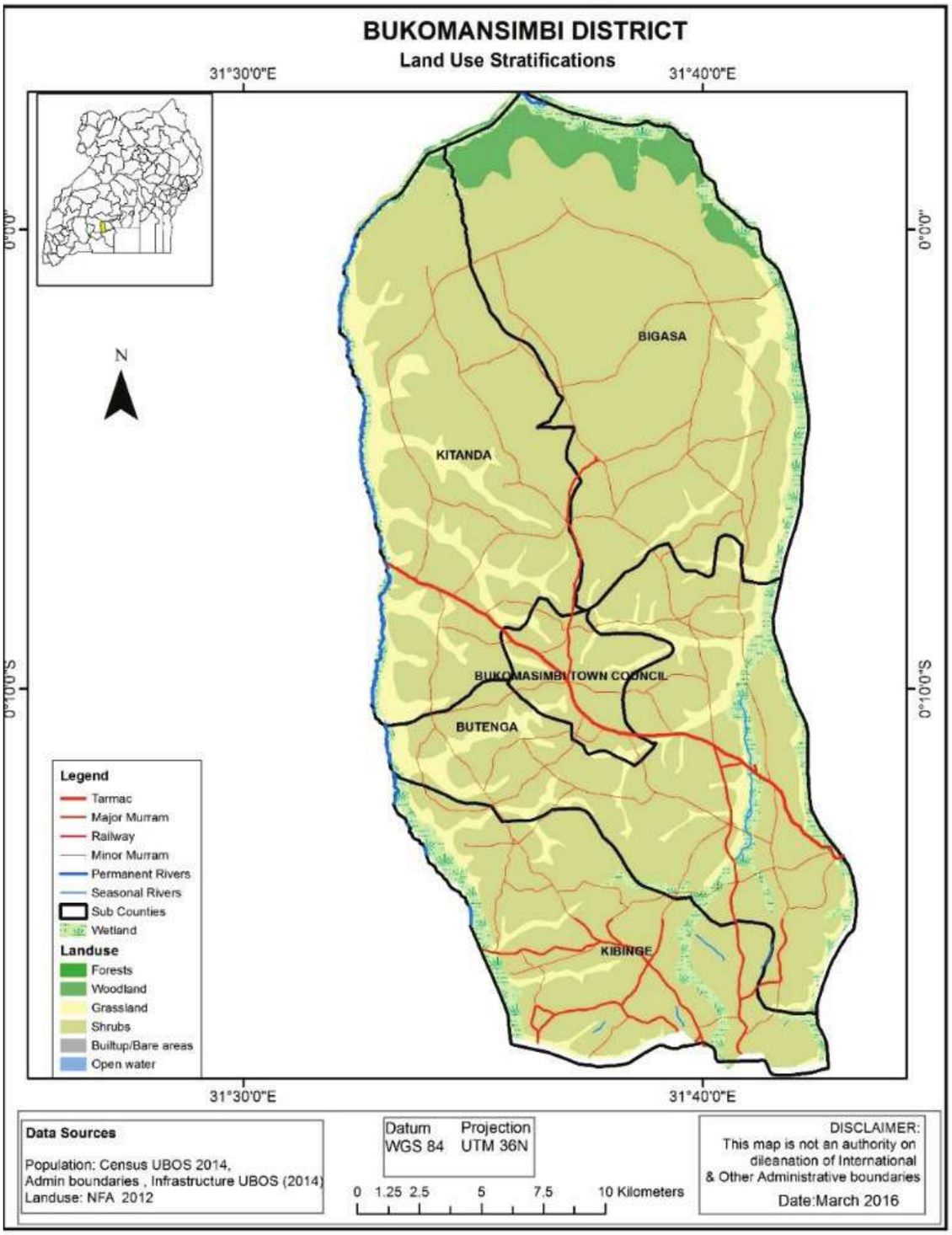

Figure 3: Land Use stratification of Bukomansimbi District

2.3 Climatic Conditions

The Climate of Bukomansimbi District is tropical in nature, being modified by relief and nearness to Lake Victoria. 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 very heavy and well-distributed rains of up to 1,200mm. The second season occurs in the months of September to December. With the exception of a few years of declining trend in precipitation, the annual average rainfall received is between 1100mm – 1200mm with 100 – 110 rainy days. The average maximum

temperature does not exceed 30^0 C and the minimum not below 10^0 C with almost equal length of day and night throughout the year. The humidity level is generally low throughout the district with the exception of lakeshore areas where it tends to rise.

2.4 Demographic Characteristics

The district currently has a total population of 151,075 people (2014, Population and Housing census results). According to the 2002 Census, the population stood at 134,000 people with a growth rate of 4.1% compared to 130,000 people and a growth rate of 3.7% in 1991. The population density is 323 persons per square kilometer. The District has a rich cultural heritage. It has also diversity in ethnicity. The majority of the people are Baganda (77%) followed by Banyankole (9%), Banyarwanda (8%) the rest are small tribes. Most of the tribes practice Buganda cultures.

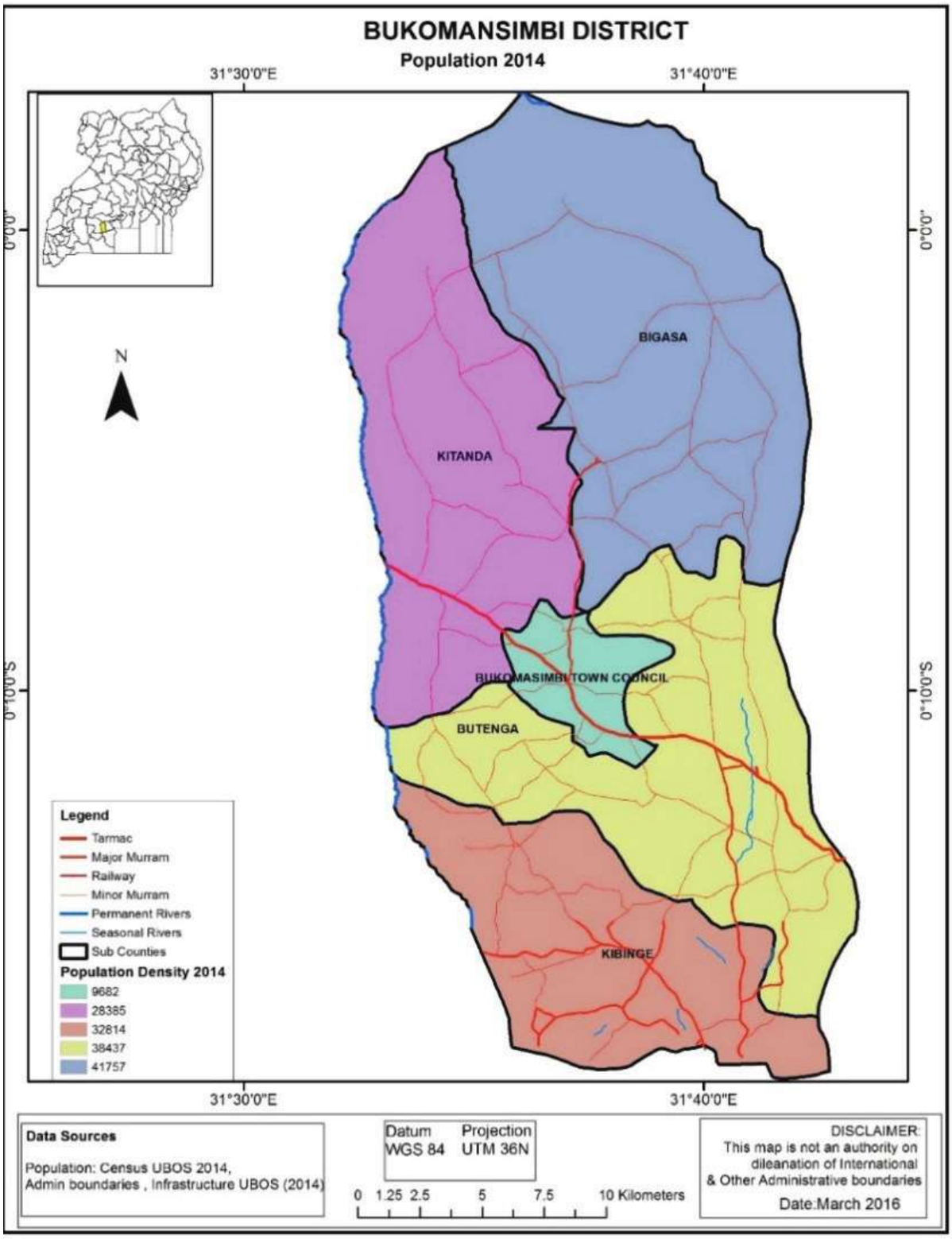

Figure 4: Population of Bukomansimbi District

2.5 Main economic activities

Agriculture is the major economic activity in Bukomansimbi district. Majority of farmers are small holders who grow both perennial and annual crops. The perennial crops include Banana, Coffee, and Tea, while the annuals include maize, sweet potatoes, beans, cassava and groundnuts. The

annual crops are mostly grown for home consumption. The annual crops are mostly grown for home consumption. The surplus production however is sold in the local and urban markets. Many farmers keep cattle, goats, and pigs and local poultry, which form an important source of animal proteins.

Despite the big potential for agricultural production possessed by the district, the actual production remains low and unsatisfactory. The district agricultural production output is at a low average of 2% while the population growth rate is 3% per annum. The District through Operation Wealth Creation has distributed a number of improved farm inputs and animals to boost this economic activity and contribute the prosperity for all theme. The other population is engaged in economic activities such as charcoal burning and selling, quarrying, logging activities, and others are employed by the public and private sector.

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.

