



Kabarole District

Hazard, Risk and Vulnerability Profile



2016

ACKNOWLEDGEMENT

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Hon. Hilary O. Onek

Minister for Relief, Disaster Preparedness and Refugees

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ACRONYMS

DDMC	District Disaster Management Committee
DRM	Disaster Risk Management
FGD	Focus Group Discussion
GIS	Geographical Information System
GOU	Government of Uganda
GPS	Global Positioning System
LC	Local Council
NGO	Non-Governmental Organization
OPM	Office of the Prime Minister
SC	Sub-County
TC	Town Council
UNDP	United Nations Development Program

DEFINITION OF TERMS

Drought. Drought is the prolonged shortage of water usually caused by lack of rain. Drought and famine are related because crop and livestock productivity suffer in droughts.

Food insecurity. Food Insecurity is the severe shortage of food that may lead to malnutrition and death.

Floods. A flood occurs when large amounts of water cover a place that is meant to be dry. Floods usually occur with high rainfall.

Landslides. These are rapid movements of large mass of mud, rocks, formed from loose soil and water. Landslides occur mainly during the rainy season, but they can also be precipitated by earthquakes. Community settlement on steep slopes and other uncontrolled land use practices increase the probability of landslides.

Epidemics. This is the occurrence of a disease, in a particular community and at a particular period, beyond normal levels and numbers. Epidemics may affect people, crops or livestock.

Human epidemics. The diseases include cholera, Meningitis, hepatitis E, marburg, Plague, avian influenza, Ebola and Sleeping sickness among others.

Crop and animal epidemics. Animal epidemics include swine fever, foot and mouth disease, naganan, and bird flu. Crop disease epidemics include coffee wilt, banana bacterial wilt, cassava mosaic and cassava brown streak disease.

Heavy storms. Heavy storms in Uganda are often accompanied by hail, lightning and violent winds. Storms can result in destruction of crops, animals, public facilities and human settlements. Lightning can be deadly and may be mitigated by lightning ground conductors on buildings.

Pest infestation. These are destructive insects, worms, caterpillars or any other animal that attacks crops or livestock. Common pests in Uganda include weevils, locusts and caterpillars.

Vermin. Baboons, chimpanzees, bush pigs and other animals which raid crops cause damage and losses which may significantly diminish agricultural productivity.

Land conflict. These are conflicts arising from ownership and use of land and other land resources.

Cattle rustling. This is when one community raids another to steal livestock.

Environmental Degradation. This results from poor land use and other unsustainable ecosystem exploitation that lead to deterioration of the environment. Overgrazing, cultivation on sloping land, unguided and uncontrolled use of fertilizers and pesticides, bush burning, overfishing, deforestation, mining, poor wastewater treatment, inappropriate waste disposal and wetlands reclamation are examples of causes of environmental degradation.

Mines and unexploded ordinance. Mines are devices designed to explode with fatal effect when disturbed. Unexploded ordinance are unspent bullets, grenades, rockets, etc., which are discarded or stored.

Bush fires. Fires set deliberately to clear forest or pasture for agricultural purposes may go out of control and consume far more than intended.

Earthquakes. Earthquakes results from sudden violent movements of the earth's surface, sometimes causing massive loss of lives and property due to building collapse.

Invasive Species. A non-native plant or animal that invades a habitat or bioregion with adverse economic, environmental, and/or ecological effects. An example is a grass that is dominating pasture in the Rwenzori sub-region, reducing the grazing capacity of the land.

EXECUTIVE SUMMARY

This Kabarole District Hazard, Risk and Vulnerability Profile integrates scientific information provided by GoU agencies and hazard and vulnerability knowledge provided by communities on the district base map to contribute to a Ugandan atlas of disaster risk. It will support planning and decision-making processes to manage disaster risk in the District

The methodology provided for four phases of work:

- Phase I: requirements analysis, work planning, team building, logistical arrangements
- Phase II: stakeholder mapping, consultation, spatial data acquisition, secondary data assessment
- Phase III: data cleaning, analysis and verification
- Phase IV: dissemination workshop

The report characterizes the district in terms of location, geography, and gender demographics by administrative unit.

