THE REPUBLIC OF UGANDA

Gomba District

Hazard, Risk and Vulnerability Profile

2016

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.

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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My appreciation also goes to Gomba District Team.
The entire body of stakeholders who in one way or another yielded valuable ideas and time to support the completion of this exercise.

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

EXECUTIVE SUMMARY

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

TABLE OF CONTENTS

Acknowledgement i
Executive Summary ii
Table of Contents iv
List of Tables v
List of Figures v
List of Acronyms vi
Definition of Key Concepts vii

INTRODUCTION 1
1.1 Background 1
1.2 Objectives of the study 1
1.2.1 Main Objective of the study 1
1.2.2 Specific objectives 1
1.3 Scope of work and deliverables 2
1.4 Justification 2

2.0 Overview of Gomba District 4
2.1 Geology 4
2.2 Vegetation and Landuse stratification 6
2.3 Climatic Conditions 7
2.4 Population and Demographic Characteristics 7
2.5 Main economic activities 7

3.0 METHODOLOGY 8
3.1 Preliminary spatial analysis 8
3.2 Stakeholder engagements and developing survey instruments 8
3.3 Participatory mapping 8
3.4 Field work and ground truthing verification 9
3.5 GIS modelling analysis 10
3.6 Regional Stakeholder Workshop for Data verification and validation 12

4.0 RESULTS FROM MULTI-HAZARD RISK, VULNERABILITY MAPPING 13
4.1 Livestock pests and diseases 13
4.2 Crop pests and diseases 14
4.3 Human disease out breaks 15
4.4 Environmental degradation 16
4.5 Land conflicts 17
4.6 Droughts 18
4.7 Road accidents 19
4.8 Strong winds, hailstorms and Lightning. 20
4.9 Bush fires 22
4.10 Floods 23
4.11 Vermins and problem animal attacks 24
4.12 Erosion 25
4.13 Gender and age group most afected 26

5.0 Coping Strategies 27

6.0 District Vulnerability Analysis at District level 28

6.1 Exposure Analysis..... 29
6.2 Sensitivity Analysis..... 30
6.3 Lack of Adaptive Capacity..... 31
6.4 Vulnerability assessment 32

7.0 General Conclusion and Recommendations 33
7.1 Conclusion 33
7.2 Recommendations 33

Annex I: Hazard risk assessment in sub-counties within the district 35
Annex II: Field Data collection questionnaire 36

List of Tables

Table 1: Gender and age group most affected in Gomba district 26
Table 2: Coping strategies of Gomba district 27
Table 3: Indicators utilised by vulnerability component 28

List of Figures

Figure 1: Location of the study area 3
Figure 2: Geology and Lithology structures of Gomba District 5
Figure 3: Land use stratification of Gomba District 6
Figure 4: Population density of Gomba District 7
Figure 5: Data conversion work flow 12
Figure 6: Livestock pests and diseases in Gomba District 13
Figure 7: Crops pests and Diseases in Gomba District 14
Figure 8: Human diseases in Gomba District 15
Figure 9: Environmental degradation in Gomba District 16
Figure 10: Land conflicts in Gomba District 17
Figure 11: Drought in Gomba District 18
Figure 12: Raod accidents in Gomba District 19
Figure 13: Strong winds, hailstorms in Gomba District 20
Figure 14: Lightning in Gomba District 21
Figure 15: Bush fires in Gomba District 22
Figure 16: Floods in Gomba District 23
Figure 17: Vermin and wildlife attacks in Gomba District 24
Figure 18: Soil erosion in Gomba District 25
Figure 19: Exposure of climatic conditions in Gomba District 29
Figure 20: Sensitivty of stressors in Gomba District 30
Figure 21: Lack of adaptive capacity in Gomba District 31
Figure 22: Vulnerability assessment of Gomba District 32

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).

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

Since 2013 UNDP has been supporting the Office of the Prime Minister to develop district hazard risk and vulnerability profiles in the sub-regions of Rwenzori, Karamoja, Teso, Lango, Acholi and West Nile covering 42 districts. During the 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 Gomba 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."

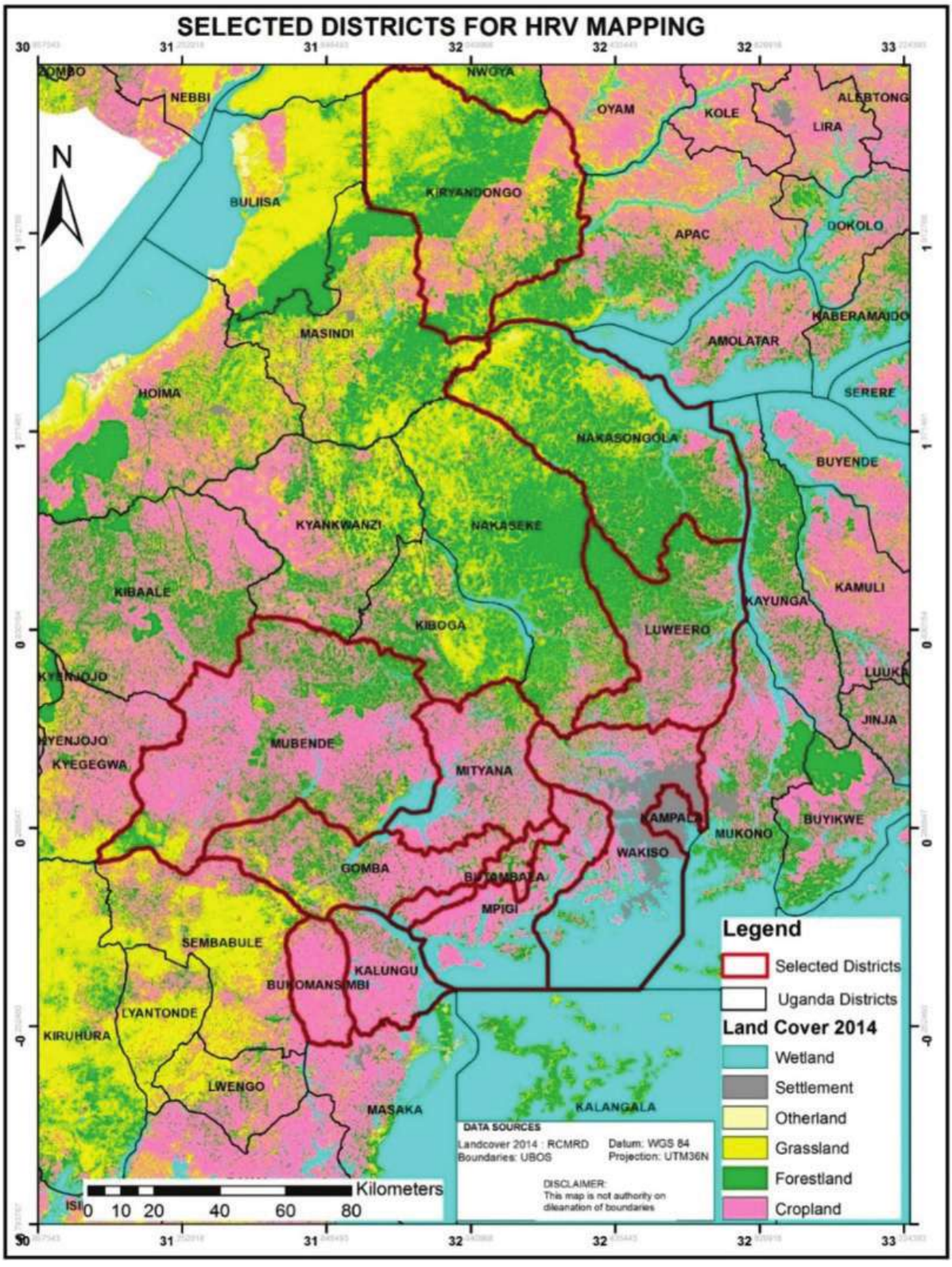

Figure 1: Location of the study area

2.0 Overview of Gomba District

Gomba District is one of the 24 districts of Buganda Kingdom. It was formed in 2010 breaking away from Mpigi District. Gomba District is bordered by Mubende District to the West and North, Mityana District to the Northeast and Butambala District to the East. Kalungu District, Bukomansimbi District and Sembabule District lie to the South of Gomba District. Kanoni, where the district headquarters are located, lies approximately 97 kilometres (60 miles), by road, Southwest of Kampala, the capital of Uganda and the largest city in that country. The coordinates of the district are:00 11N, 31 55E. (Latitude: 0.1750; Longitude:31.9100). The district is made up of four Sub counties of Mpenja, Kabulasoke, Kyegonza and Maddu, and one Town Council Kanoni Town Council where the district Headquarters are located, with a total size area of 1,541.13 square. Kilometres, 37 parishes with 289 villages.

2.1 Geology

The district lies in the central plateau of Uganda, which comprises undulating hills with deeply incised valleys. The hill summits lie between 1,182 and 1,341 meters above sea level. Seasonal and permanent streams drain much of the low-lying areas. The underlying rocks mainly comprise rocks of Precambrian age that are highly weathered. The most dominant rocks being of the Buganda-Toro system. The topography and geology provides abundant gravel and rocks resources used in construction. In areas with relatively flat terrain, it presents an opportunity for large scale animal rearing as in the area of Maddu subcounty.

Soils are mainly of the Buganda Catena and are combinations of clay and sandy loams resulting in sandy clay loams. The soils are relatively fertile and favorable for crop production. Most soils however require soil engineering and vegetative soil conservation. Soils on hills tend to be thin and unsuitable for cultivation and are therefore mainly used for grazing under natural vegetation. Poor farming practices have resulted in loss of fertility in most parts of the district thus reducing productivity.

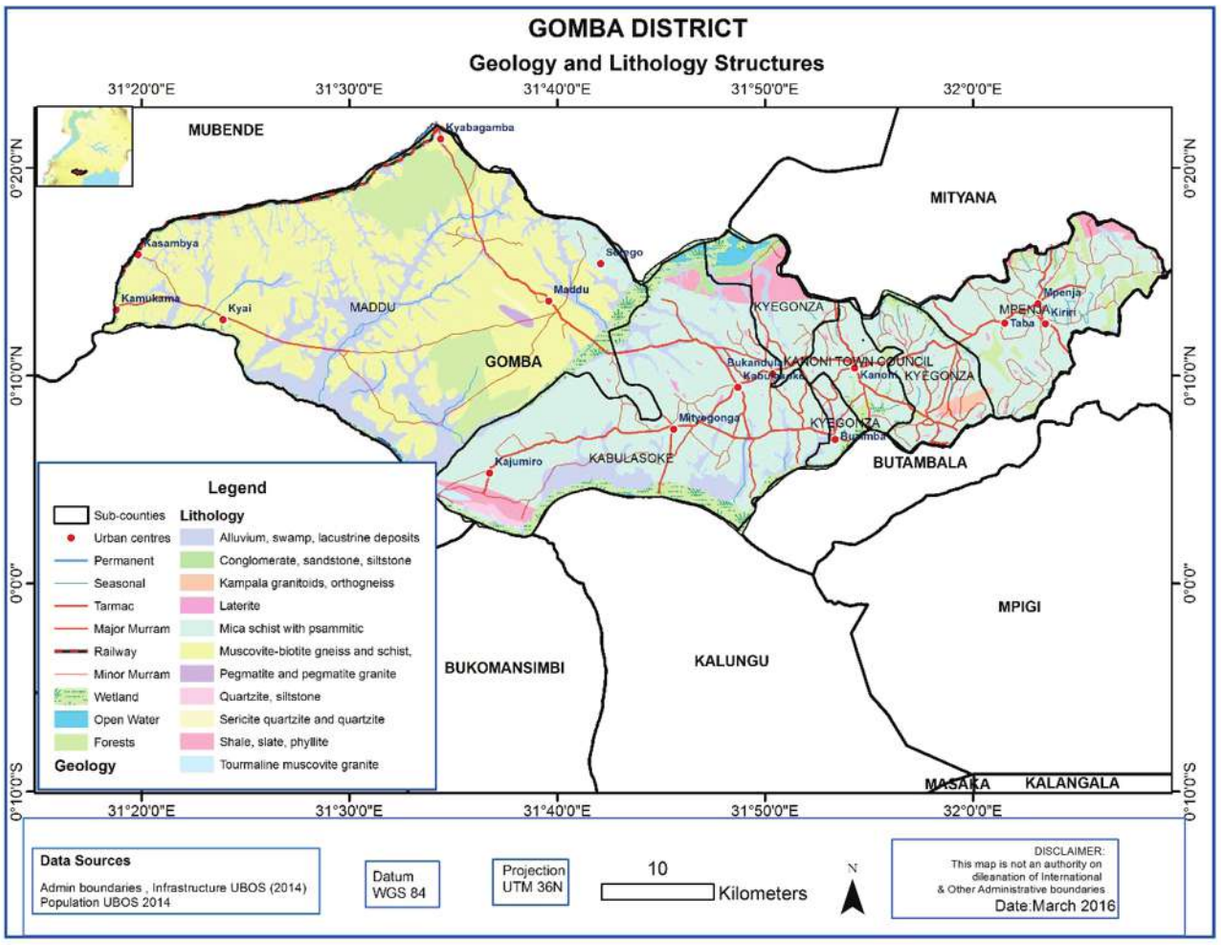

Figure 2: Geology and Lithology structures of Gomba District

2.2 Vegetation and Landuse stratification

The forest resource in the district is comprised of natural forests both gazetted and private. These can be categorized as tropical high forests, savannah woodlands, broad leaf plantation forests and conifer plantations which are distributed through out the district with Maddu subcounty having more of Tropical High Forests and the savannah woodlands. Wetlands range from forested wetlands to grassland wetlands. These have traditionally been a source of fuel wood and craft materials.