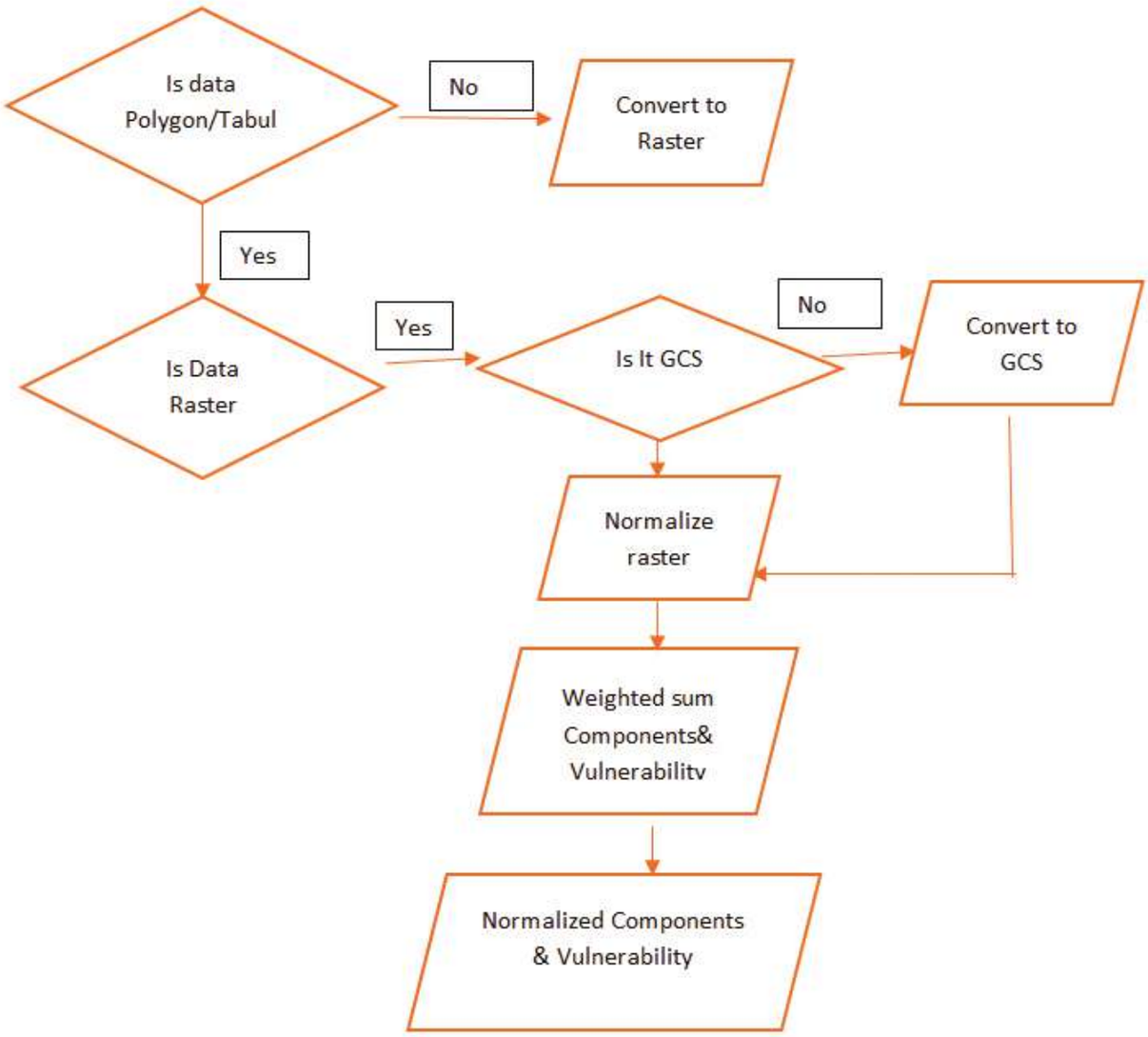

Figure 5: Data conversion work flow

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

4.1 Hailstorms and Lightning

It was noted that Bigasa Sub County experiences moderate levels of hailstorms while the rest of the sub counties experiences very low levels hailstorms. There is history of occurrences in Kigangazzi, Bukango, Mbirizzi, Kassebwera and Kiryasaka parishes. Communication to OPM was done and relief was received.

The district is prone to lightning with high incidences in Kibinge subcounty. Children in schools are mostly affected. History of occurrences in Kiryasaka, Bukango, Kassebwera, Kigangazzi and Mbirizzi parishes has been reported. Sensitization of communities to procure and install thunder arrestors in schools and houses is being encouraged, in addition to wearing of rubber shoes by school children.

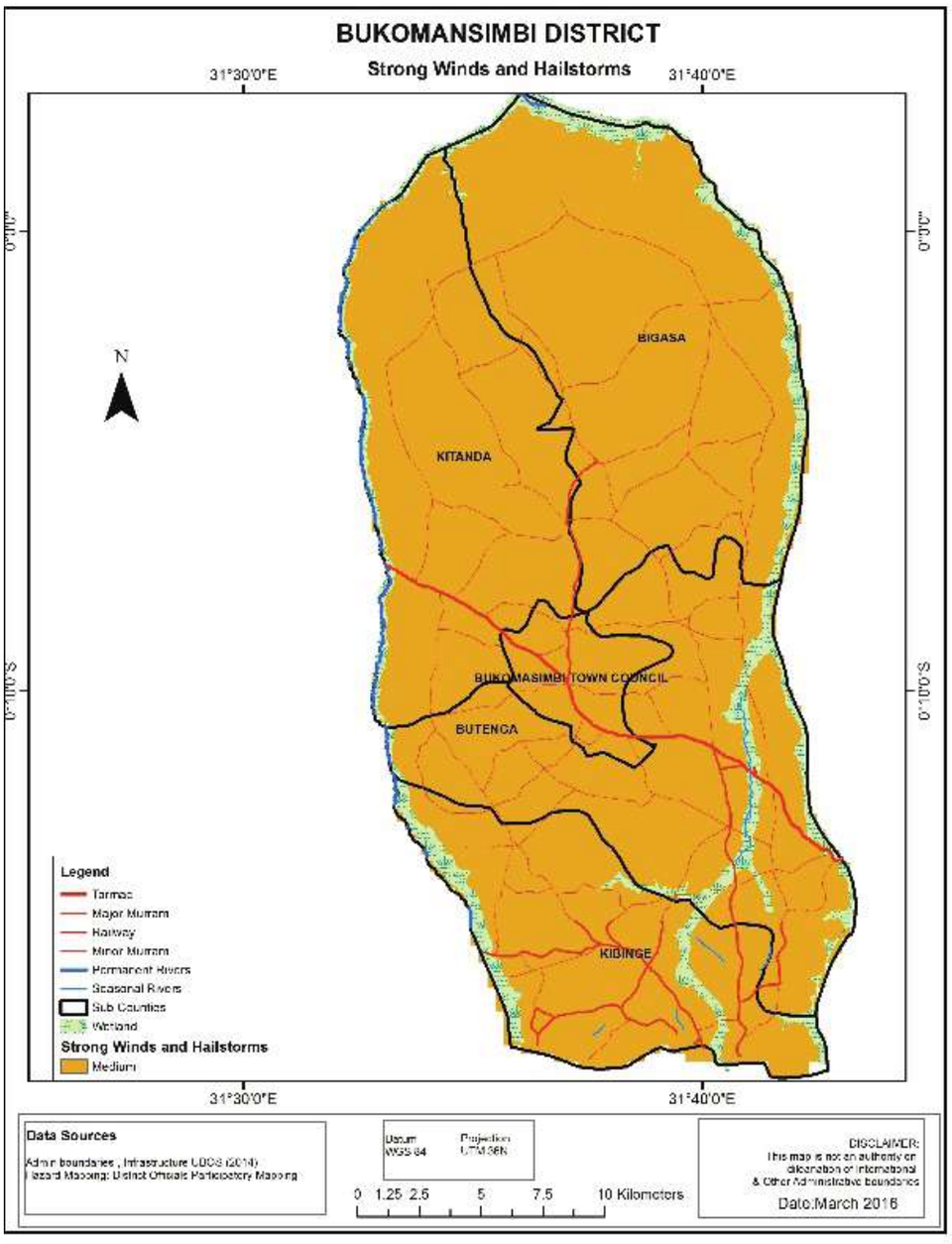

Figure 6: Strong winds in Bukomansimbi District

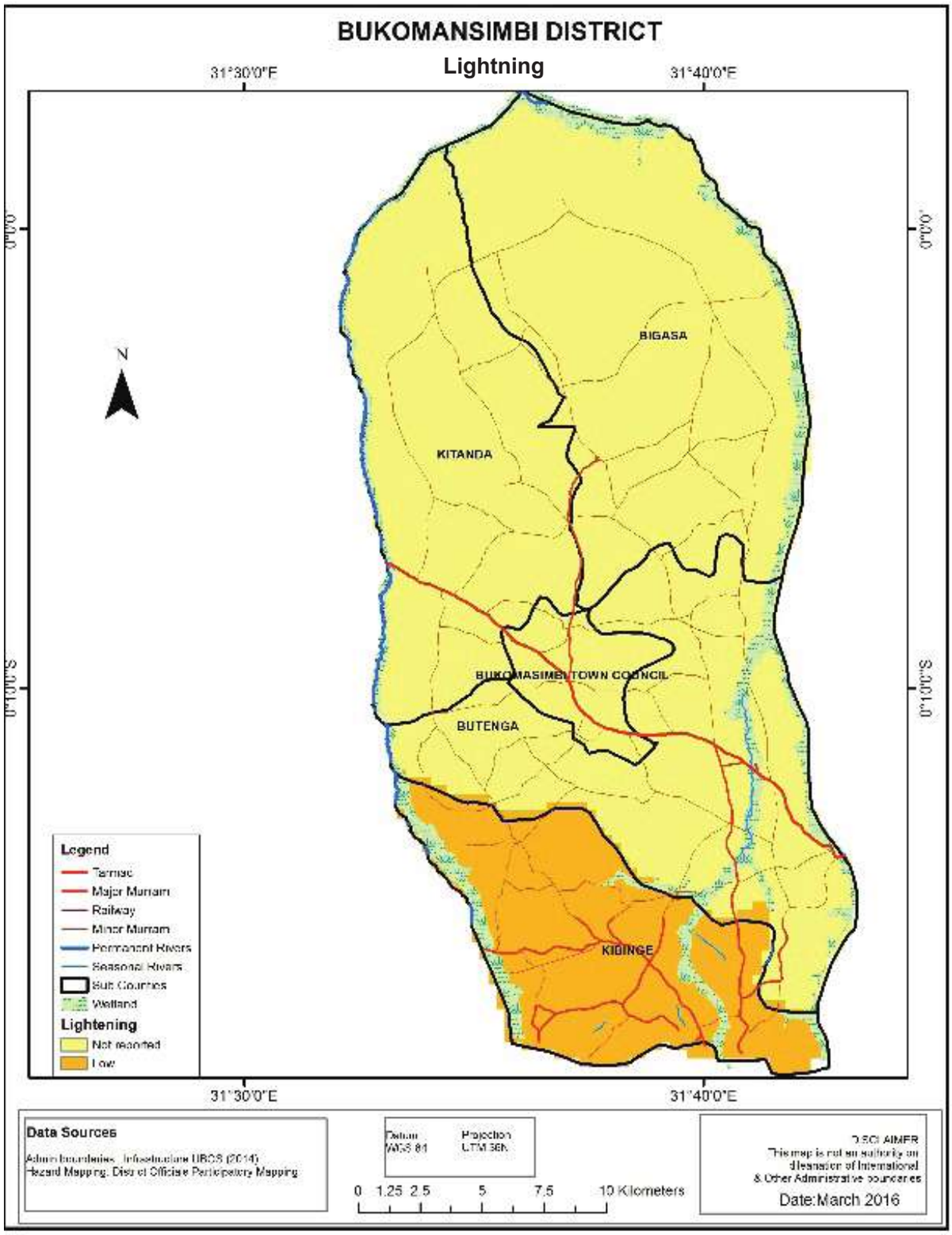

Figure 7: Hailstorms and Lightning in Bukomansimbi District

4.2 Environmental degradation

Environmental degradation mainly due to wetland reclamation for farming sand, excavation and brick making was noted to be a major threat to the environment. This was attributed to the increasing dry spells and population explosion exerting pressure on resources. Sub-counties of Butega and Kibige are heavily affected in Kassebwera, Kawoko, Kabigi and Kissojjo parishes. Communities here are normally in search for water for crops and free land for cultivation. Enforcing bye laws, Sensitization of communities of the importance of wetlands and Community policing are being done to mitigate this challenge.