The discussion of the nature of each hazard and its geographic extent in terms of sub-counties provides a qualitative assessment of the situations that the communities face. Maps corresponding to each hazard show the areas where the hazard is significant, and also hotspots as points of incidence of the hazard.

Kabarole District is located at 00° 36' N, 30° 18' E and bordered by Ntoroko District to the North, Kyenjojo District to the East, Kamwenge District to the Southeast, Kasese District to the South and Bundibugyo District, across the Rwenzori Mountains to the West.

Eight hazards are endemic in the district: environmental degradation, severe storms, floods, landslides, crop and animal pests and diseases, earthquakes, drought, and animal attacks on crop, livestock and humans.

Environmental degradation was reported in Karangura, Katebwa, Kabonero, Bukuuku, Rwimi sub-county and town council, Kibiito, Buheesi, Ruteete, Kisomoro, Kasenda, Fort Portal municipal council West Division, Busoro, Karambi.

Severe storms risk ranks second with high winds, hail and/or lightning that afflict the entire district. Floods rank third.

The district has a fairly low level of cumulative vulnerability to the hazards except Kabonero Sub-county which is at the medium level of the vulnerability scale. Though Kicwamba and Kiko Sub-counties are at the lowest (green) level of the vulnerability scale, they should be closely monitored since they have higher cumulative and weighted vulnerabilities compared to their counterparts in the same category. The rest of the sub-counties with quite low vulnerabilities to the hazards should be fortified against occurrences of new hazards and exacerbation of resident hazards now occurring at lower magnitudes but which may be worsened by climate extremes expected in the near future.

Early warning systems and other DRR interventions would be able to enhance the resilience of the people of Kabarole to the effects of climate change.

This profile is therefore a valid outcome of an integration of the spatial information obtained from the mapping exercise and the community perception of the hazards. It should henceforth inform the contingency planning, district development planning process towards disaster proof plans.

INTRODUCTION

The Kabarole District Local Government and the Department of Relief Disaster Preparedness and Management in the Office of the Prime Minister (OPM), with the support of the United Nations Development Programme (UNDP), have mapped the various hazards and analysed the disaster risks and vulnerability of the district. The information contained in this District Hazard, Risk, and Vulnerability Profile will guide the adoption of disaster risk management (DRM) measures in the district, and inform the elaboration of the district's contingency and development plans.

Objectives

The objective of the hazard, risk, and vulnerability mapping is to produce a District Profile that will support planning and decision-making processes for addressing disaster risks in Kabarole District.

Methodology

The multi-hazard, risk and vulnerability mapping approach employed a people-centered, multi-sectorial, and multi-stakeholder approach. A mapping team led by the Office of the Prime Minister (OPM) and involving representatives from UNDP and district sector offices deployed on a field mission to Rwenzori sub-region to capture the required information and produce the district profile.

The team employed a variety of data-collection methods including use of a mix-scale approach involving the integration of primary and secondary data. Secondary data were acquired through government sources (relevant Ministries, Departments and Agencies, the districts in the Rwenzori sub-region) and data bases from other organizations/NGOS operating in these districts. The raw spatial data and satellite images were assembled from relevant sources and analysed with descriptive statistics and remote sensing technology.

The mapping exercise involved four critical phases as follows:

- Phase I Preliminary activities
- Phase II Field data collection, mapping, verification and ground truthing
- Phase III Participatory data analysis, mapping and report writing
- Phase IV Refinement, validation and final map production/reporting

Phase I: Preliminary Activities

In this phase the mapping team undertook a series of planning and programming activities before start of field activity including holding meetings with relevant teams, mobilizing required resources, acquiring required equipment and materials, review of relevant literature, establishing relevant contacts and developing a checklist of activities to be undertaken in Phase Two.

The main objectives of Phase One were to prepare and undertake preliminary assessment of the quality and nature of the resources/materials, develop a quick understanding within the mapping team and other actors of the task of the multi-hazard, risk, and vulnerability mapping before any detailed physical field work was undertaken. This phase enabled the

scoping and design of specific content and legends for the thematic maps.

The phase was also useful for preparing the resource deployment plan, and outlining procedure and field work plans, etc. It articulated, among other issues, the utilization of various stakeholders to ensure maximum participation in locating disaster prone locations and any other information relevant to the mapping exercise.