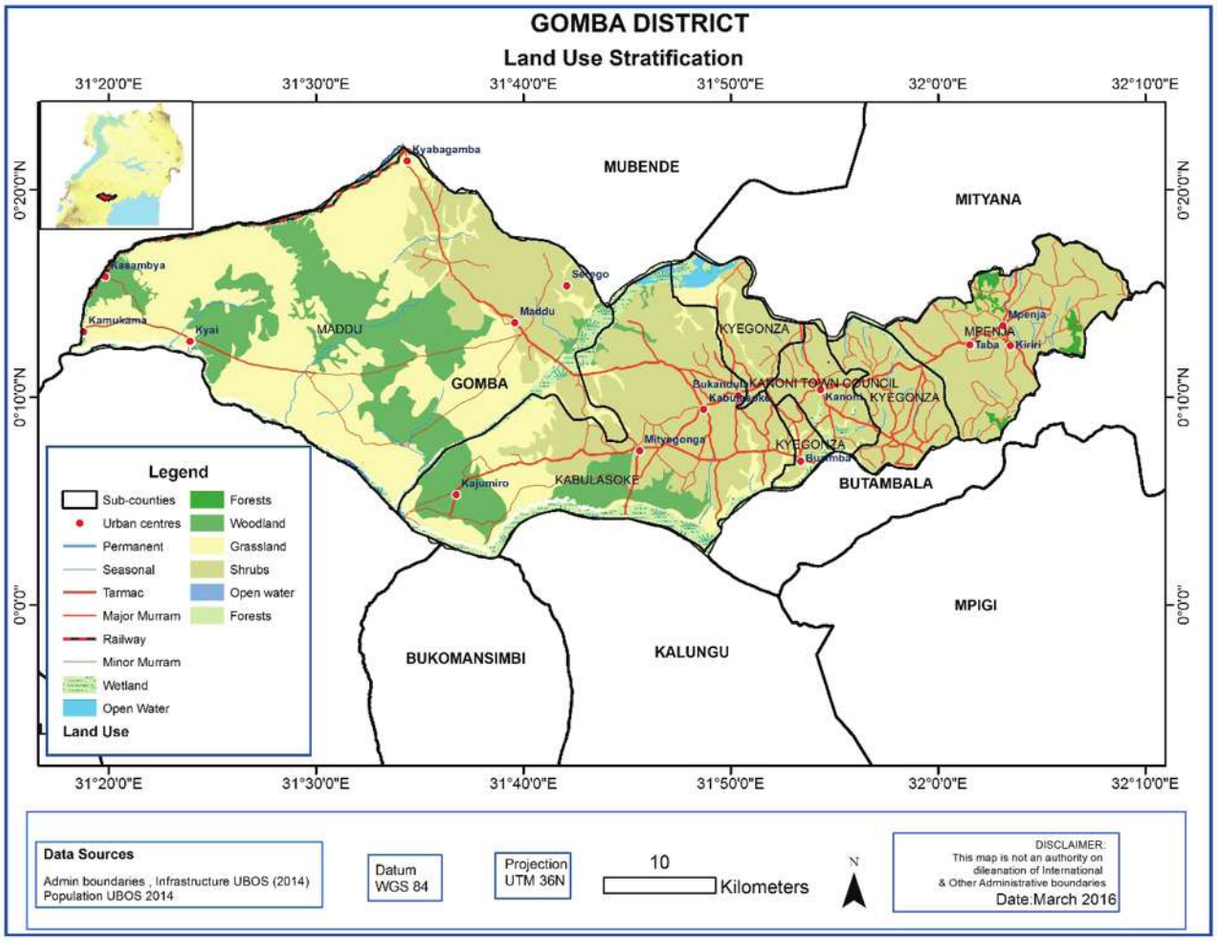

Figure 3: Land use stratification of Gomba District

2.3 Climatic Conditions

A bi-modal rainfall pattern is experienced in the district with the first rains occurring between March and May and the second rains between August and November with an average annual rainfall amount of 1320mm. Although the annual rainfall is high, its distribution is not even and is sometimes unreliable. Average annual maximum temperature ranges between 22.5° C and 27°C. Average minimum temperatures vary from about 18°C to 23°C. Average relative humidity ranges between 80% and 95% especially in forest areas. Hailstorms are usually experienced in Mpenja and Kyegonza Sub Counties affecting crops and property.

2.4 Population and Demographic Characteristics

According to the 2014 Population and Housing Census, the district has a total population of 160,075 of whom 81,520 are male and 78,555 are females. Its population density is 230 persons per Sq. Km and it has an annual growth rate of 1.43% per annum. In pastoral areas of Maddu sub-county the density tends to show a decline. The sex distribution of population is about 49% female and 51% male. Gomba District covers an area of 1,541.13 Square Km, which is about 0.07% of the country's size. Out of the total area, 218.9 Sq. Km is occupied by water and wetlands.

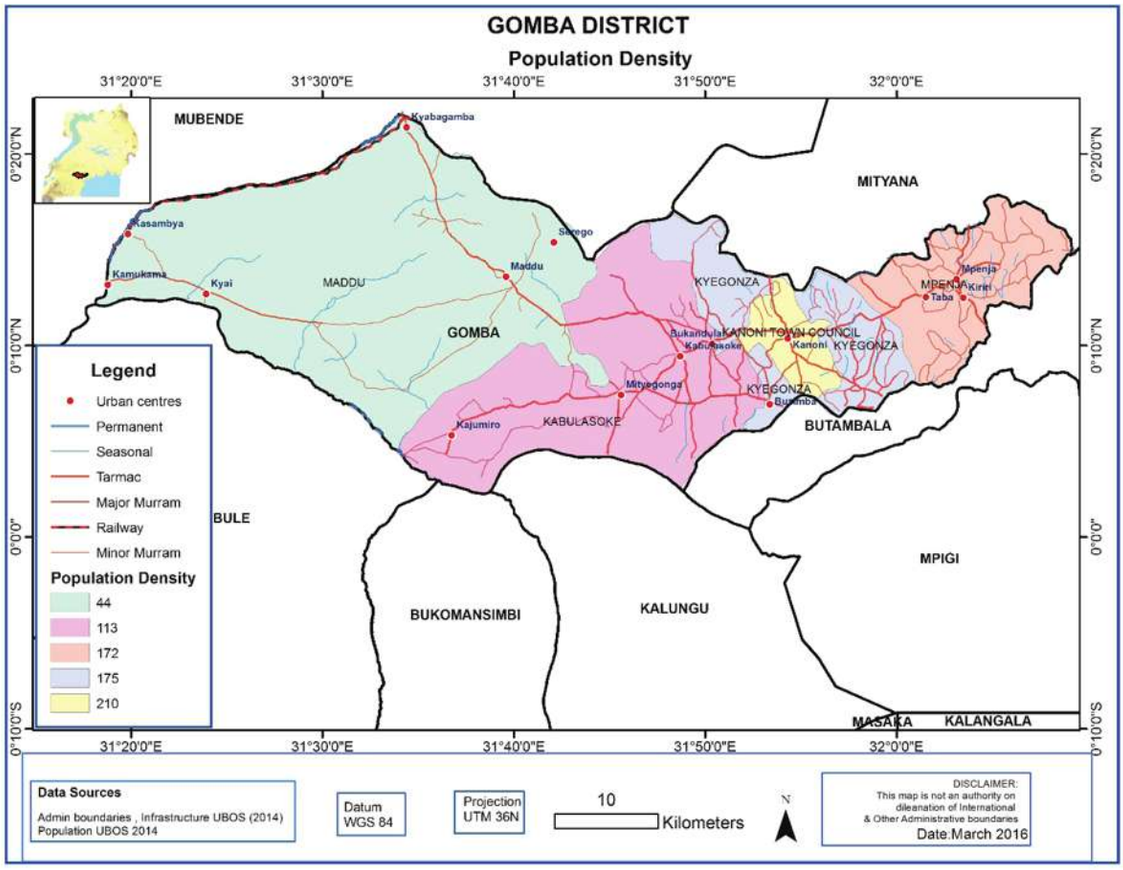

Figure 4: Population density of Gomba District

2.5 Main economic activities

The major economic activities in Gomba is agriculture coffee growing, cattle keeping (diary and meat production), horticulture (hot pepper – Mpenja Sub County), forestry and trade. There is also fisheries activities, Sand and Clay mining and stone quarrying and agro-processing.

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 modelling analysis

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

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

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

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

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

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

c) - Adaptive Capacity Layer: This layer informs on the ability of an ecosystem or community to bounce back from an extreme climatic event (hazard). Again, the GIS layers used to form this layer composite were determined largely by the varying ecosystems, societal and economic disparities from district to district and this was identified during participatory mapping. Despite this, the consultant envisaged that the following layers will cut across different districts for this composite; market access and poverty index.

The final vulnerability hotspots map for each district was developed by summing up the 3 composite layers (exposure, sensitivity and lack of adaptive capacity layers) then dividing by 3. This was then normalized to a scale of 0 – 100 after which the vulnerability hotspot layer were indexed into 4 scores as follows not reported, low, medium, high.

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

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

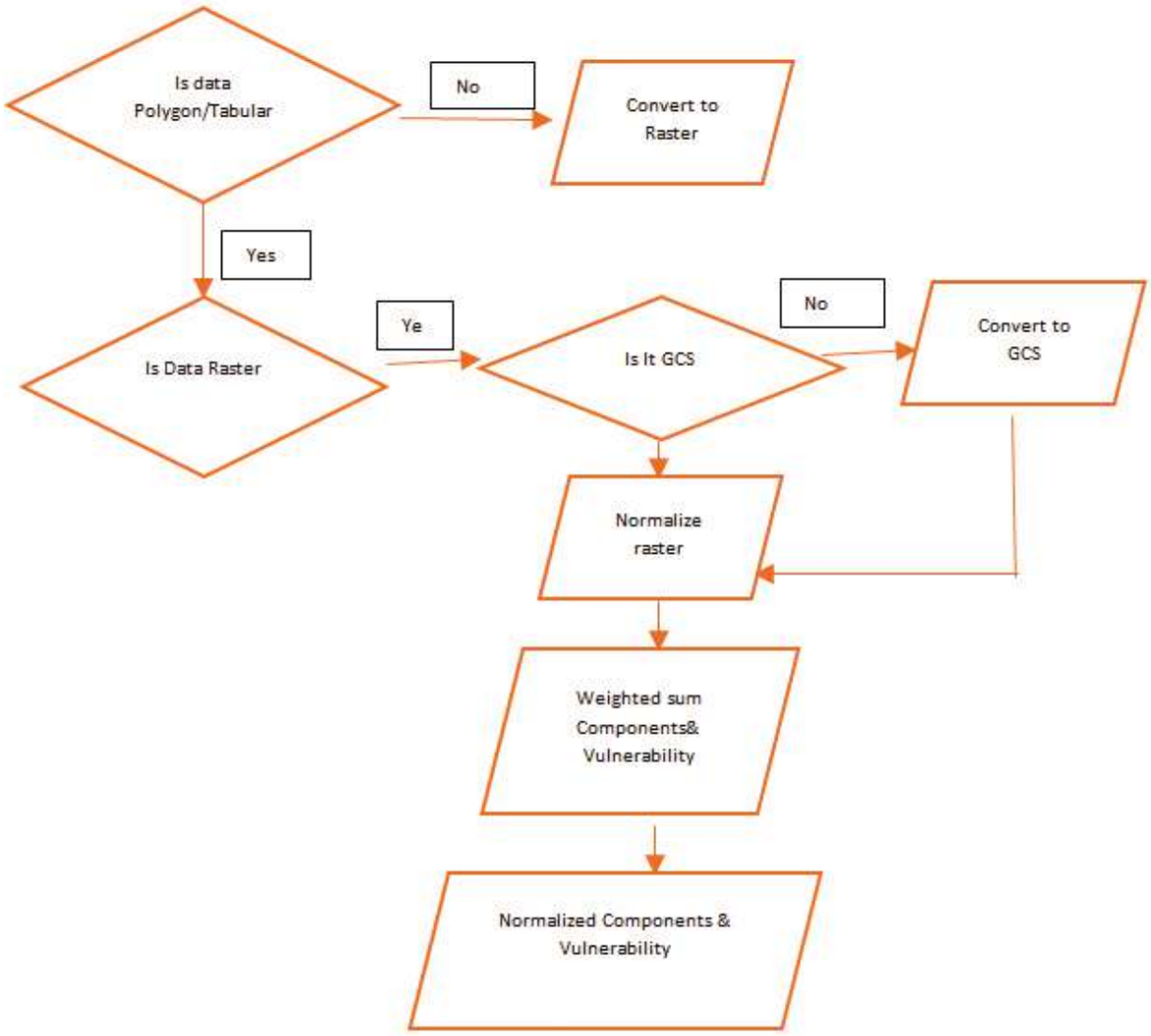

Figure 5: Data conversion work flow

3.6 Regional Stakeholder Workshop for Data verification and validation

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

4.0 RESULTS FROM MULTI-HAZARD RISK, VULNERABILITY MAPPING

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

4.1 Livestock pests and diseases

Gomba district is known for cattle keeping; however it is prone to foot and mouth disease that affects the entire district leading to quarantines which result into losses of revenues and livelihoods in communities. There are no clear trends for FMD and the disease has become endemic within the region as wildlife habour the disease. This is mainly because during the dry seasons, cows are normally taken to watering points and graze in protected areas where they interact with wildlife.