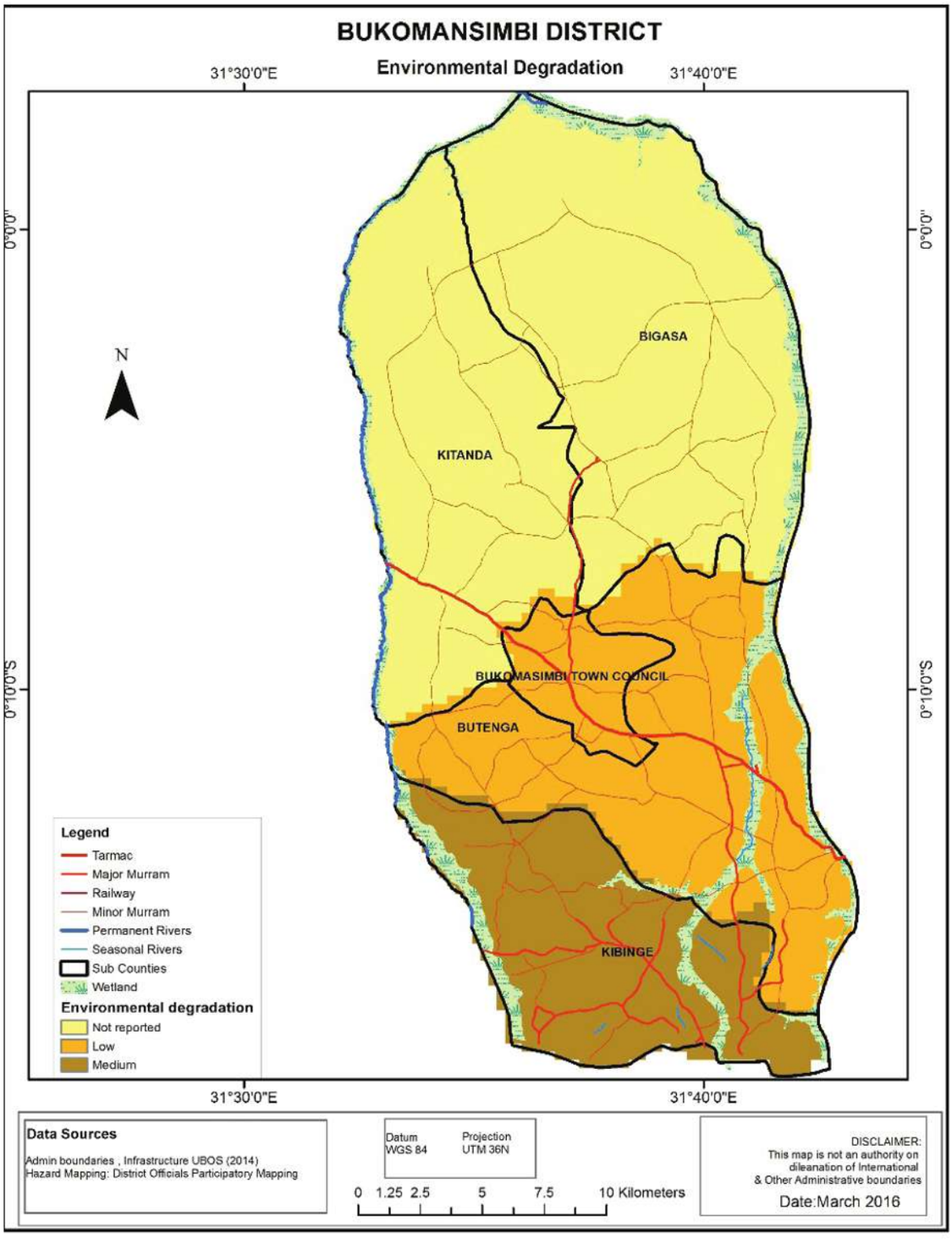

Figure 8: Environmental degradation in Bukomansimbi District

4.3 Land conflicts

It was noted that issues of land conflicts are high in Kitanda sub county, moderate in other sub counties but low in the Bukomansimbi town council. Mitigyera and Gayaza parishes were identified as key hotspots for such conflicts mainly due to Lack of rightful ownership, Family conflicts and Land grabbing. Sensitization about land ownership, acquisition of land titles and settlement of conflicts is being encouraged as a solution to mitigate such conflicts.

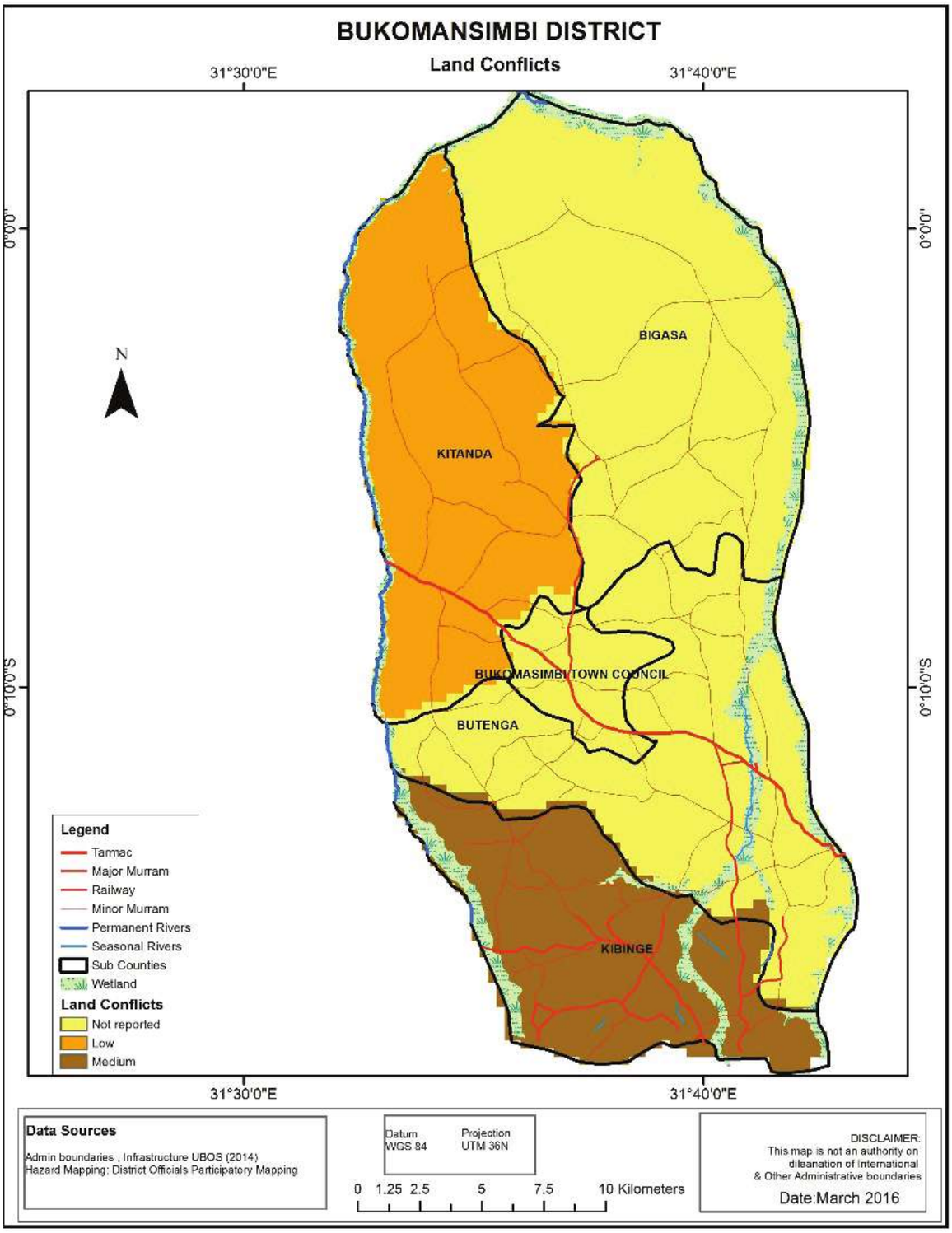

Figure 9: Land Conflicts in Bukomansimbi District

4.4 Human disease outbreaks

Malaria which is mostly affecting women and children was noted to be high in the entire district. HIV is also prominent especially in girl children especially youth, Diarrhea and pneumonia in children. Suitable breeding habitats for mosquitoes seem to be the major contributing factor for the high prevalence of malaria in the district. Waste management challenge and wetland ecosystem change could also be creating suitable environments for mosquito breeding. Human behavior especially in towns was also heighted as the main risk to human diseases such as HIV. Bukomansimbi central ward, Mirambi, Kawoko, Kigangazzi and Kiryasaka Parishes were identified as the main hotspots were human disease burden is high.

Interventions such as sensitization campaigns, free malaria testing and treatment and use of mosquito nets to control malaria are being done. Condom distribution, voluntary counseling and testing for HIV are some of the strategies being done to manage the HIV disease burden. Pneumo cocco vaccination against pneumonia in children is also being encouraged. Health system strengthening through medical staff recruitment is also being done. Although there are government strategies to combat these diseases, poor attitudes and mentality of the locals have left such programs impractical.