Phase II: Field Data Collection and Mapping

Stakeholder mapping and local meetings. A preliminary field meeting was held in each district to capture key local issues related to disaster incidence and trends. The meetings gave opportunities for the mapping team and stakeholders to identify other key resource persons and support staff from within the local community for consultation.

Stakeholder Participation Practices. Stakeholder participation was a key component of the mapping exercise. The team conducted consultations with district technical sector heads under the overall purview of the District Disaster Management Committee (DDMC) involved in the ground truthing exercises to ensure district leadership and ownership of the data and results. During exit meetings, stakeholders, particularly those at district level, were given the opportunity to validate, update and also contribute any other relevant information vital to the mapping process.

Capture of spatial data. Spatial data were captured and complemented by base maps prepared at appropriate scales. The base maps contained relevant data including location of existing social-infrastructure and services, district area boundaries, environmental elements, forest areas, utilities like roads, drainage and river course, contours and flood prone settlements.

Secondary data or desktop research. A desk review of relevant documents at the district and other umbrella organizations, including policy and legal documents, previous maps/report and studies, was conducted. A checklist summarized the required information according to the multi-disaster risk indicators being studied/mapped. Data from documents were analysed using various methods including content analysis.

Critical observation and ground truthing. This approach was used to critically assess the conditions, nature and location of disaster prone zones, “current human activity” and settlement patterns along disaster prone areas. Critical observation and ground truthing included inspection and observation of social infrastructure, major household economic activities being practiced, natural drainage lines, rivers etc. Non-mappable and non-physical situations were captured through remote sensing (e.g. satellite images) and physical observation.

Main instruments of data collection. The main instruments used for data collection were manuals of instructions (guides to mapping assistants), use of key informant guides and notebooks, high resolution GPS receivers, digital camera for taking critical photographs, high resolution satellite images and base maps/topographic sheets of the mapping areas.

Exit/feedback meetings with stakeholders. After field activities and data collection,

feedback and exit meetings with stakeholders were carried out in the district. These meetings provided additional information regarding the disaster mapping exercise, validated the data generated, and provided clarity on the expected outputs and the way forward into the next phase.

Phase III: Data Analysis and Verification

Analysis of collected data. The mapping team and district government officials analyzed the collected data, and developed thematic disaster maps by integrating features generated from GPS data with base maps and high resolution satellite images. The main activities at this phase included:

- Data entry, cleaning and coding

- Preparation of base maps and process maps

- Preparation of disaster risk and vulnerability maps

Methods used for data analysis. Data analysis methods used are the following:

- Geo-processing, data transformation and geo-referencing

- Discussions/FGDs

- Drafting, digitizing and GIS Overlays

- Compiling of different data and information

Data editing, coding and cleaning. Data entry clerks, data editors and coders digitized, edited, coded and cleaned data collected using the various tools mentioned above. Both qualitative and quantitative data obtained from the field were entered via a data entry interface customized to the layout of the field data forms. Data coding and analysis started immediately the data was available. Arrangements were made in the field to handle manual editing and coding as and when data was received from the field crew. Furthermore, data entry, verification, screen editing and system development followed sequentially to enable the preparation of draft maps.

Data analysis package. The mapping team analysed acquired data using MS Word and MS Excel for Windows, and spatial data using ArcGIS 10 software and mobile GIS applications. They performed rapid and systematic GIS overlays to generate base maps and risk and vulnerability maps.

Descriptive statistics. The mapping team investigated trends per given indicator using tables, graphs, charts and frequencies. As processing of data developed, they merged it for cross tabulation and eventual production of thematic maps for the various types of hazards.

Generation and appraisal of draft Maps: Prioritization set by the districts determined the various hazards presented on the thematic maps. The team convened a field workshop to present, appraise and validate the risk and vulnerability maps with respect to their accuracy and completeness. Information gaps were identified and filled in the final risk and vulnerability maps.

Phase IV: Refinement, validation and reporting

A final workshop was conducted by the OPM to facilitate validation and dissemination of the district hazard, risk, and vulnerability profile to relevant partners.