The sub counties of Kaburasoke and Maddu are heavily affected. The other livestock diseases identified are tick borne diseases such as East coast fever and Anaplasmosis that are manageable through vaccination and continual spraying of cattle. However, uncontrolled uses of acaricides some of which are not effective are leading to resistance of the drugs which is a likely challenge for disease control in the near future.

Irresponsible cattle movement; Failure to vaccinate animals due to high costs and inadequate vaccine supplies; Prolonged dry spells; Drugs abuse and misuse; Bush clearing (anthrax) and cultural practices were noted as some of the reasons for continual occurrence of livestock pests and diseases. Hotspots were identified in Ddegeya, Kigezi, Kisozi, Kifampa, Kyayi, Kyabagamba and Ntalagi parishes.

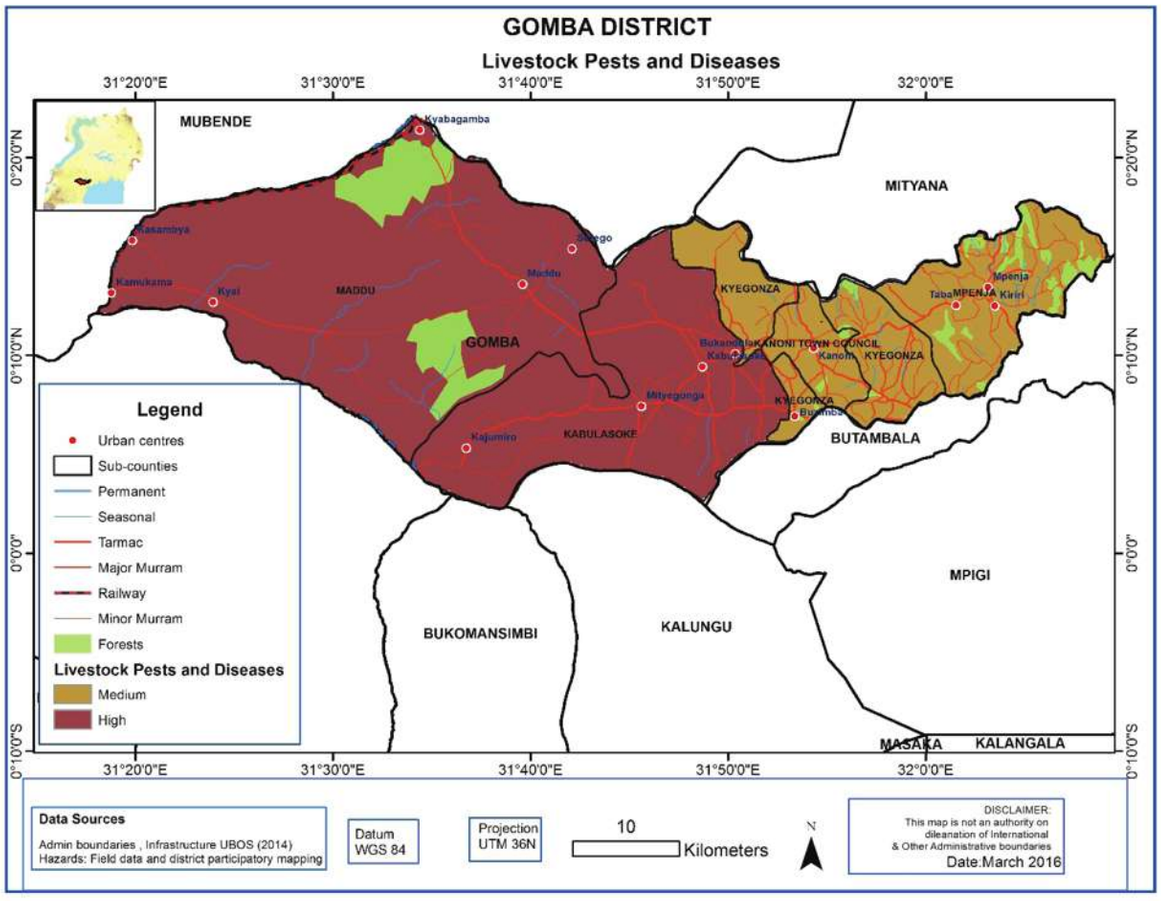

Figure 6: Livestock pests and diseases in Gomba District

4.2 Crop pests and diseases

Crop pests and identified in Gomba include banana bacterial wilt, banana weevil, coffee wilt and coffee twig bora which are affecting the whole district. Irresponsible movement of plant materials and plant produce, Abuse of herbicides, Climate change, Poor traditional farming methods and low extension -Farmer ratio were noted as the main challenges why crop pests and diseases have persisted.

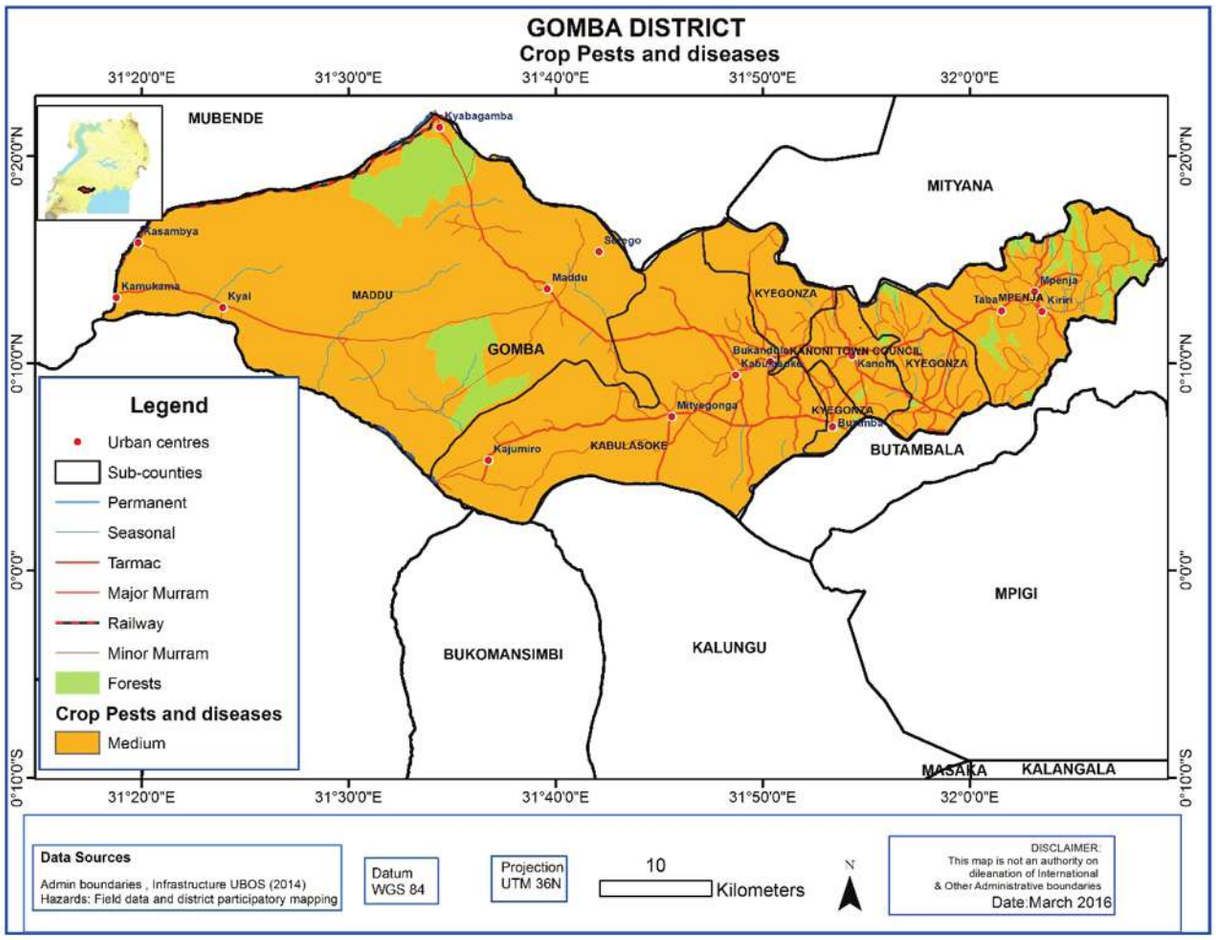

Figure 7: Crops pests and diseases in Gomba District

4.3 Human disease out breaks

Malaria remains a challenge in the district despite government programmes to distribute mosquito nests and anti-malarials. Diarrhea is also common because toilet coverage use in the district is low. Other notable diseases are HIV&AIDS (prevalence is likely high in Kyegoza and Bulwanda in Kaburasoke subcounty); typhoid, stomach warms and brucellosis which become endemic in Gomba. Persistence of some of human disease outbreaks was attributed to Low latrine coverage, Irresponsible sex life especially among the fishing communities, Lack of access to safe water, Failure to use mosquito nets and Low literacy levels.

Hotspots were noted in Mamba parish (HIV), Kisozi parish (Malaria), Bulwadda parish (HIV), Maddu parish (malaria), Kyayi Parish (water bond diseases), Mamba Parish (water bond diseases), Kigezi (water bond diseases), Kisozi (water borne diseases), Kifampa (water borne diseases)

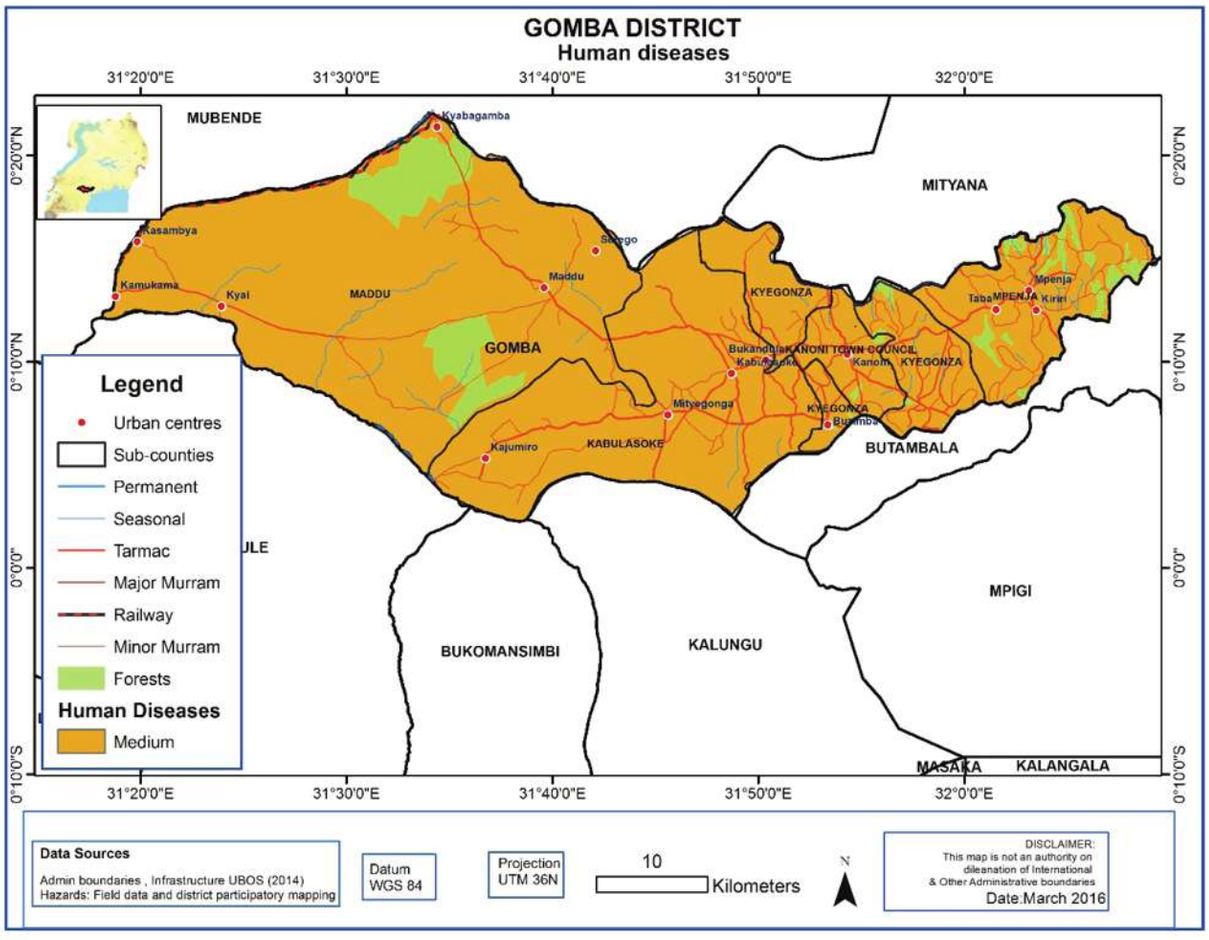

Figure 8: Human diseases in Gomba District

4.4 Environmental degradation

Wetland reclamation for farms and eucalyptus growing together with deforestation for charcoal were identified as the major challenges to environmental conservation. However interventions such as tree growing are being encouraged to mitigate the impacts of deforestation. Kanoni, Malere, Mamba, Mpunge, Bukandula, Bulwadda, Maseruka, Ntalagi, Golola parishes were identified as hotspots for environmental degradation. This was mainly due to high pressures on land, deforestation, overgrazing & bush clearing, poor waste management, poor soil management and abuse of agricultural chemicals within these parishes.