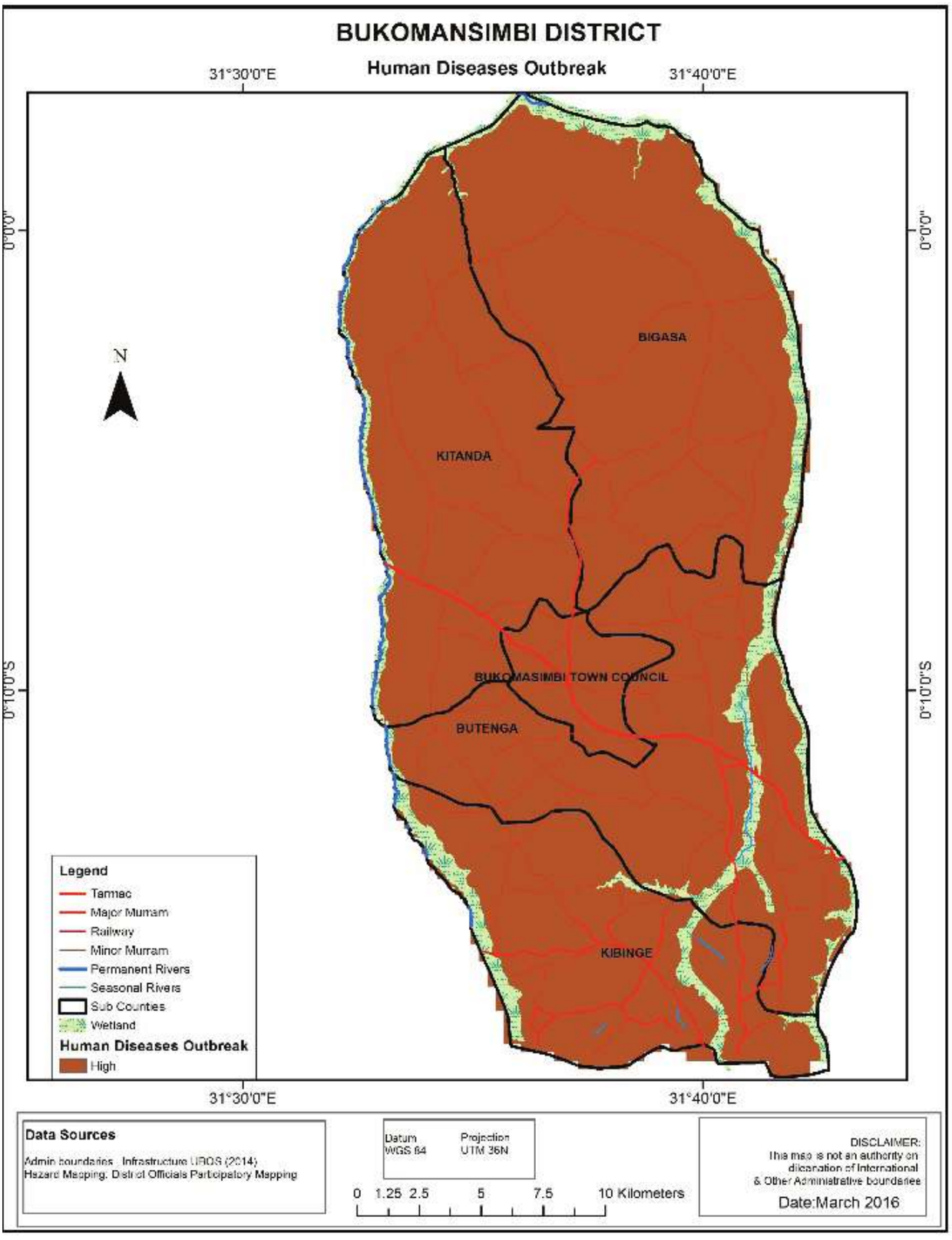

Figure 10: Human diseases outbreak in Bukomansimbi District

4.5 Drought

The entire district is prone to droughts as it is located in the cattle corridor. However Kitanda and Bigasa sub-counties are badly affected. Mitigyera, Gayaza, Kigangazi and Mbirizzi Parishes were noted as major hotspots were drought seriously impacts communities. Women and children are vulnerable to such dry spells as most water wells dry up increasing distance for fetching water. Drying of crops and loss of pastures is also normally manifested. Strategies such as water harvesting by building water tanks and dams, farming in swamps in the dry season, introduction of drought tolerant crops and farmers selling off some animals in dry season are some of the approaches to adapt to dry spells. The increasing adverse weather conditions especially dry spells were attributed to destruction of the sesse forest in the Lake Victoria islands that were significant in improving the local weather conditions.

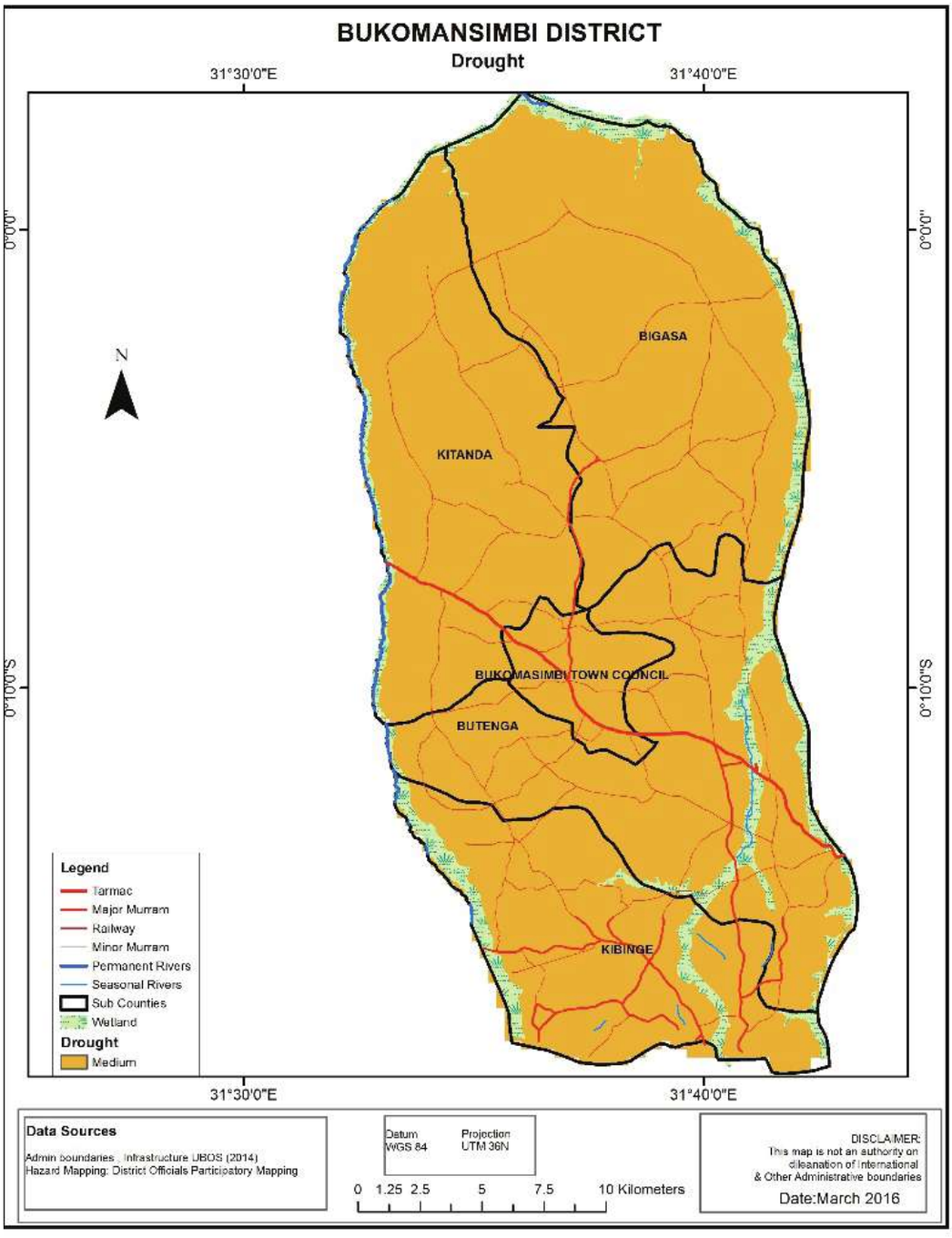

Figure 11: Drought in Bukomansimbi District

4.6 Bush fires

Bush fires were noted to be moderate in the sub-counties of Kitanda and Bigasa and not reported in the other sub counties. Kigangazi, Makukulu and Ndeeba parishes were reported as the major hotspots. Normally, these fires are a result of traditional burning looking for new pastures, hunting, Malice or Negligence. Both men and women are affected. Sensitization, enforcement of bye laws and Prosecutions are some of the strategies being done to curb bush fires.

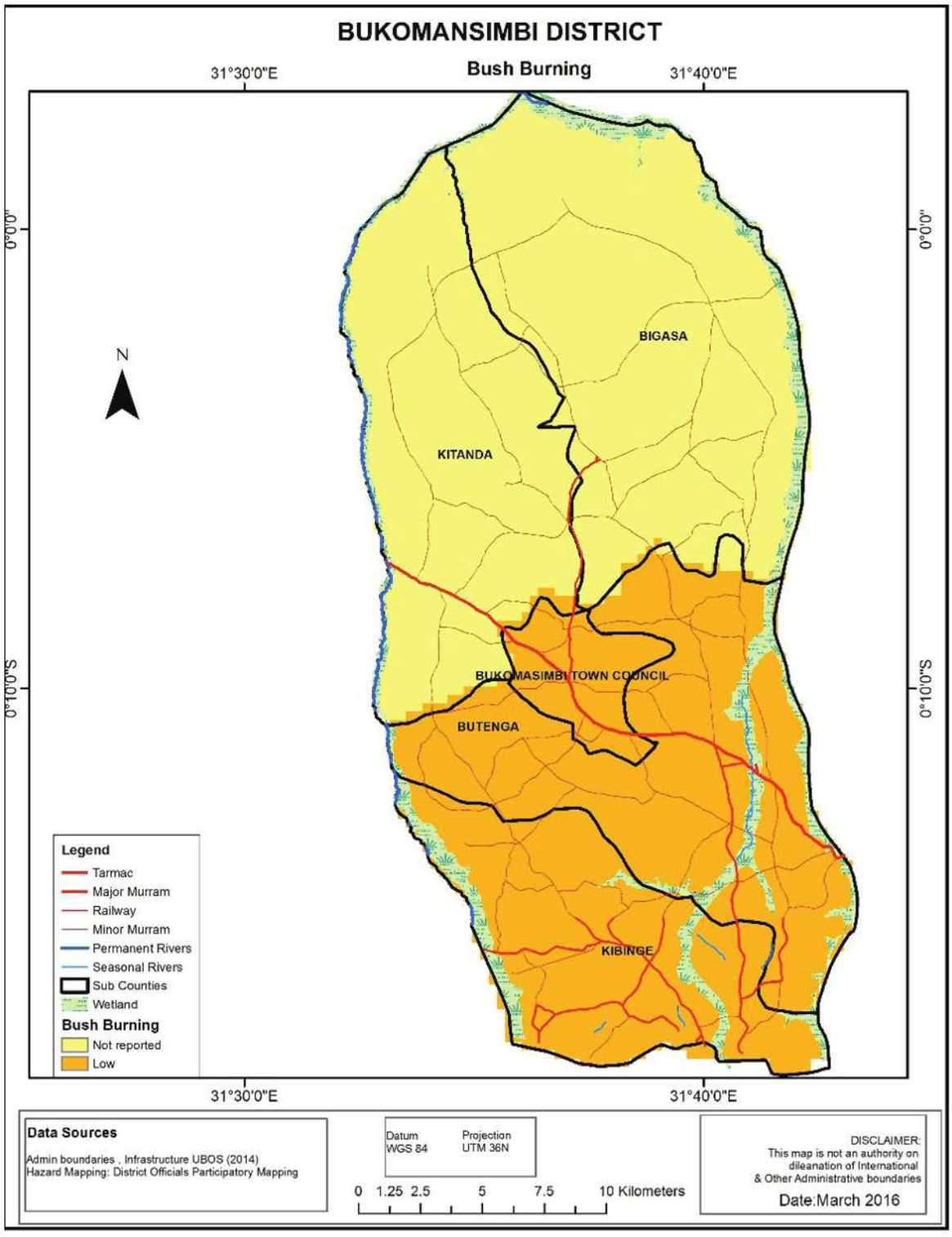

Figure 12: Bush fires in Bukomansimbi District

4.7 Crop pests and Diseases

Bukomansimbi is well known for coffee growing. Major crop diseases affecting farmers include Coffee twig bora and banana bacterial wilt which are widespread throughout the district. These are attributed to poor agricultural Practices, environmental degradation, climate change, trade of agricultural Products that area affected and use of uncertified fake inputs. For instance, the coffee twig bora insect originally used to live in the forests co-existing with the natural environment. But it is believed that because of destruction of natural habitats for twig bora they are finding refugee in coffee. These affect all age and gender. Sensitization of farmers on good agricultural practices, distribution of inputs which are pest resistant, recruitment of extension worker and OWC interventions are being done to control crop pests and diseases.