Overview of the District

Kabarole District is bordered by Ntoroko District to the North, Kyenjojo District to the East, Kamwenge District to the Southeast, Kasese District to the South and Bundibugyo District, across the Rwenzori Mountains to the West. Fort Portal, the major town in the District, lies approximately 320kms (200 mi) by road West of Kampala, the capital city of Uganda. The coordinates of the District are 00° 36' N, 30° 18' E.

The District has two national parks, Rwenzori National Game Park and Kibaale National Game Park, and three forest reserves, in Bukuuku, Itwara and Kibale. The Rwimi, Nsongya, Yerya, Igasa and Mpanga Rivers traverse it.

Demographics

The District had a projected population of 415,700 people at mid-2012 and covers a land area of 1,814 km², giving it a population density of 229 persons/km².

Table 1 Projected Population (Mid 2012)

Administrative unit	Male	Female	Total
Kabarole District	210,100	205,600	415,700
Fort-Portal Municipal Council	24,100	23,700	47,800
Southern Division	8,000	8,000	16,000
Western Division	7,500	8,200	16,100
Eastern Division	8,600	7,500	15,700

Table 2 Sub-county demographics

Sub County	Male	Female	Total
Buheesi	14000	14400	28400
Bukuuku	7200	7100	14300
Busoro	14100	12400	26500
Hakibaale	11400	10600	22000
Rwimi	9500	11400	23000
Karangura	11600	9200	18700
Kasenda	10500	10900	21400
Kateebwa	13100	8100	26600
Kibiito	8100	8400	16500
Kibonero	7600	7800	15400
Kicwamba	15900	15000	30900
Kisomoro	8100	4300	12400
Mugusu	7500	7600	15100
Ruteete	8700	7700	16400
Karambi	4100	13500	16200

Table 3 Town council demographics

Town Council	Male	Female	Total
Kibiito	6,500	6,800	13,300
Rwimi	6,500	6,400	12,900
Kijura	5,500	5,200	10,300
Karago	5,700	5,300	10,200
Rubona	5,100	4,500	10,800
KikoTown Council	5,800	5,500	11,300

Ethnicity

The Batoro, Batuku and Basongora ethnicities constitute about 52% of the population. The Bakiga constitute 28%, followed by the Bakonjo and the Bamba. The major languages spoken in the district are Rutooro, Rukiga and Runyankore.

HAZARDS

Table 4 Hazard status

Hazard	Status	Sub County
Environmental degradation	Instances of pozolana rock mining, sand and stone mining, deforestation, encroachment on wetlands, swamp reclamation and encroachment on Crater Lakes reported	Karangura, Katebwa, Kabonero, Bukuuku, Rwimi sub-county and Town Council, Kibiito, Buheesi, Ruteete, Kisomoro, Kasenda, Fort Portal Municipal Council West Division, Busoro, Karambi
Severe storms	instances reported every wet season	Kicwamba, Buheesi, Kibiito, Kisomoro, Hakibaale, Busoro, Ruteete, Kabonero, Kiko TC, Karambi, RubonaTC
Floods	Instances of river flooding reported	Fort Portal MC- East Division, Kisomoro SC, Karangura SC, Rwimi TC and SC, Kabonero SC, Kibiito SC,
Landslides	Instances of mudslides reported	Kisomoro, Katebwa, Kabonero, Kibiito, Bukuuku, Karangura,
Crop and animal pests and diseases	Incidence of crop pests and diseases are reported throughout the district; animal pests and diseases are reported in two sub-counties.	Kicwamba, Hakibaale
Earthquakes	Incidents in 1966 and 1994 reported	Kisomoro, Fort Portal
Drought	Prolonged dry spells reported	Rwimi, Rwimi TC, Kibiito,
Crop, livestock and human attacks	The big five (elephants, lions, leopards, buffalo and rhinoceros) and vermin are reported to invade villages throughout Kibale National Park	Kasenda, Hakibaale, Kiko TC, Busoro, Rwimi, Kiko TC

Table 4 displays the status and summarizes the nature of hazards in the district and provides the locations of instances. Their ranking reflects the perception of stakeholders of the relative severity of the corresponding impacts on them.