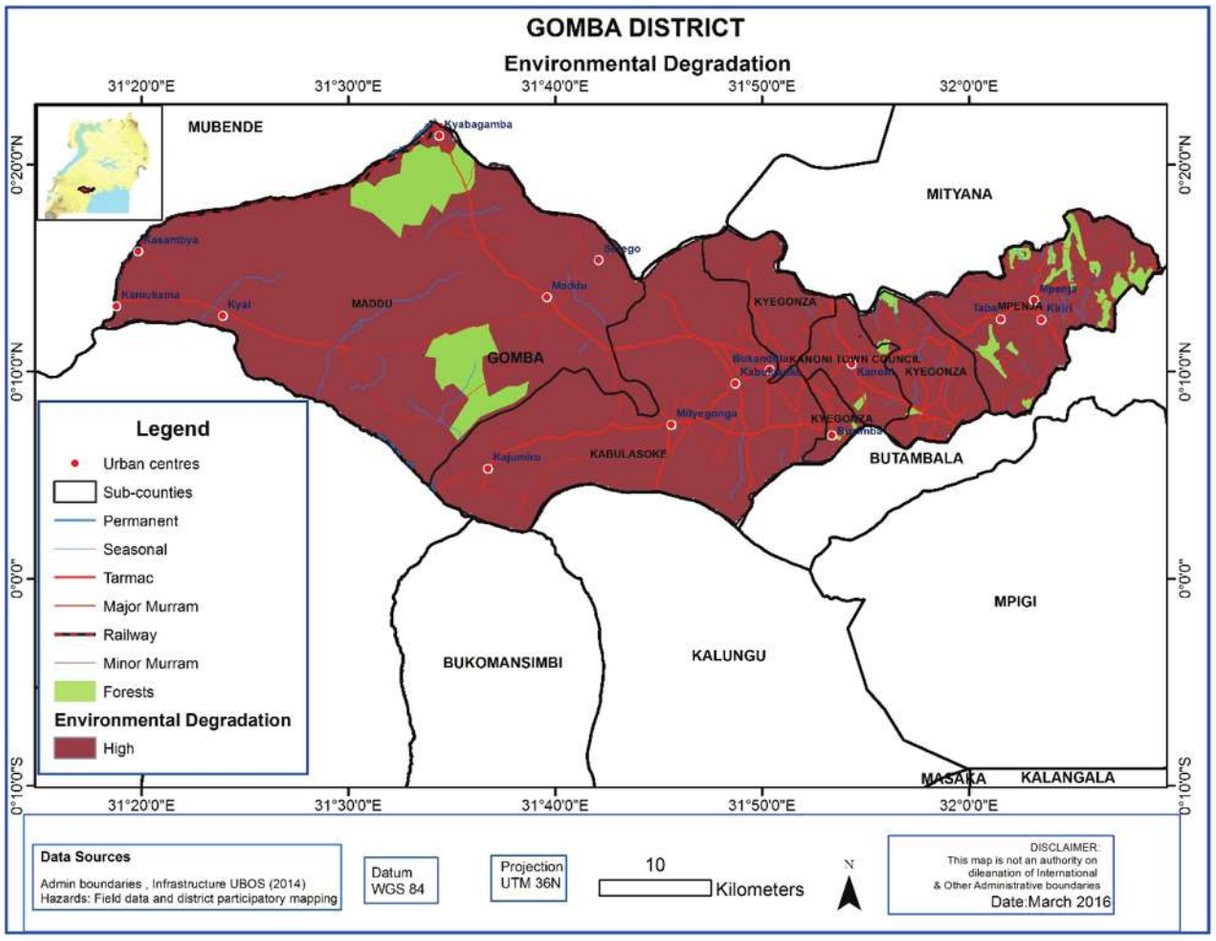

Figure 9: Environmental degradation in Gomba District

4.5 Land conflicts

Land conflicts are common in the sub counties of Maddu and Kaburasoke. These are mainly attributed to poor land ownership system related to Buganda and central government lands that people have been trying to take over. Competition for such lands fuels the conflicts especially when one party knows that the lease for an individual is almost over and wants to take over from the other party. The other issue is where some ranchers fence off water points and yet this watering area was being used by a number of people. Other casues include overstocking and unclear land laws governing land within the district. Hotspots were identified in Ddegeya, Kigezi, Kisozi, Kifampa, Kyayi, Kyabagamba, Ntalagi, Bulwadda, Mamba, Bukandula, Kakubansiri and Malere parishes.

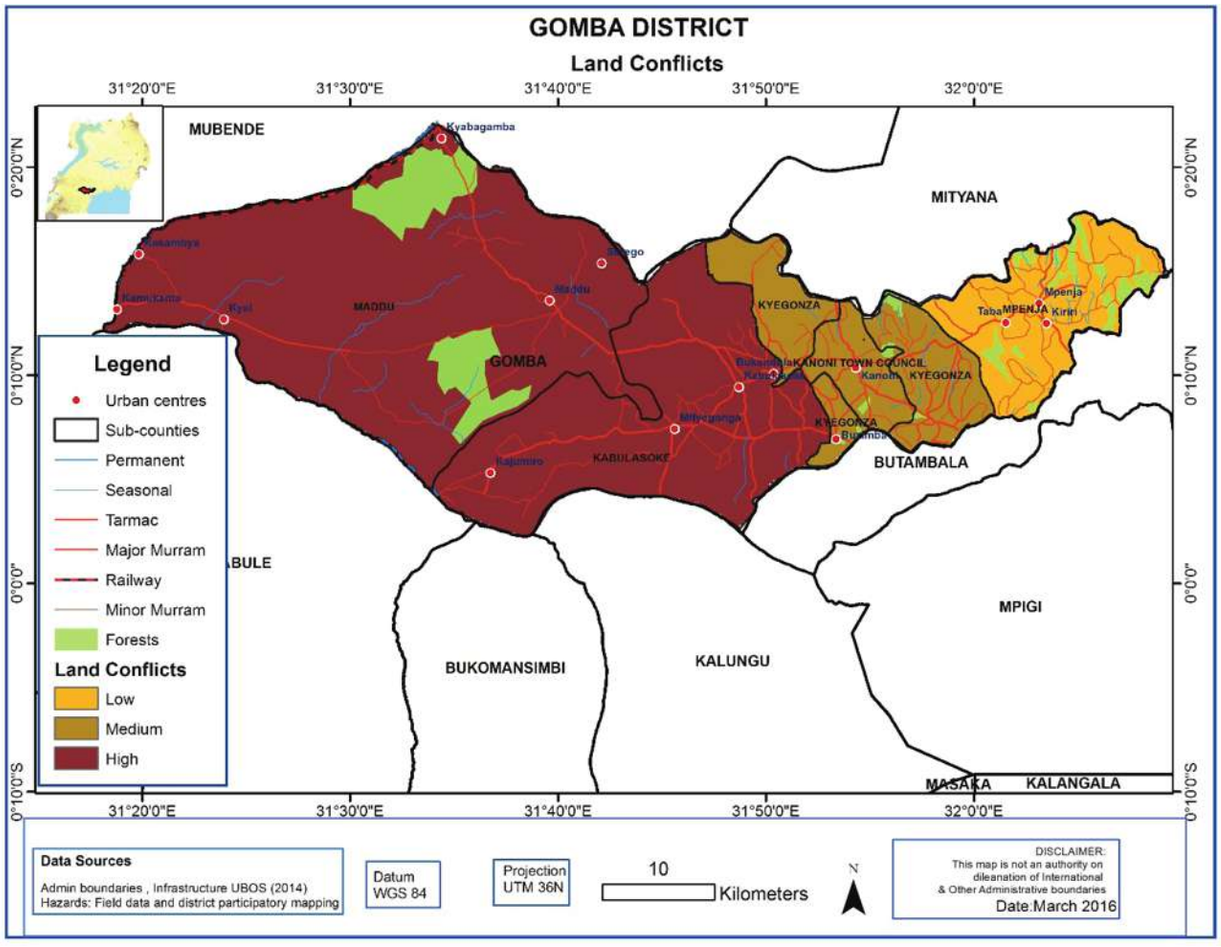

Figure 10: Land conflicts in Gomba District

4.6 Droughts

Gomba is one of the districts in the cattle corridor, an area prone to severe drughts. For instance in 2009 Gomba experience terrible droughts were animals started dying of because of lack of grass and water. This normally happens in a cycle of every 10 years. Because of droughts, many streams and water points dry up and accessing water can be challenging. However, the government has come up with strategies to get communities cope with droughts such as water harvesting by building valley tanks and boreholes. Communities are also normally encouraged to sell of their cattle herds to minimize on losses and have cattle they can manage. Intensive cultivation, deforestation were noted as the some of the issues exacerbating dry spells. Over grazing Hotspots were identified in areas of Ddegeya, Kigezi, Kisozi, Kifampa, Kyayi, Kyabagamba, Ntalagi and Bulwadda parishes.

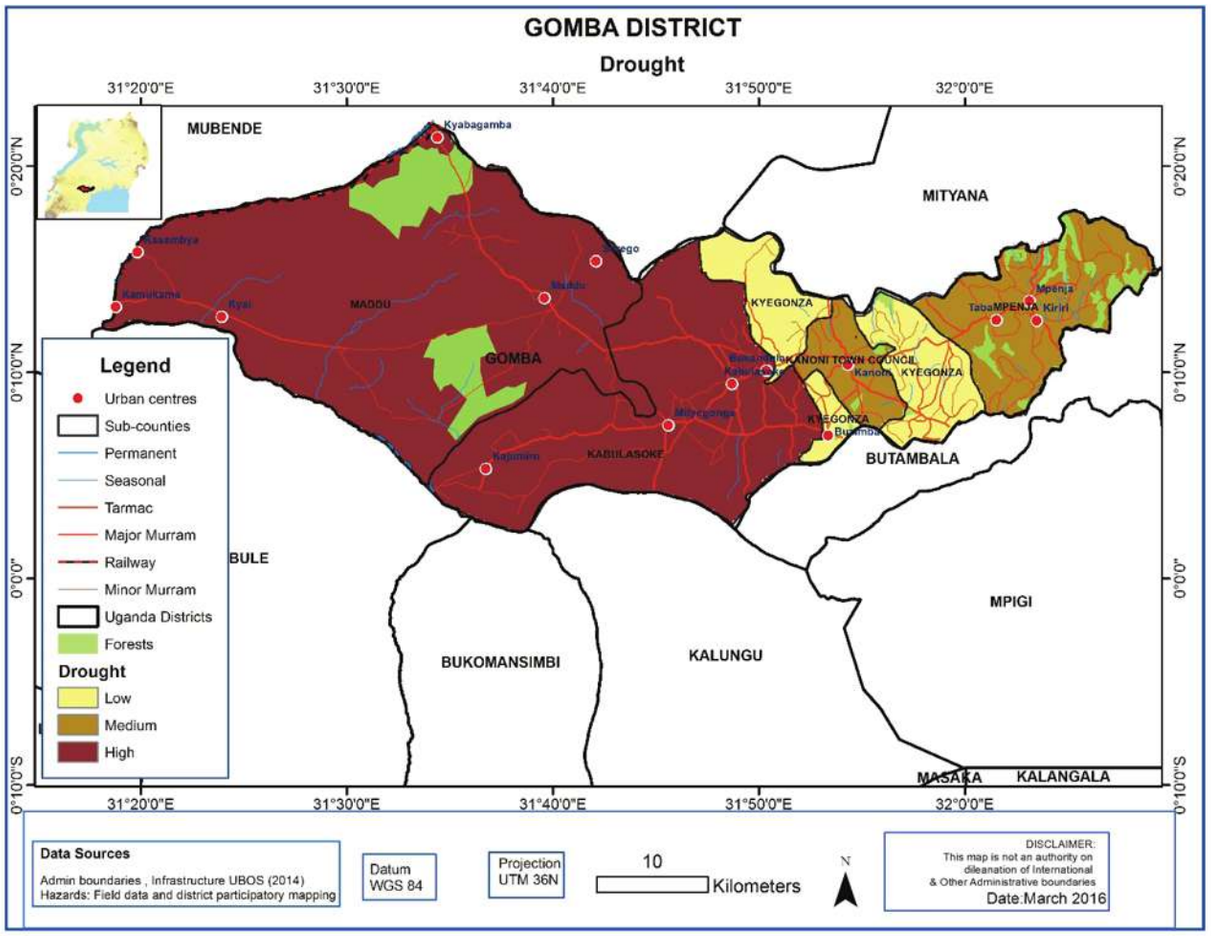

Figure 11: Drought in Gomba District

4.7 Road accidents

The incidences of accidents are minimal. These accidents are attributed to growth of Boda boda industry especially in upcoming town councils. Kanoni, Kabulasoke, Bukandula, Maddu, Ngomanene, Kiriri, Malere, Kifampa Town Councils were identified as hotspots. Lack of road signs, humps at some critical points, poor roads (pot holes), Lack of enough traffic personnel to enforce traffic laws, Poor mechanical conditions of the vehicles and Poor road use were noted as some of the conditions that continue to casue accidents.