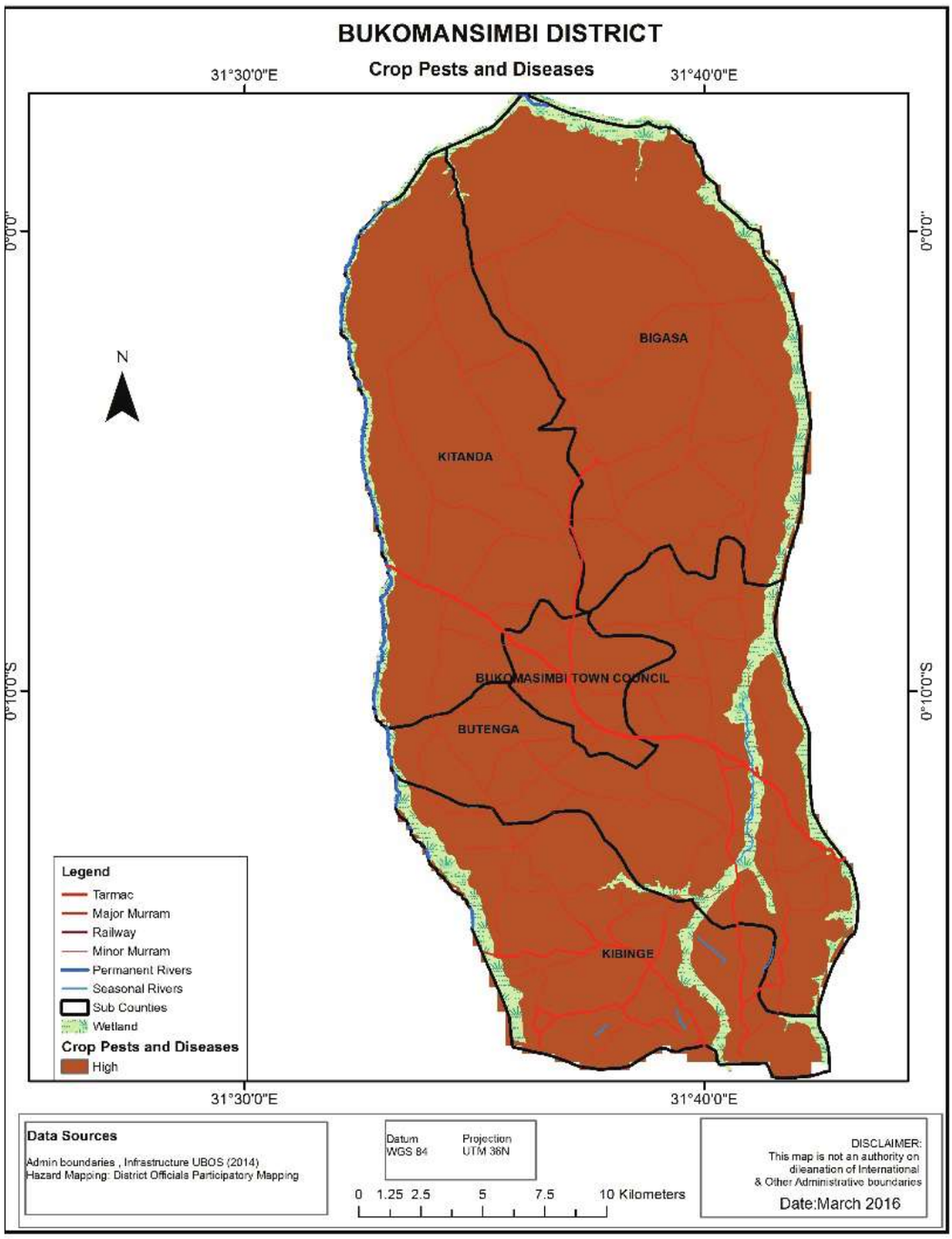

Figure 13: Crop Pests and Diseases in Bukomansimbi District

4.8 Livestock pests and Diseases

Livestock reared in the district include cattle, pigs and poultry. Livestock diseases in the district are high and the major diseases noted are African swine fever and tick borne diseases. It was noted that because of the wetlands that surround the district, there is very limited cross boarder cattle crossing which has limited cattle diseases like Foot and Mouth Disease rampant in other districts. However ASF continue to be prevalent because of the presence of bush pigs in the wetlands as they are the natural reservoirs. But the other risk behavior noted was that pig traders move around from farm to farm with pigs increasing the chances of contact and spread of the virus. Greater Masaka of which Bukomasimbi is part is the leading pig producer. Women are mostly affected by ASF as it causes 100% mortality in affected herds and most pigs belong to women. Imposing quarantines, Sensitization of farmers on animal husbandry, Vaccination, spraying, recruitment of extension worker and OWC interventions are some of the strategies to control these pests and diseases.

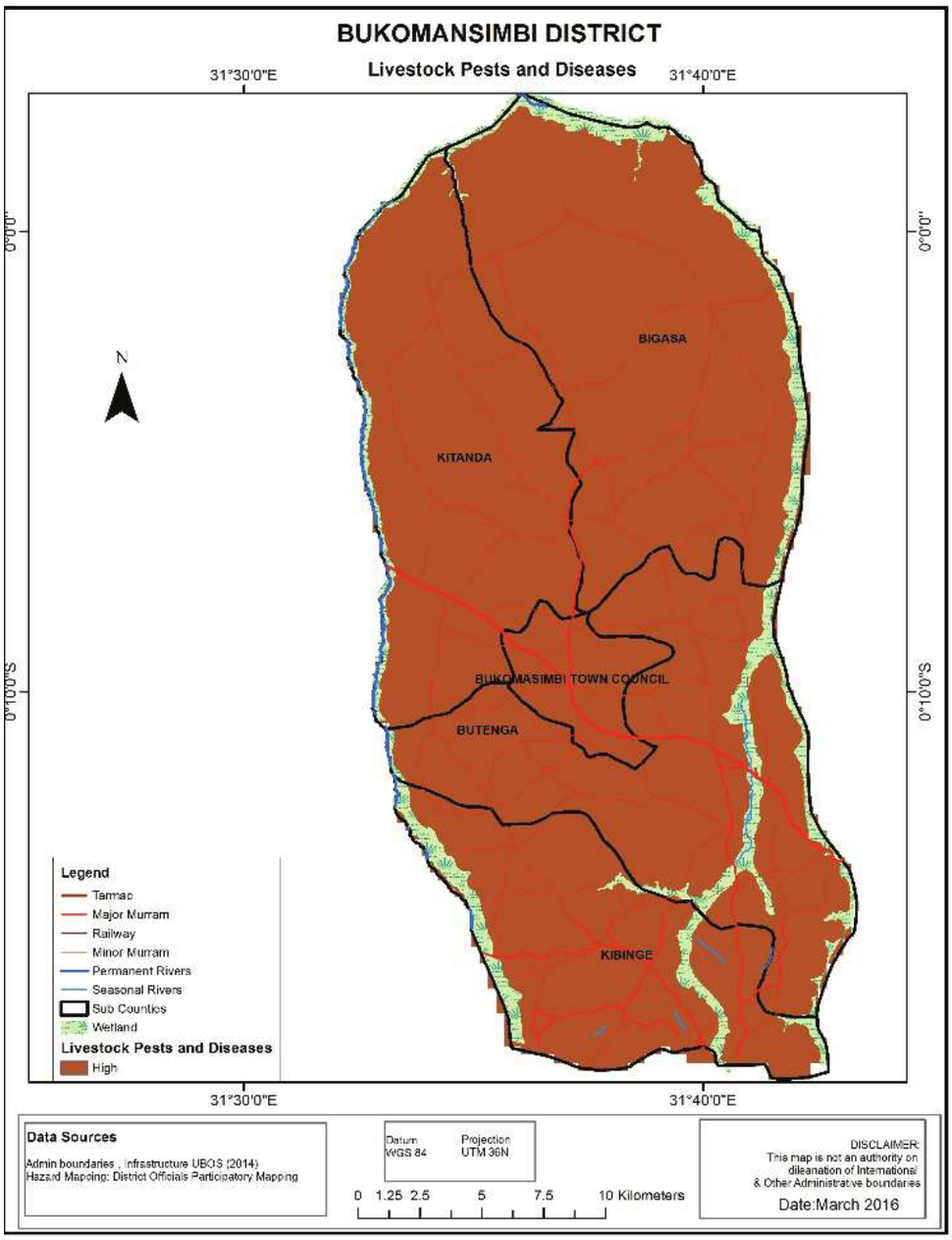

Figure 14: Livestock Pests and Diseases in Bukomansimbi District

4.9 Vermin and Wildlife animal attacks

Although there are vermin's within the district their burden is low**.** Bush pigs live within the wetlands which are there suitable habitat and they are only of significance as reservoirs for African swine fever. Stray dogs especially in the town council were also noted to be increasingly becoming a threat. Hotspots along the major wetlands of Namajjuzi, Kyogya and Katonga, Trading centers of Bukomansimbi, Kawoko, Buyoga, Misanvu. Natural habitats for the wild pigs and statungas still exist and uncontrolled dogs especially in urban centers. Strategies such as Hunting, Dog vaccinations and elimination are being encouraged to manage these vermins.