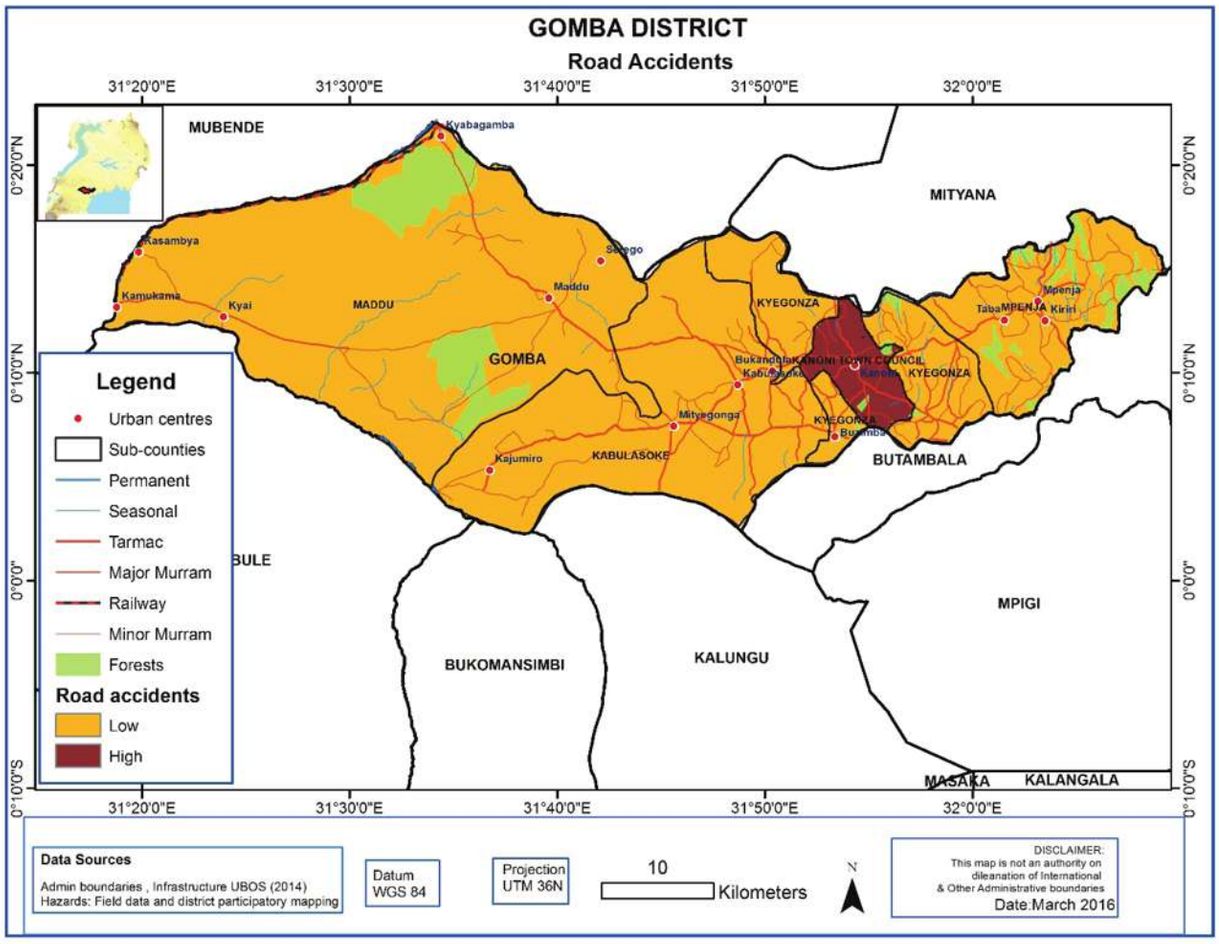

Figure 12: Raod accidents in Gomba District

4.8 Strong winds, hailstorms and Lightning.

It was noted that there have been incidences of strong winds that blow away schools. Deforestation resulting in absence of wind breakers was highlighted as main contributor of severe wind occurrences. Hotspots were noted in Kyayi, Ntalagi, Lugaaga, Ddegeya, Kanoni and Mamba parishes and these are normally accompanied by hailstorms. Occurrences of hailstorms is common within the district With hotpots identified in Nsambwe, Kyayi, Lugaaga, Ddegeya, Bulwadda, Ngeribalya, Kakomo, Mamba parishes. Lightning incidences are also a common phenomena with school children in schools mostly are affected. Kisozi, Kifampa, Ddegeya, Bulwadda and Kigezi parishes were identified as the main hotspots. Environmental degradation and local Ankole cattle with their long pointed horns which are prone to Lightning were noted to seemingly be the cause of Lightning incindences.

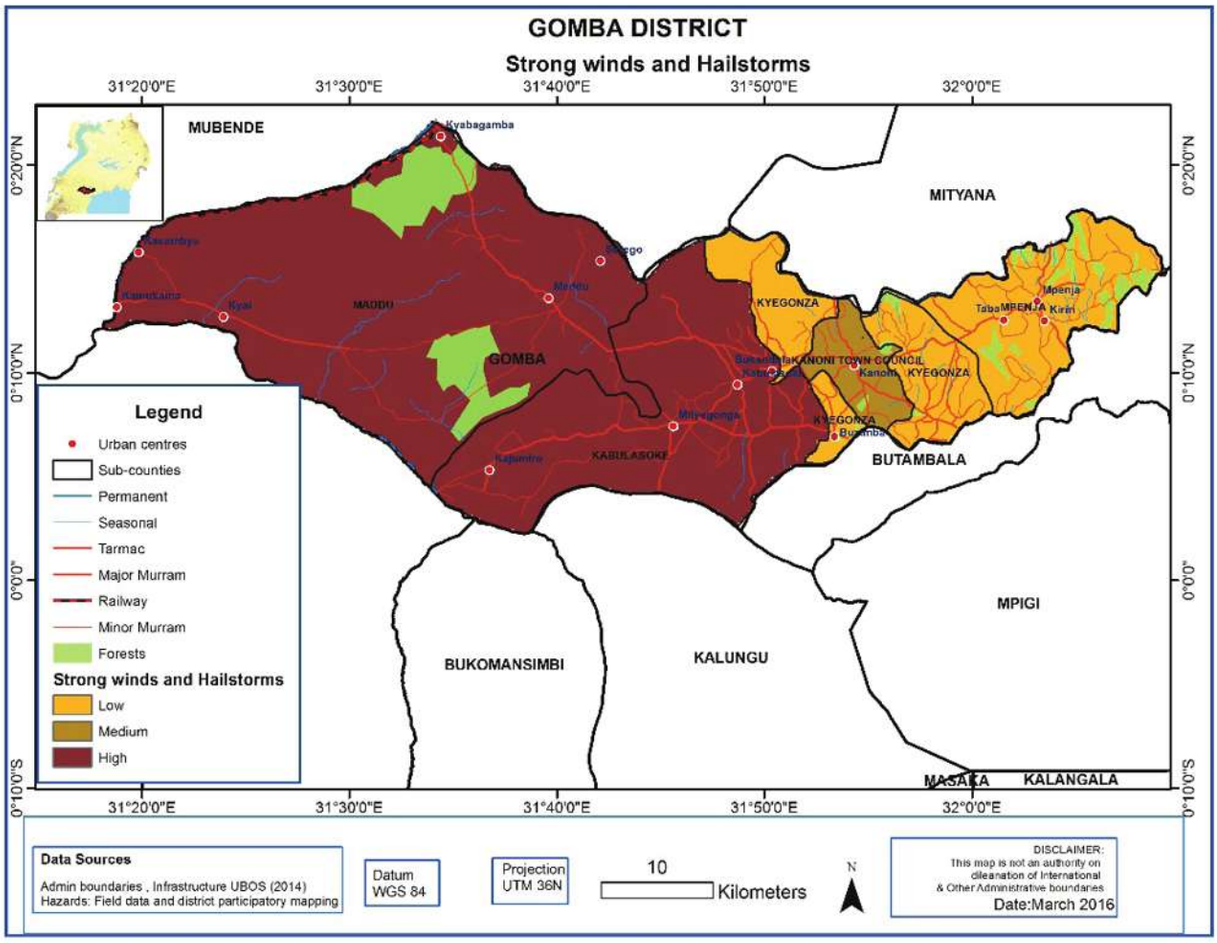

Figure 13: Strong winds, hailstorms in Gomba District

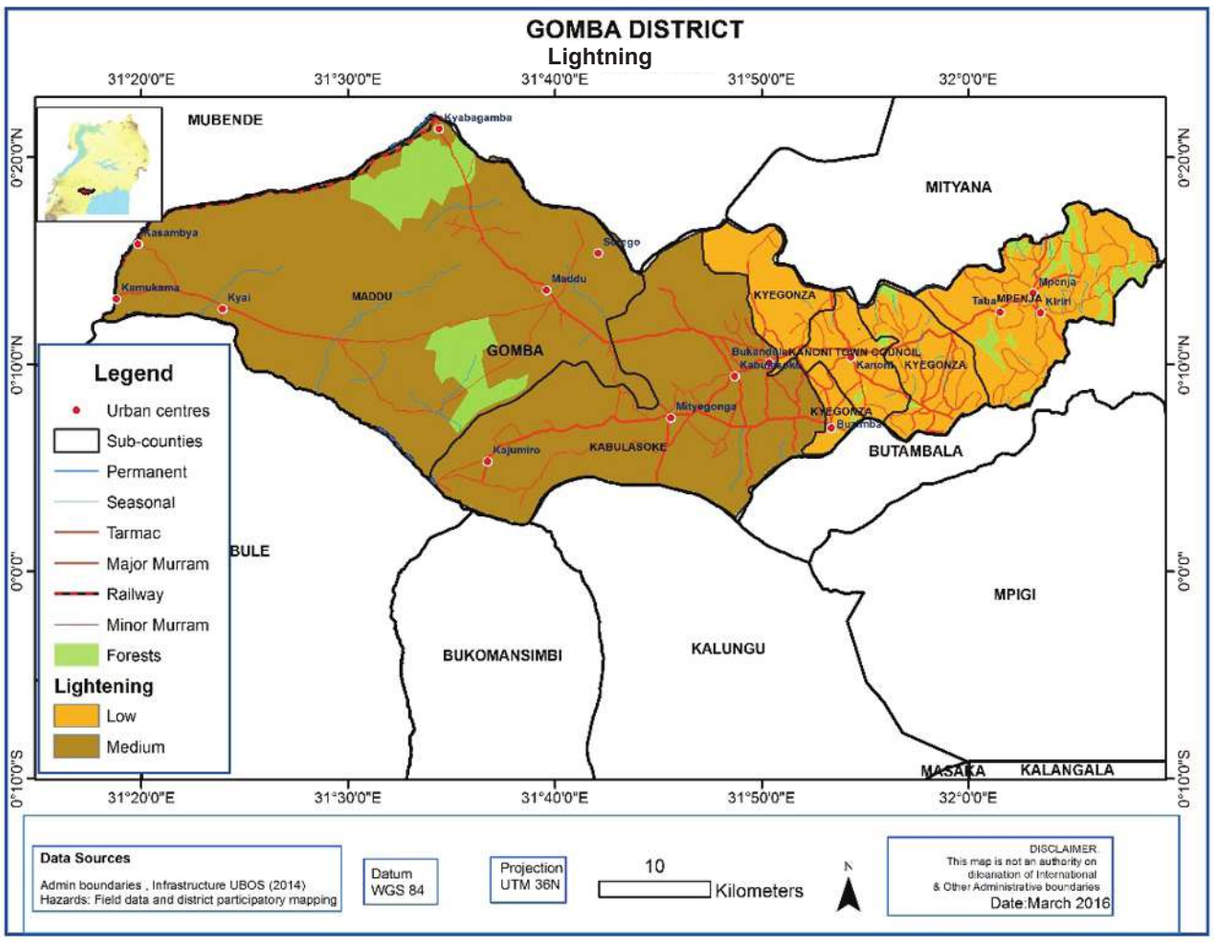

Figure 14: Lightning in Gomba District

4.9 Bush fires

Bush fires have been going down due to people grazing their cattle in enclosed paddocks as opposed to the past were people would graze more communally and fire would be used to control ticks. However a few bush fires still exist in cattle rearing areas to have new grass for the cattle. Land wrangles; poor traditional agricultural methods; prolonged dry spells; hunting; Spontaneous fires were noted as the main causes of these fires. Ddegeya, Kigezi, Kisozi, Kifampa, Kyayi, Kyabagamba, Ntalagi, Maddu, Kakubansiri, Ddegeya parishes were noted as Hotspots.

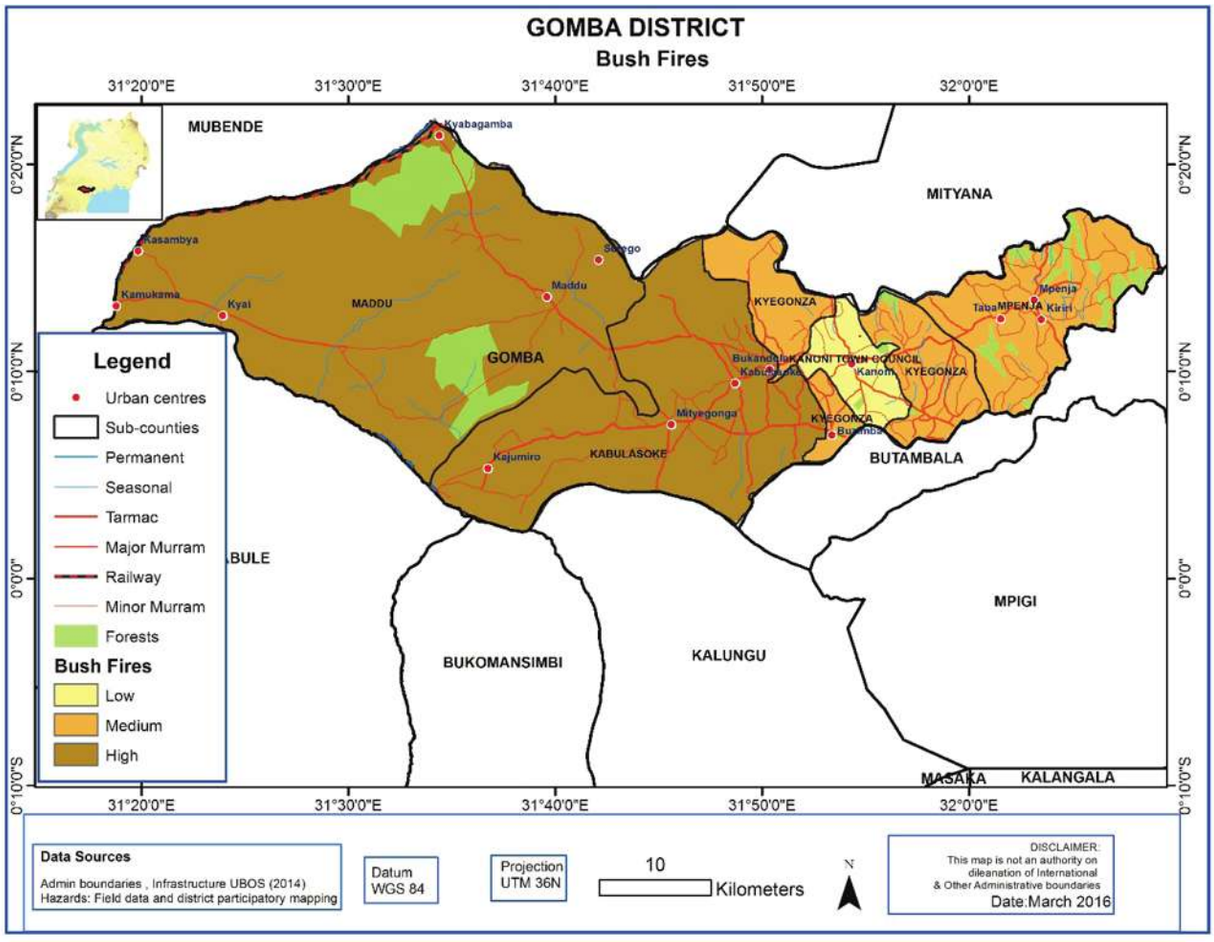

Figure 15: Bush fires in Gomba District

4.10 Floods

There are incidences of floods in Maddu and Kaburasoke area which result in cases of foot rot in most hooved animals. These normally occur in rainy seasons of March-May and September-November. Severity of such floods depends on the amounts of rains received. Ddegeya, Kigezi, Kisozi, Kifampa, Kyayi, Kyabagamba parishes were highlighted as hotspots within the district. These areas are low lying and relatively flat. Kyayi and kigezi do flood when river Katonga burst its banks mostly during heavy rain seasons.

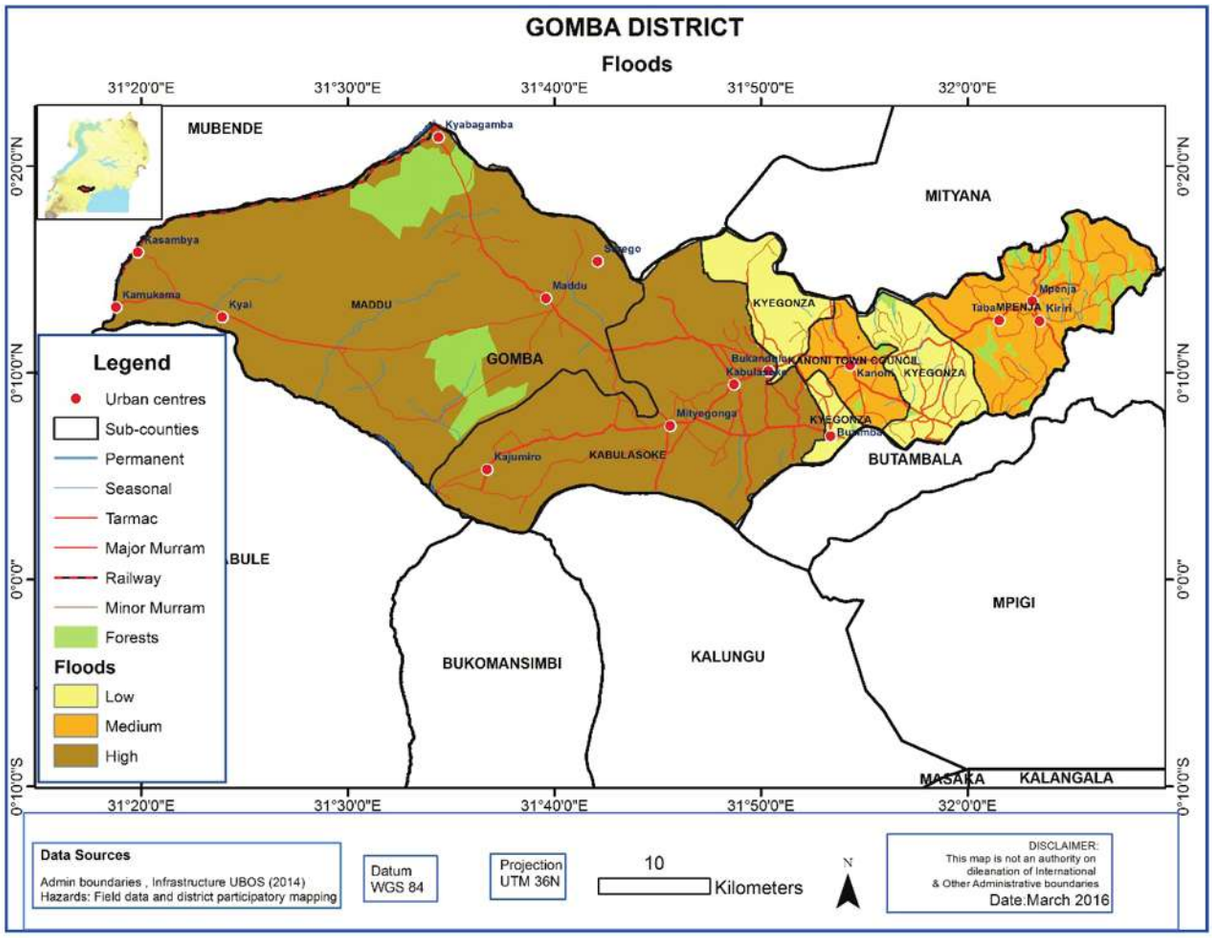

Figure 16: Floods in Gomba District

4.11 Vermins and wild animal attacks

There are a few cases of vermin's such as vervet monkey crop raiding. The other issue highlighted was that wild hogs in the bushes are causing diseases to livestock such as African swine fever in pig and this was notable in Kaburasoke and Maddu sub counties. Ddegeya, Kigezi, Kisozi, Kifampa, Kyayi, Kyabagamba and Maddu parishes were identified as hotspots mainly because they are made up of farms and ranches which are endowed with bushes and thickets with wildlife. There are also forest reserves and wetlands in the areas.

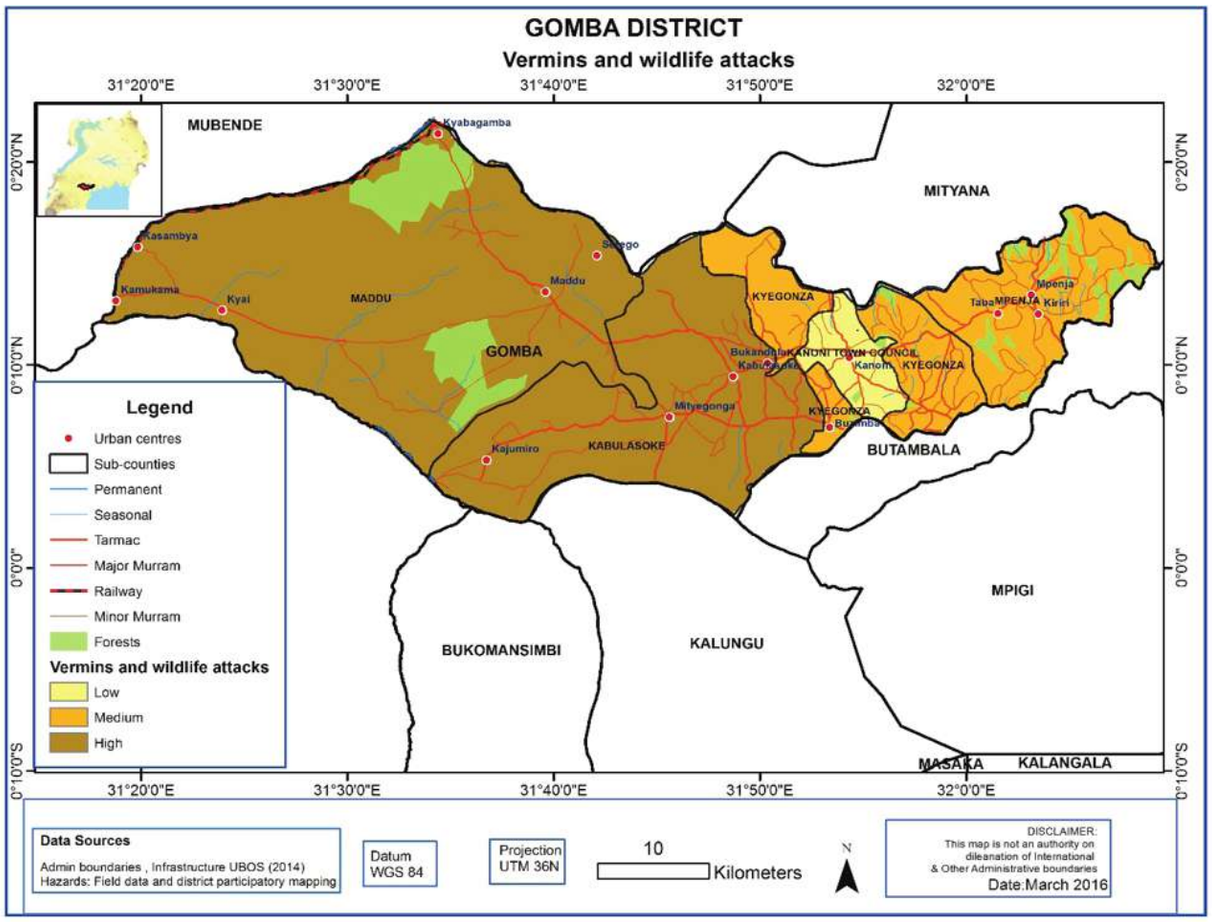

Figure 17: Vermin and wildlife attacks in Gomba District

4.12 Erosion

There is minimal occurrence of erosion. Just some hilly areas are the one that could potentially be prone to erosion especially if poorly utilized. Bush clearing, Deforestation, Poor drainage patterns along roads, Sloppy gradient, poor farming methods were highlighted as the main causes of soil erosion. Mamba, Malere, Golola, Ngeribalya parishes were noted as hotspots.