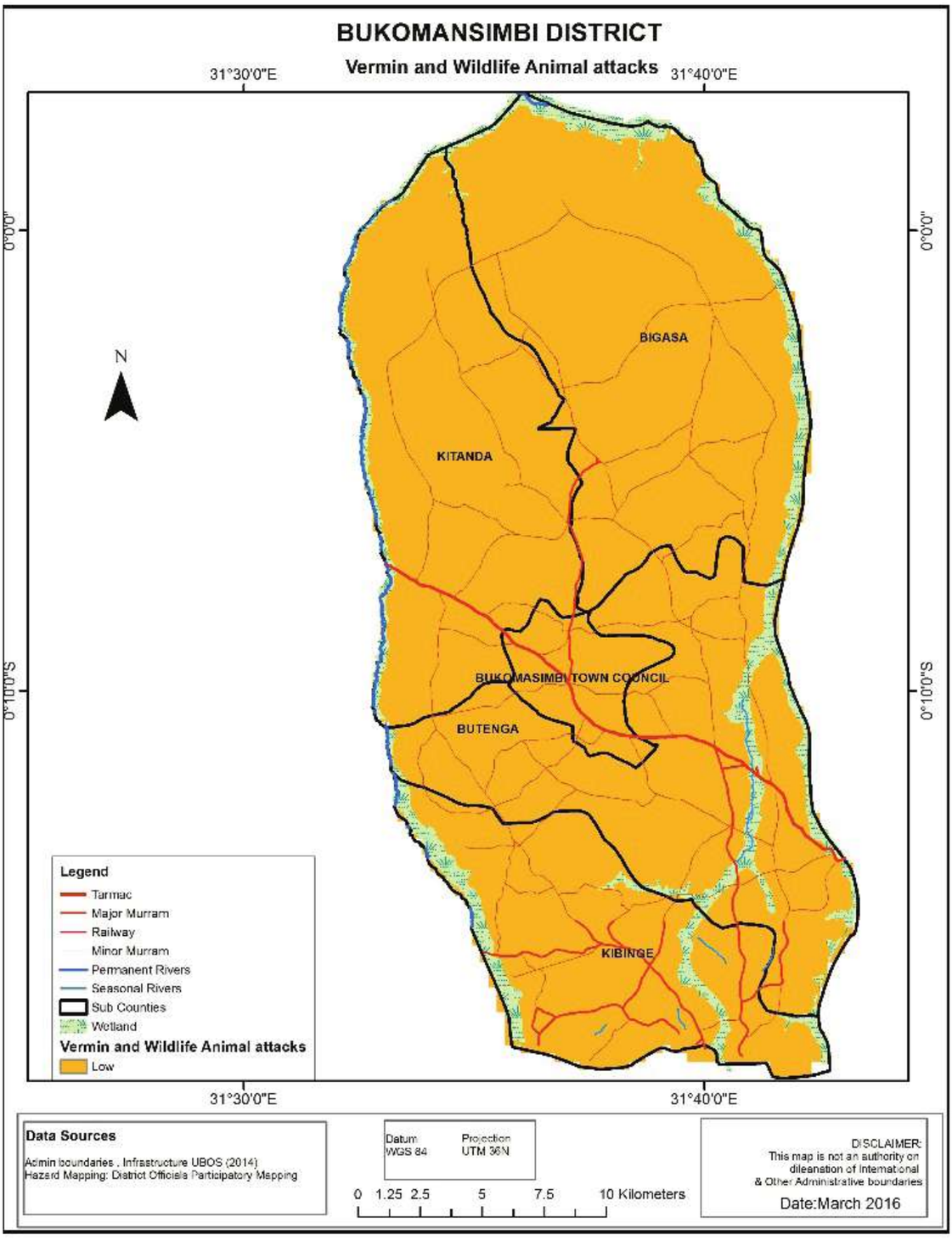

Figure 15: Vermin and Wildlife animal attacks in Bukomansimbi District

4.10 Soil erosion

Soil erosion in Bukomasimbi is moderate, possibly as result of deforestation and poor farming practices. But the topology of the area which is dominated by hills and valleys is prone to erosion. Poor soil and water conservation methods were also noted as the causes of this erosion. Kabigi, Gayaza, Kyankole, Butayunja and Kisojjo parishes were identified as the major hotspots of soil erosion. Sensitizations on soil and water conservation practices are being conducted to mitigate its impact.

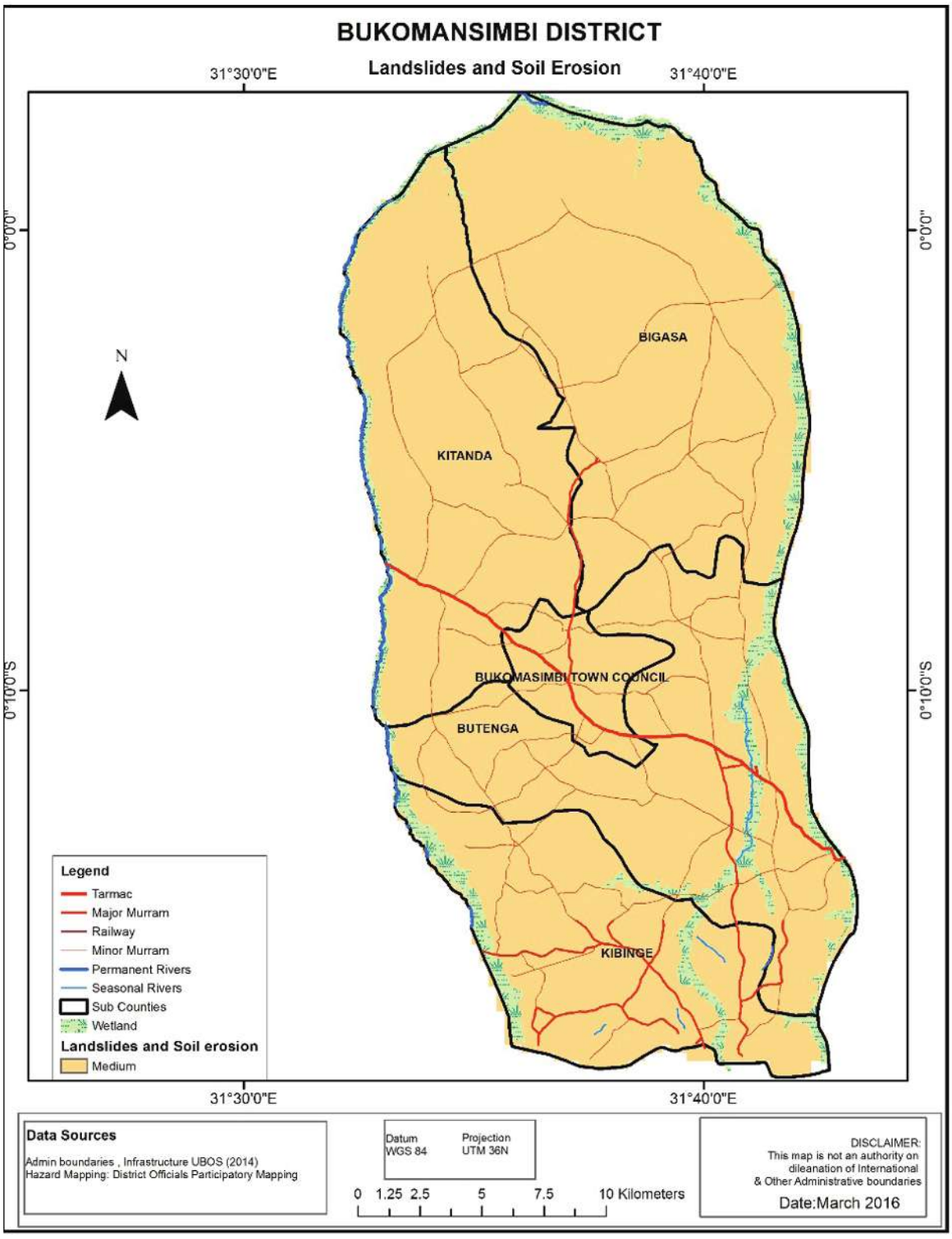

Figure 16: Soil erosion in Bukomansimbi District

4.11 Road accidents

Accidents were noted to be high in the sub-counties of Butenga and Bukomansimbi TC. Kawoko, Mitigyera and Kigungumika were identified as main hotspots because they are along the highway were reckless driving is common especially on steep corners along the Bad murram roads road. Spot improvement and Traffic police have been put in place to help mitigate road accidents.