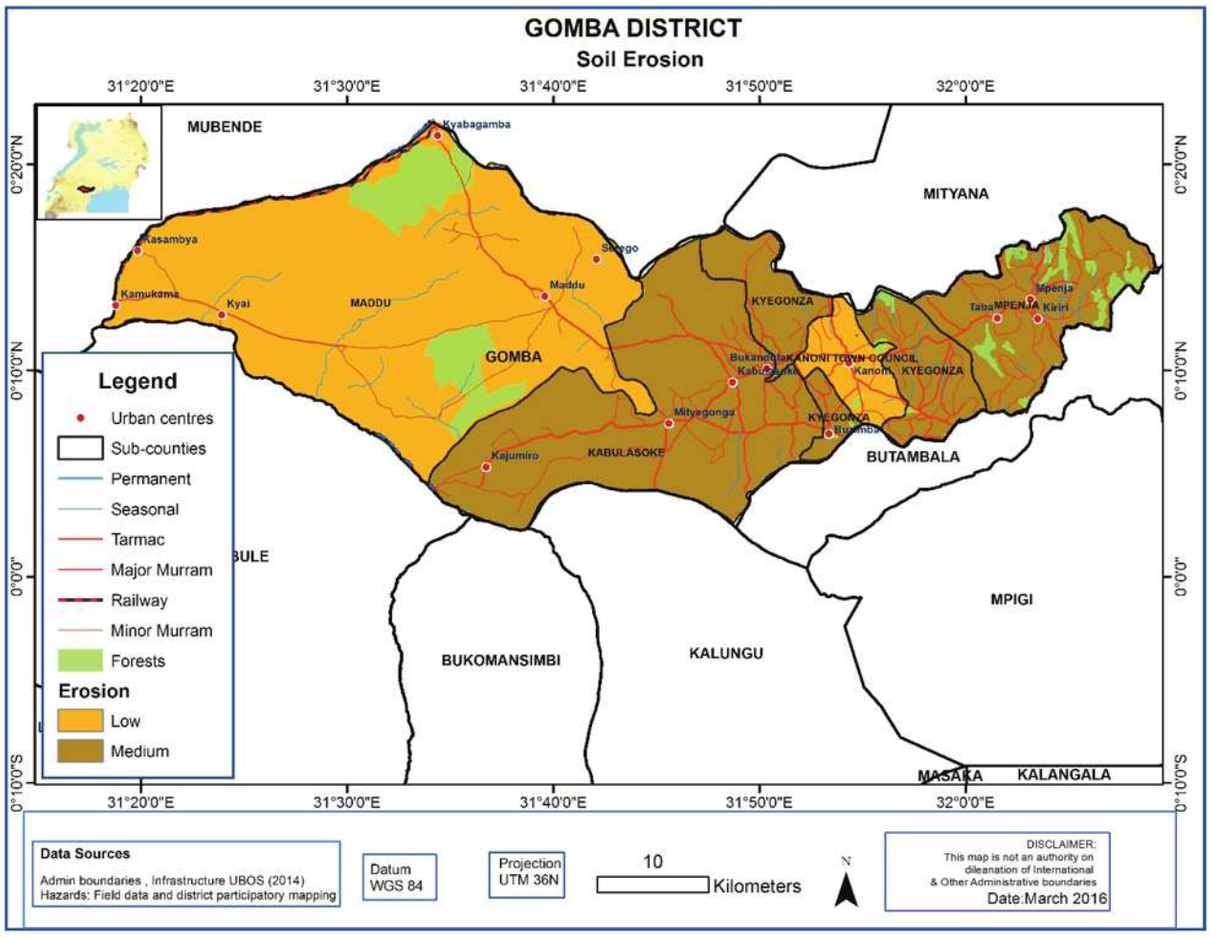

Figure 18: Soil erosion in Gomba District

4.13 Gender and age group most afected

Table 1: Gender and age group most affected in Gomba district

Hazard	Affected
Floods	Men, women and children
Vermin and wildlife	Men, women and children
Livestock pests and diseases	Men, women and children
Drought	Men, women and children
Road accidents	Men, women and Children
Soil erosion	Men, women and children
Strong winds	Men, women and children
Hailstorms	Men, women and children
Lightning	Men, women and children
Crops pests and diseases	Men and Children, women
Human diseases	Men, women and children
Land conflicts	Men, women and children
Environmental degradation	Men, women and children
Bush fires	Men, women and children

5.0 Coping Strategies

Table 2: Coping strategies of Gomba district

Hazard	Ranking	Coping strategies in Gomba
Floods	10	restoration of wetlands and forest reserves
Vermin and wildlife	14	Mitigate destruction of ecological niches for these animals
Livestock pests and diseases	1	Improved seeds. Early planting. Stop deforestation
Drought	6	Dissemination of Water harvesting technologies Tree planting
Road accidents	07	Installation of warning signs. Speed fines.
Soil erosion	12	Halting of tillage on fragile ecosystems
Strong winds	13	Afforestation and reforestation.
Hailstorms	08	Hailstorm preparedness
Lightning	11	Lightning arrestors.
Crops pests and diseases	2	Sensitisation on preventive measures and Restoration of fragile ecosystems
Human diseases	3	Sensitisation on preventive measures
Land conflicts	5	Streaming land laws Population reduction.
Environmental degradation	4	Awareness creation.
Bush fires	9	Establishment of fire breakers. Community sensitization

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 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

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**

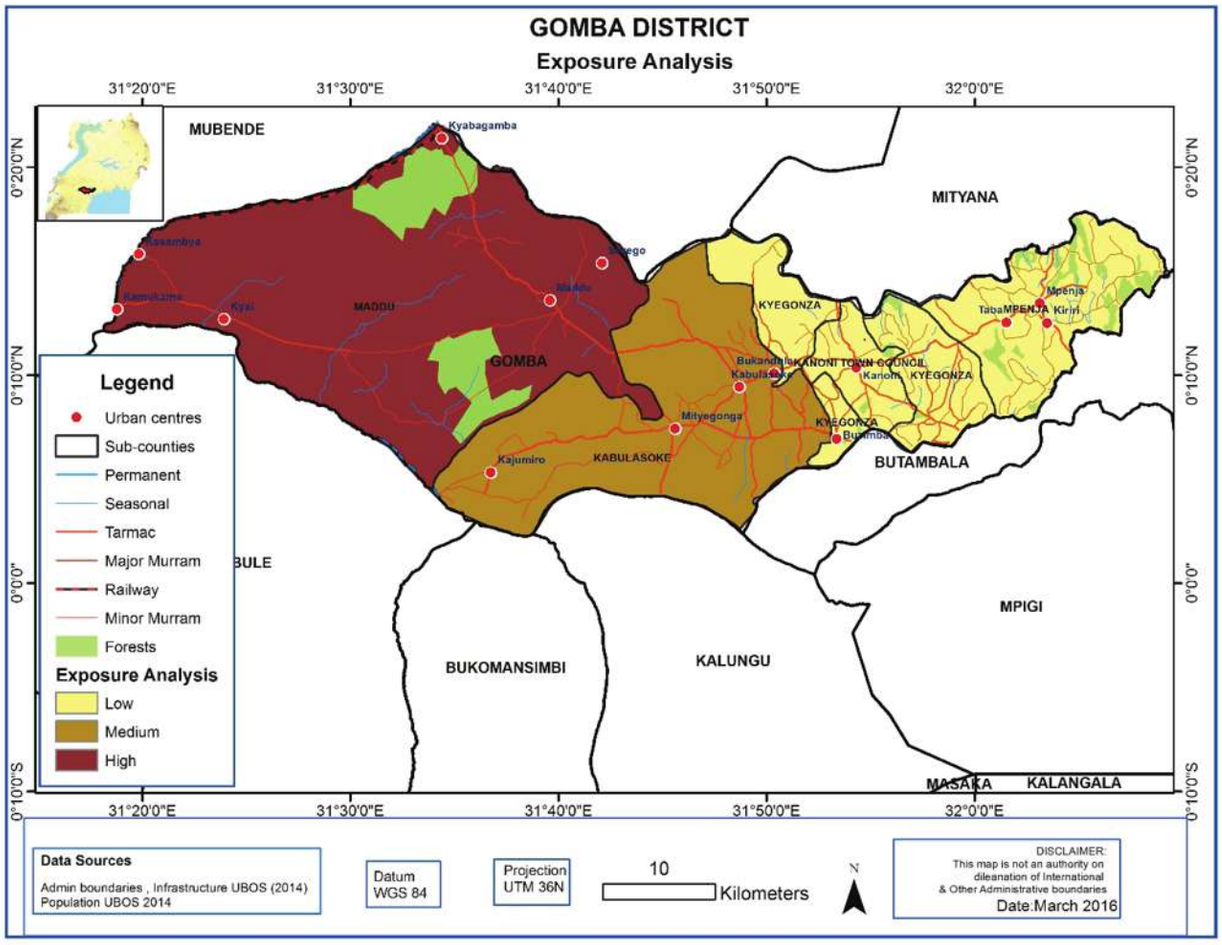

Figure 19: Exposure of climatic conditions in Gomba District

Maddu Sub County is highly vulnerable facing high annual average temperatures and precipitation and being prone to droughts. The exposure layer was influenced low annual average rainfall and high annual average temperatures which led to higher occurrences of drought.

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.

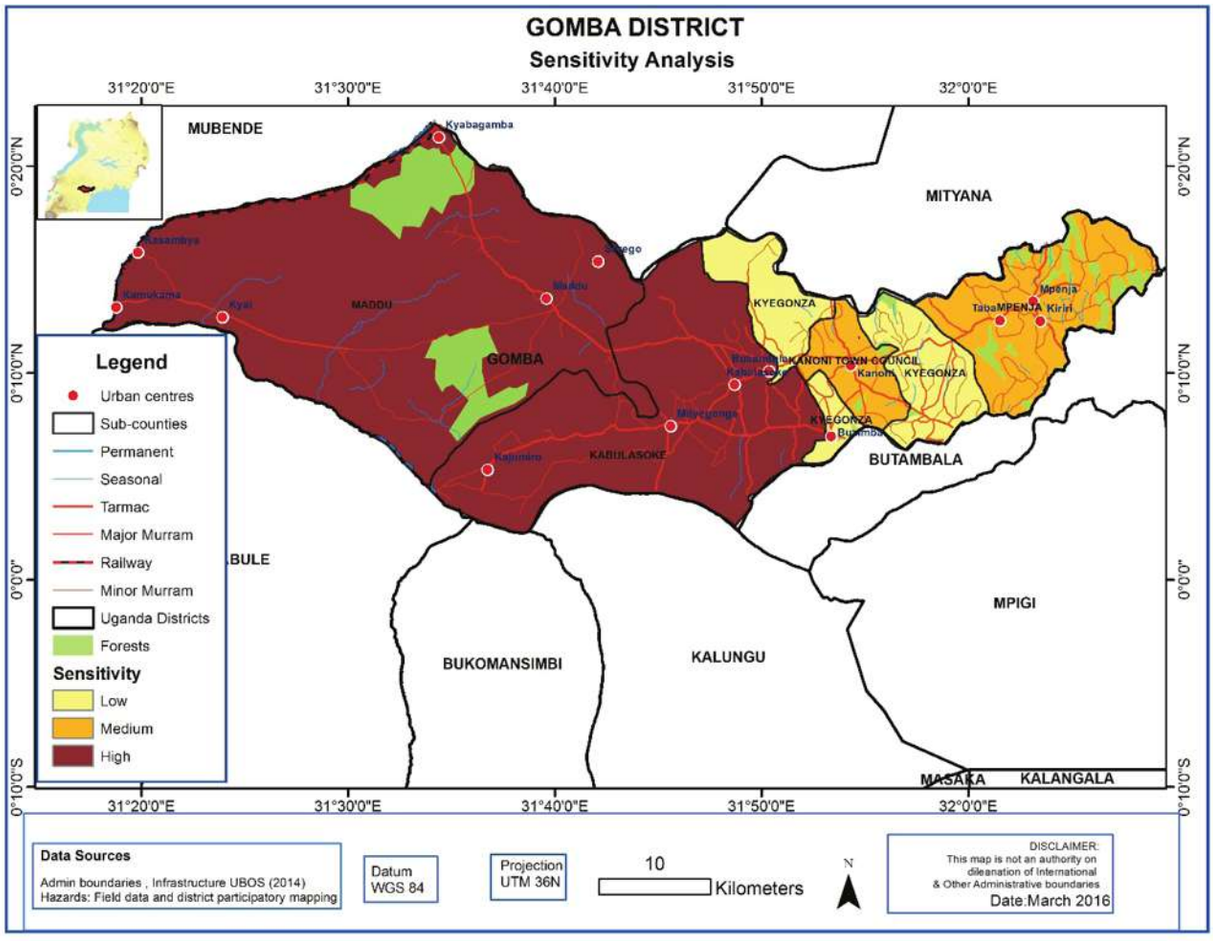

Figure 20: Sensitivty of stressors in Gomba District

Land conflicts, environmental hazards, strong winds and livestock diseases highly influenced the Exposure Layer. Maddu and Kabulasoke are the most vulnerable sub counties due to since they are highly affected by Livestock diseases, environmental hazards and strong winds, while still moderately affected by most of the sensitivity indicators