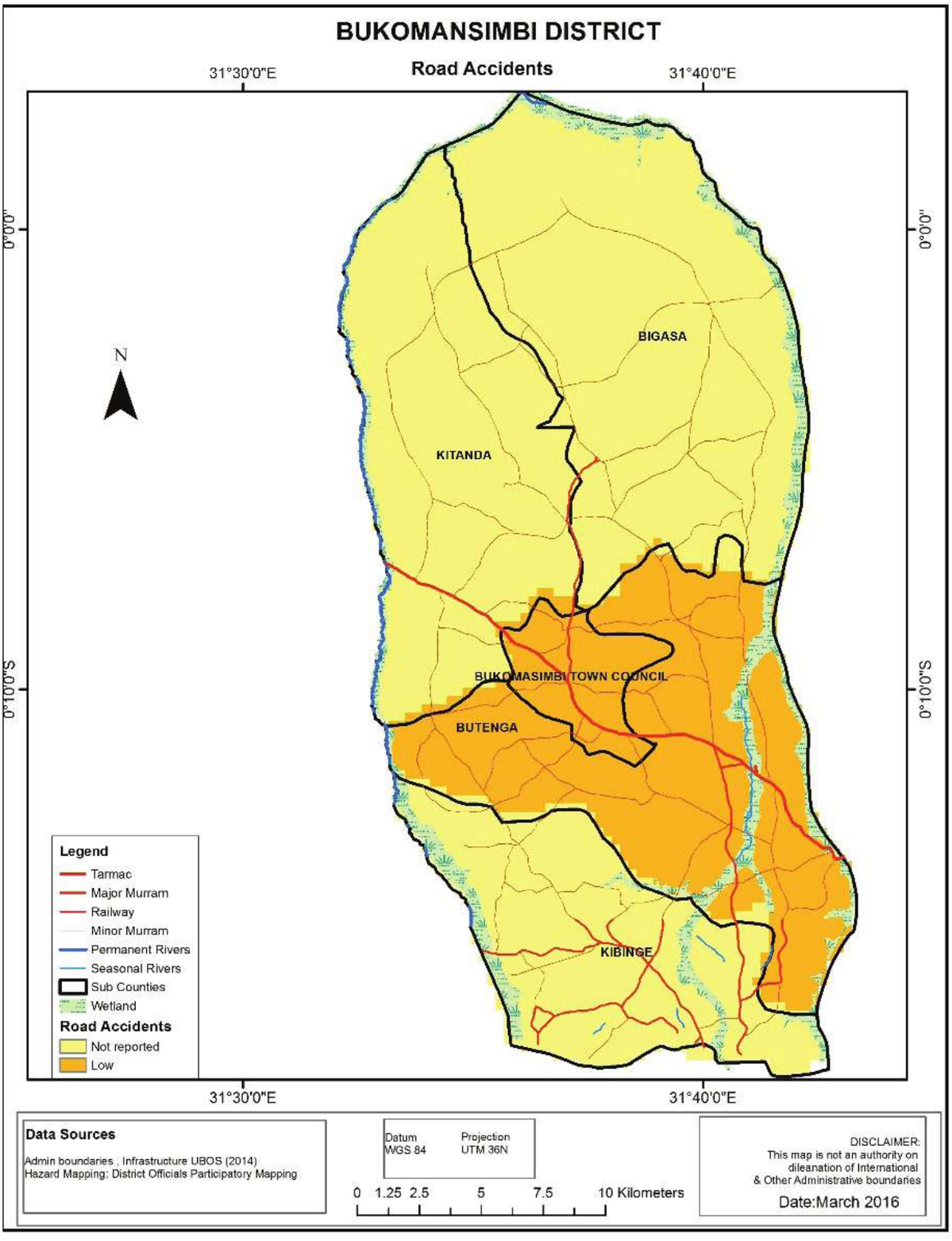

Figure 17: Road accidents in Bukomansimbi District

5.0 Gender and age groups mostly affected by the Hazards in Bukomansimbi district

Table 1: Gender and age groups mostly affected by hazards

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

6.0 Coping Strategies

Table 2: Coping strategies of the hazards in Bukomansimbi district

Hazard	Coping strategies in Bukomansimbi
Drought	Construction of water dams, Construction of water harvesting tanks at household and village level, Introduction of drought tolerant crops.
Erosion	Encouraging communities on soil and water conservation practices.
Hailstorms	Communicating to key stakeholders such as OPM for relief
Lightning	Sensitization of communities to procure and install thunder arrestors in schools and houses. Encourage wearing of rubber shoes
Crop pests and Diseases	Sensitization of farmers on good agricultural practices, distribution of inputs which are pest resistant, recruitment of extension worker and OWC interventions
Livestock pests and Diseases	Vaccination, Sensitization of farmers on animal husbandry, imposing quarantines, recruitment of extension worker and OWC interventions
Human disease outbreaks	Condom distribution, - strengthening health system by recruitment more medical Staff, Distribution mosquito net, free testing and treatment of malaria and HIV& AIDS, and Pneumo- cocco vaccination.
Vermin and Wildlife animal attacks	Chasing and Hunting of vermin's and for dogs, vaccinations and culling of stray dogs were possible.
Land conflicts	Sensitization of communities about land ownership and acquisition of land titles. Encourage settlement of conflicts.
Bush fires	Sensitization of communities to avoid setting fires, Enforcing bye laws and Prosecutions of offenders
Environmental degradation	Enforcing bye laws, Sensitization of communities of the importance of wetlands and Community policing are being done to mitigate this challenge.
Road accidents	Spot improvement and putting Traffic police in place.

7.0 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 3: 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

7.1 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

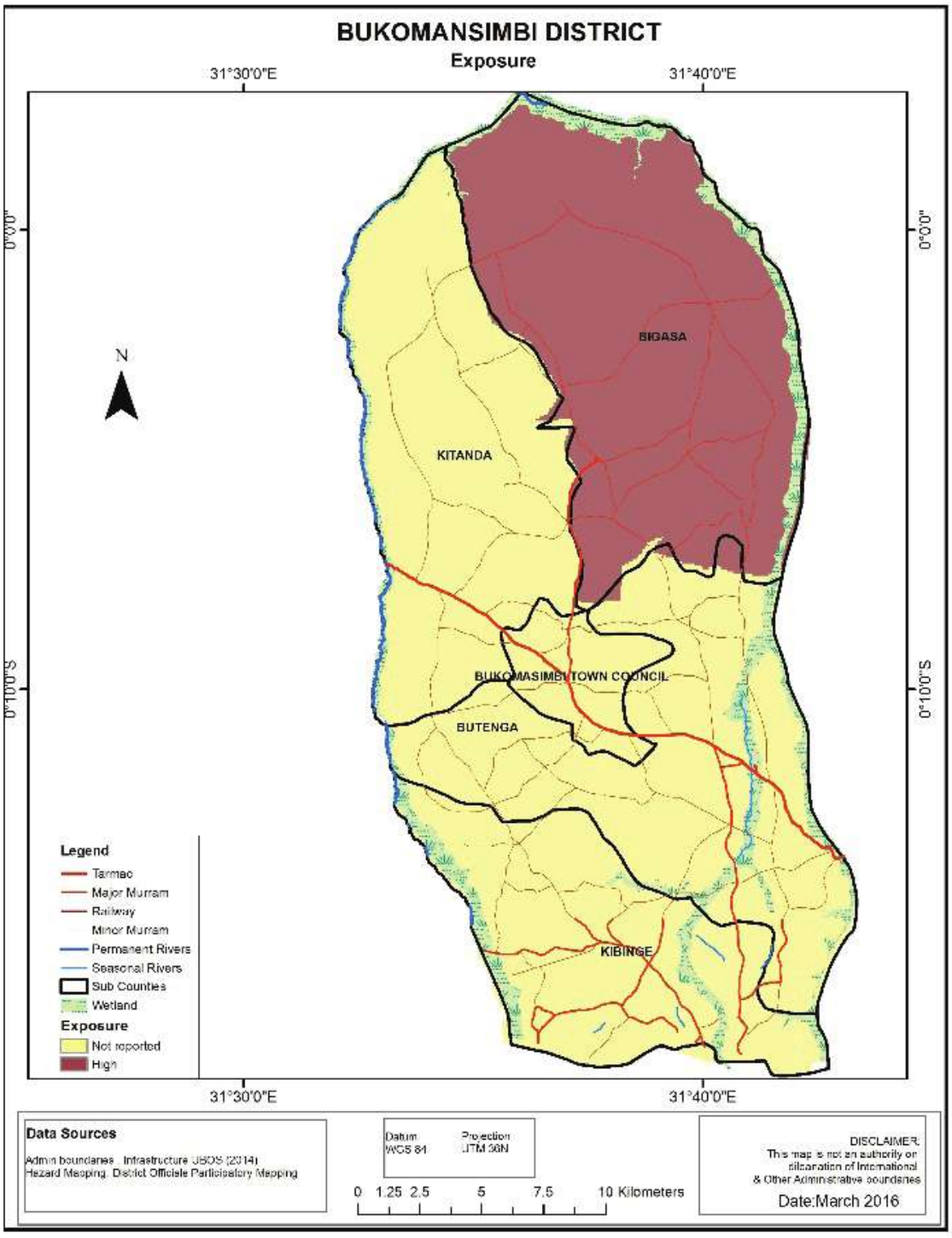

Figure 18: Exposure of climatic conditions in Bukomansimbi District

Generally Bukomasimbi district does not register high climatic exposure and as such disasters like floods and droughts are not reported. However considering the high annual temperatures registered in Kitanda and Bigasa paired with other factors like low average annual precipitation and varying rainfall received, Bigasa stands out as the most exposed sub-couty.

7.2 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.

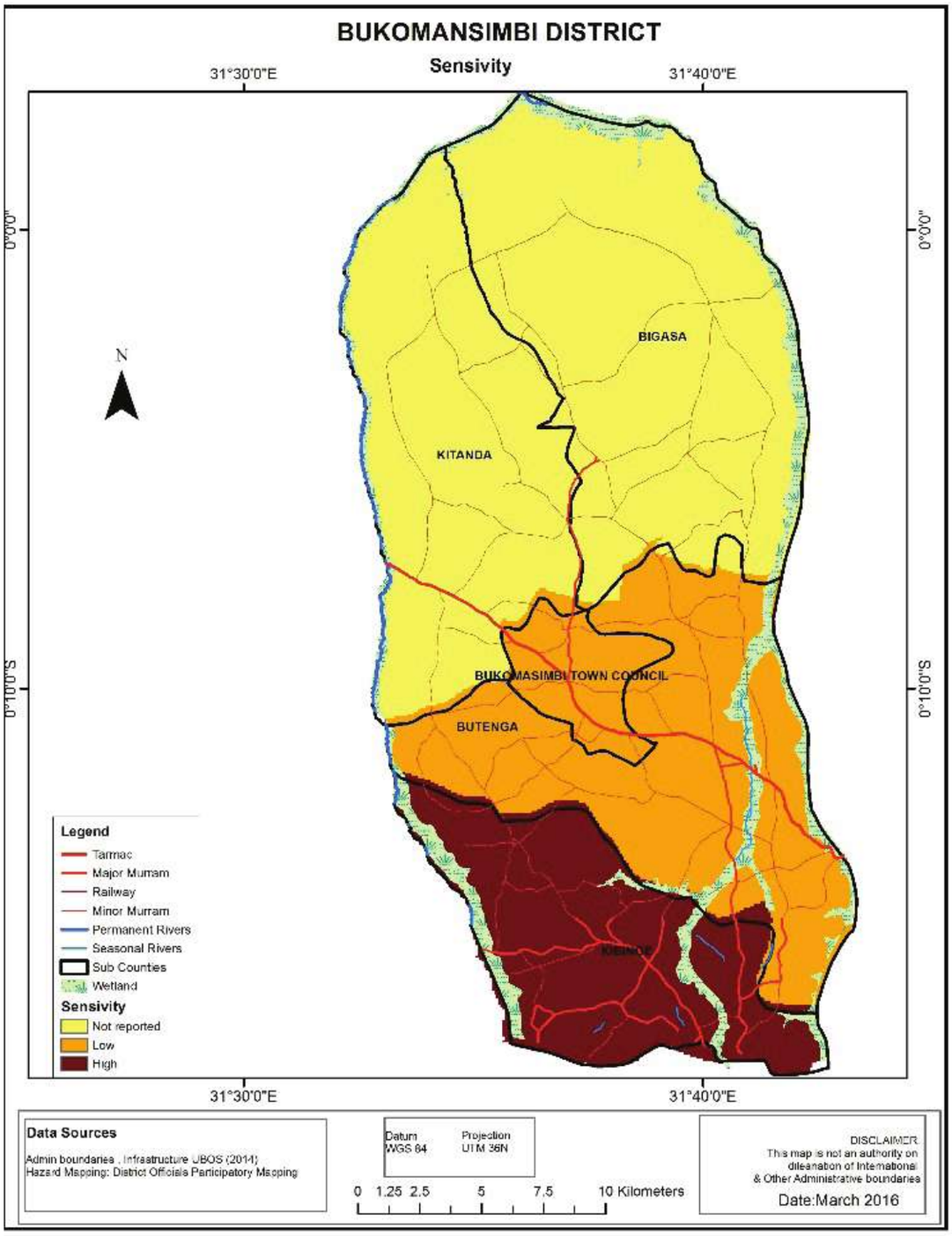

Figure 19: Sensitivty of stressors in Bukomansimbi District

Bukomasimbi district is moderately affected by landslides and slightly by vermin pests. Kikingo/ Kibonge is moderately affected by land conflicts and environmental hazard while Butenga is slightly prone to environmental hazards, road accidents and bush fires. Data on crop pests, human diseases, landslides, livestock diseases, wind and hailstorms was not reported and therefore they had the least effect on the sensitivity of the district. The overall sensitivity was influenced by environmental hazards, conflights, prevalence of lightning and vermin pests. Kibinge registered the highest sensitivity levels.

7.3 Lack of Adaptive Capacity

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

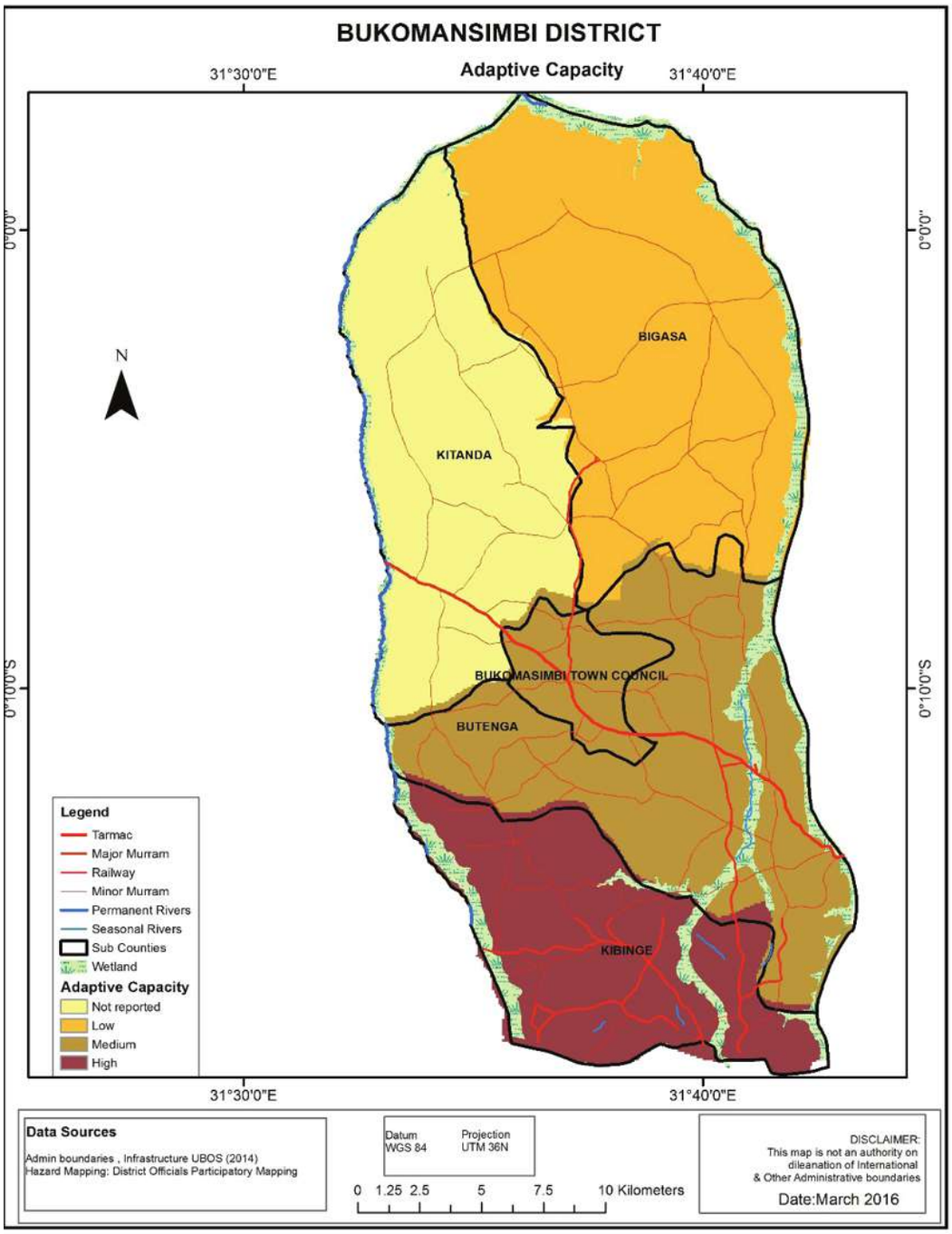

Figure 20: Lack of adaptive capacity in Bukomansimbi District

Both layers contributed to the adaptive capacity layer with Kibinge having the lowest capacity to

withstand the shock of the stressors.

7.4 Vulnerability assessment

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

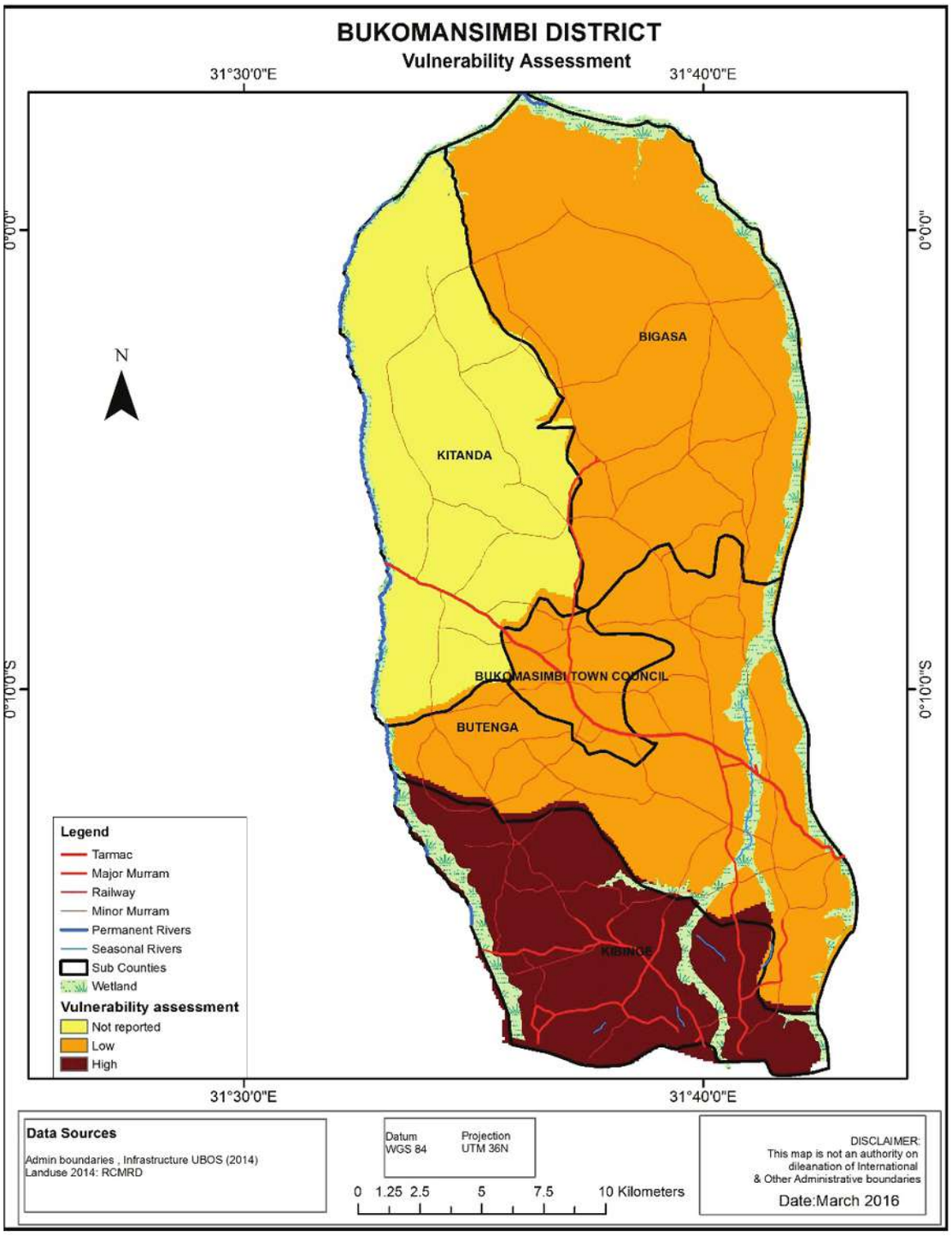

Figure 21: Vulnerability assessment of Bukomansimbi District

Kibinge was the most vulnerable sub county in Bukomasibi due to being highly exposed to climate stressors and having the lowest capacity to adapt.

8.0 General Conclusions and Recommendations

8.1 Conclusions

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 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.

8.2 Recommendations

The following are recommendations to mitigate and prevent these disaster in Bukomansimbi District.

Hailstorms

- Introduction of early warning systems
- Emergency budgeting for the effects of hailstorms.

Lightning

- Introduce early warning systems.
- Promote shoe wearing especially in school going children.
- More sensitization of communities to procure and install thunder arrestors in schools and houses.
- Avail thunder arresters especially in schools.
- Bill of quantities (BOQ'S) on construction projects should include installation of thunder arresters.

Environmental degradation

- Intensify sensitizations of wetland conservation.
- Enforce the law (NEA)
- Create other income generating activities.
- Regulate wetland users.

Land conflicts

- Recruitment of more staff in the Land's office to handle land conflicts.
- More Sensitization about land ownership and acquisition of land titles.
- Law enforcement

Human disease out break

- More sensitization of disease prevention.
- Popularize vaccination exercises.
- Empower VHTs.
- Strengthen outreach activities.
- Improve on drug stocks.
- Increase Mass immunization activities.

Droughts

- Construction of more water dams.
- Construction of more water harvesting tanks at household and village level.
- Popularize use of drought tolerant crops.
- Introduction of irrigation systems.
- Planting of more trees.
- Plan and budget for drought mitigation.

Bush fires

- Intensify sensitizations on dangers of bush fires.
- Formulate and enact a bye law on bush fires.
- Penalize the culprits.
- Introduce fire control measures.

Crop pests and diseases

- More sensitization of farmers on good agric. Practices.
- More distribution of inputs which are pest resistant.
- Allocate effective budget to the agricultural sector.
- Certification of inputs.
- Intensify research

Livestock pests and diseases

- More vaccinations.
- More sensitization of farmers on animal husbandry.
- Allocate effective budget to the Veterinary sector.
- Avail quality drugs and vaccines on time.
- Intensify disease surveillance.

Vermin's and wildlife animal attacks

- Vaccination of all stray dogs.
- Sensitization of farmers about the vermin.
- Recruit Vermin controllers.
- Regulate hunters.

Soil erosion

- Planting of more trees.
- More sensitization of farmers on soil and water conservation.
- Mechanize agriculture.
- Reduce land fragmentation.
- Road contractors to regulate water runoff along the roads.

Road accidents

- Put sign posts and humps along the hot spots.
- Police to sensitize road users.
- Tarmac the high way.

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

Hazard	Sub-county					Comments
	Kitanda	Bigasa	Butega	Kibinge	Bukomansimbi TC	
Floods	N	N	N	N	N	
Drought	H	H	H	H	H	Affect mostly women and children as most water wells dry up increasing distance for fetching water
Erosion	M	M	M	M	M	Hazard highlighted in Red means it was not mentioned
Hailstorms	L	M	L	L	L	All gender and age are affected
Lightning	M	M	M	H	M	Children in schools are mostly affected
Crop pests and Diseases	H	H	H	H	H	Coffee twig bora, banana bacterial wilt
Livestock pests and Diseases	H	H	H	H	H	Mainly African swine fever and tick borne diseases
Human disease outbreaks	H	H	H	H	H	Malaria in children, HIV especially prominent in girl child Diarrhea and pneumonia
Vermin and Wildlife animal attacks	M	M	L	M	L	Bush pigs along the wetlands which are there suitable habitat Stray dogs especially in the town council
Land conflicts	H	M	M	M	L	
Bush fires	M	M	L	L	L	
Environmental degradation	M	M	H	H	M	Wetland reclamation
Earthquakes and faults	N	N	N	N	N	
Road accidents	L	L	H	M	H	

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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