6.3 Lack of Adaptive Capacity

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

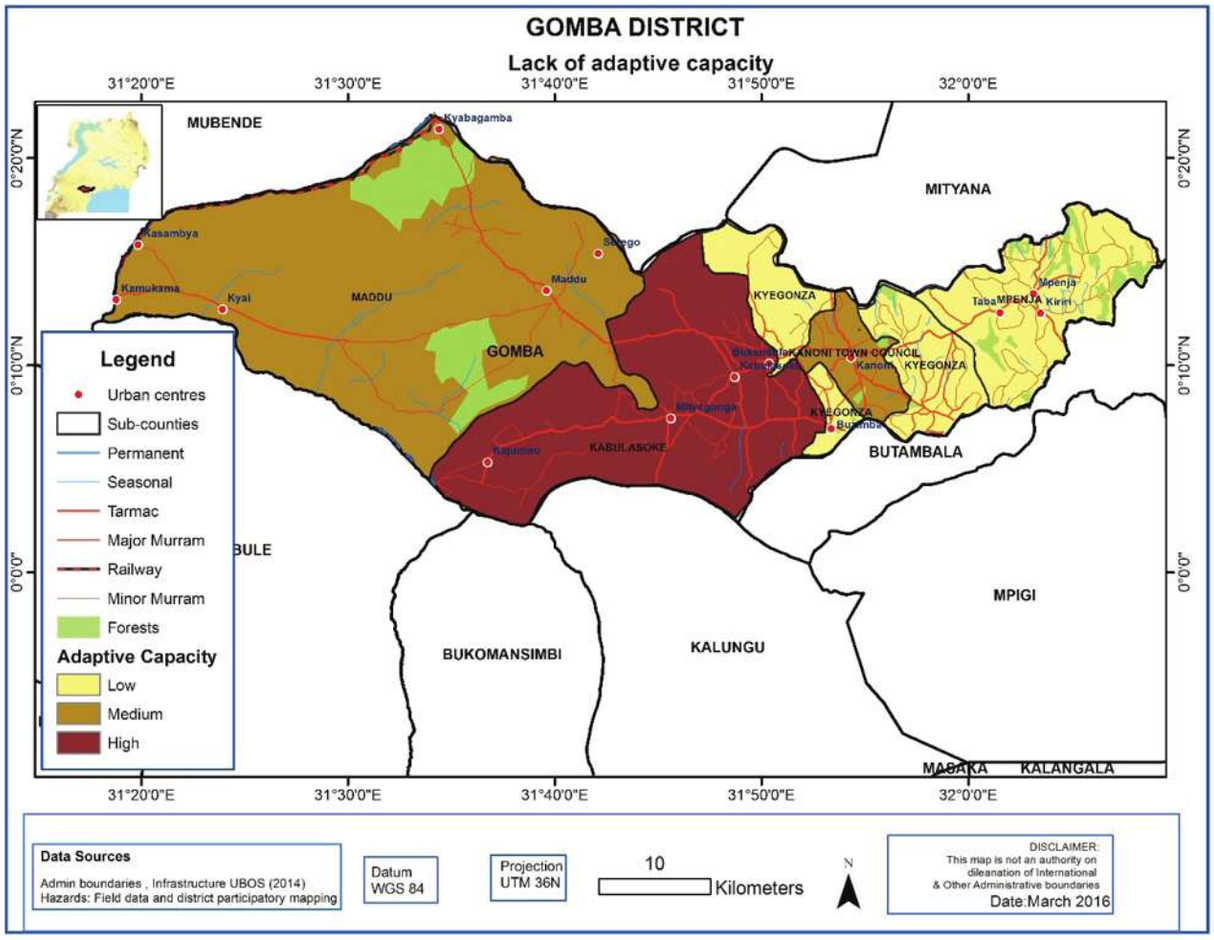

Figure 21: Lack of adaptive capacity in Gomba District

Both layers influenced the capacity of the area to withstand climate shocks and hazards. Buwama, Kituntu and Kamengo displayed a low adaptive capacity due to their lack of access to markets coupled with medium poverty index.

6.4 Vulnerability assessment

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

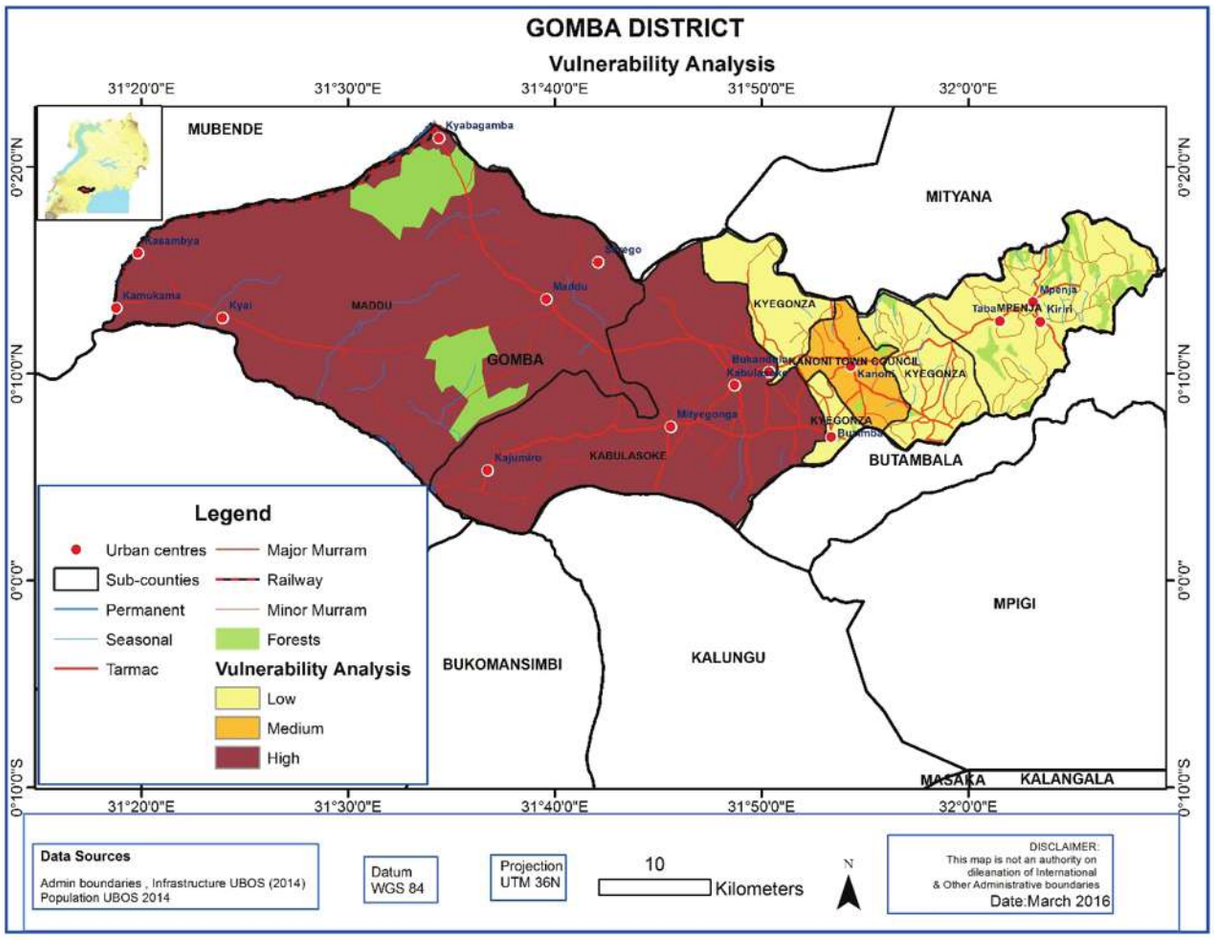

Figure 22: Vulnerability assessment of Gomba District

Maddu and Kabulasoke exhibited the highest vulnerability to stressors while lacking the capacity to adapt. The sensitivity layer highly influenced the vulnerability of Gomba district

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

Floods
- Protection of river and lake banks

Vermin and wildlife
- Fencing off farmlands

Livestock pests and diseases
- Regular spraying of livestock affected.
- Vaccination of livestock.
- Control and regulation of livestock movements.
- Sensitization of farming communities.

Drought
- Reforestation and afforestation of forest reserves.
- Controlled grazing.
- Establishment of irrigation systems.

Road accidents
- Install speed limit humps
- Sensitization of road users.
- Installation of road signs.
- Road maintenance and improvement.

Soil erosion
- Construction of infiltration ditches.

Strong winds
- Afforestation and reforestation of bear land

Hailstorms
- Afforestation and reforestation of bear land.

Lightning
- Installation of Lightning arrestors.
- Adopting climate change mitigation.

Crops pests and diseases
- Community sensitization.
- Soil engineering

Human diseases
- Sensitization
- Immunization
- Stocking of health units with necessary drugs

Land conflicts
- Streamlining land laws.
- Awareness creation.

Environmental degradation
- Awareness creation.
- Establishment of environmental committees

Bush fires
- Establishment of fire breakers.
- Community sensitization.

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

Gomba district					
	Sub county				
Hazard	Kabulasoke	Kanoni town Council	Kyegonza	Maddu	Mpenja
Floods	M	L	N	M	L
Drought	H	M	M	H	M
Landslides	N	N	N	N	N
Erosion	M	L	M	L	M
Strong winds	H	M	L	H	L
Hailstorms	M	M	M	M	M
Lightning	M	L	L	M	L
Crop pests and Diseases	M	M	M	M	M
Livestock pests and Diseases	H	M	M	H	M
Human disease outbreaks	M	M	M	M	M
Vermin and Wildlife animal attacks	M	N	L	M	L
Land conflicts	H	M	M	H	L
Bush fires	M	N	L	M	L
Environmental degradation	H	H	H	H	H
Earthquakes and faults	N	N	N	N	N
Road accidents	L	H	L	L	L

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

Annex II: Field Data collection questionnaire

DATA COLLECTION

FOCUS GROUP DISCUSSION GUIDE FOR DISTRICT DISASTER RISK MANAGEMENT FOCAL PERSONS

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

No.	Name of Participants	Designation	Contact	Signature

Introduction

i. You have all been requested to this session because we are interested in learning from you. We appreciate your rich experiences and hope to use them to strengthen service delivery across the district and the country as whole in a bid to improve access to information on Hazards and early warning.

ii. There is no “right” or “wrong” answers to any of the questions. As a Focus Group Discussion leader, I will try to ask all people here today to take turns speaking. If you have already spoken several times, I may call upon someone who has not said as much. I will also ask people to share their remarks with the group and not just with the person beside them, as we anxious to hear what you have to say.

iii. This session will be tape recorded so we can keep track of what is said, write it up later for our report. We are not attaching names to what you have to what is said, so whatever you say here will be anonymous and we will not quote you by name.

iv. I would not like to keep you here long; at most we should be here for 30 minutes- 1 hour.

Hazard risk assessment

1. Which crops are majorly grown in your area of jurisdiction?
2. Which domestic animals are dominant in your area of jurisdiction?
3. List down/ elaborate on the major contributor's hazards in the region.
4. Which gender (Male and female) and age group (children≤5, youth10-25, middle aged 30-40, old (>60years) in the societal set-up is the most affected and by what hazard.
5. What challenges are faced by farmers in your area of jurisdiction?
6. Have you experienced any of the following (risks and disasters) in the last 10 years?

- Floods, Droughts, Landslides, rock falls and erosion
- Strong winds, hailstorms and Lightning
- Crop pests and diseases
- Animal pests and diseases
- Human diseases and out breaks
- Vermin and wildlife animal attacks
- Land conflicts
- Bush fires
- Environmental degradation
- Earthquakes and faults road accidents

7. How often do you experience such?
8. Which sub-counties have been most affected?
9. As a way of ranking from (1-5) for not reported, Low, Medium, High and Very high, rank sub-counties that have been most affected?
10. What impacts have been caused by the above hazards?
11. List the above hazards in their order of importance on how they are affecting you?
12. What strategies are being adopted by communities to cope with the above hazards?
13. Is there any relevant government's interventions focusing on mitigating the above challenges?

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