Table 5 Summary of hazards by location

Sub-county	Hazards									Total
	Environmental degradation	Severe storms	Floods	Landslides	Crop pests and diseases	Drought	Crop, Livestock and Human attacks	Animal vector and diseases	Earthquakes	
Kabonero	✓	✓	✓	✓	✓	✓				6
Kisomoro	✓	✓	✓	✓					✓	5
Kichwamba	✓	✓		✓	✓			✓		5
Rwimi	✓		✓			✓	✓			4
Kibiito	✓	✓	✓	✓						4
Busoro	✓	✓			✓		✓			4
Hakibaale	✓	✓					✓	✓		4
Rwimi TC	✓		✓			✓				3
Kasende	✓				✓		✓			3
Kibiito TC	✓	✓				✓				3
Kateebwa	✓		✓	✓						3
Rubona TC	✓	✓	✓							3
Karangura	✓		✓	✓						3
Bukuuku	✓		✓	✓						3
Fort Portal MC	✓		✓						✓	3
Buheesi	✓	✓								2
Ruteete	✓	✓								2
Karambi	✓	✓								2
Karambi	✓									1
Mugusu										0
Kijura TC										0
Total	19	11	10	7	4	4	4	2	2	63

Table 5 provides another view of the relative significance of hazards. The rightmost column is ordered by the number of hazards endemic in each sub-county, and is a measure of compound vulnerability. The bottom row is ordered by the number of sub-counties that experience each hazard, giving an indication of its geographic prevalence.

Table 6 ranks the hazards in their order of occurrence, frequency and magnitude

Table 6: Ranking of hazards

S/No.	Hazard	Frequency (Most Freq=3, Freq=2, Not Freq=1)	Area (No. of sub counties)affected >25=5, 19-24=4, 13-18=3, 7-12=2, <6=1	Magnitude (High=3, Medium=2, Low=1)	Total (Sum of Columns 3,4 &5)	Rank (Ascending order)
1	Crop pests and diseases	3	5	3	11	1
2	Environmental Degradation (Deforestation, wet land degradation, overgrazing)	2	5	3	10	2
3	Animal Diseases (BQ, CBPP, F&MD)	3	3	3	9	3
4	Drought	3	3	2	8	4
5	Heavy Storms	3	2	2	7	5
6	Crop, livestock and Human Attacks	3	1	2	6	6
7	Floods/water logging	2	1	2	5	7
8	Land slides	2	1	1	4	8
9	Earthquakes	1	2	1	4	8

HAZARD RISK ASSESSMENT

Table 7: Hazard risk assessment

Sub-county	Hazards								
	Environmental degradation	Severe storms	Floods	Landslides	Crop pests and diseases	Drought	Crop, Livestock and Human attacks	Animal vector and diseases	Earthquakes
Kabonero	H	M	L	H	H	H	N	N	N
Kisomoro	M	H	M	L	N	N	N	N	L
Kichwamba	H	M	N	L	H	N	N	H	N
Rwimi	H	N	L	N	N	H	M	N	N
Kibiito	M	H	L	L	N	N	N	N	N
Busoro	M	H	N	N	M	N	L	N	N
Hakibaale	M	L	N	N	N	N	M	H	N
Rwimi TC	H	N	L	N	N	H	N	N	N
Kasenda	H	N	N	N	M	N	H	N	N
Kibiito TC	L	L	N	N	N	M	N	N	N
Kateebwa	H	N	H	H	N	N	N	N	N
Rubona TC	L	L	H	N	N	N	N	N	N
Karangura	H	N	L	H	N	N	N	N	N
Bukuuku	H	N	M	L	N	N	N	N	N
Fort Portal MC	H	N	M	N	N	N	N	N	M
Buheesi	H	H	N	N	N	N	N	N	N
Ruteete	H	H	N	N	N	N	N	N	N
Karambi	M	H	N	N	N	N	N	N	N
Mugusu	N	N	N	N	N	N	N	N	N
Kijura TC	N	N	N	N	N	N	N	N	N
Kiko TC	H	M	N	N	M	M	N	M	N
East Division	M	N	M	N	N	N	N	N	N
South Division	M	N	M	N	N	N	N	N	N
West Division	M	N	N	N	N	N	N	N	N
Karago TC	M	N	M	N	M	N	N	M	N

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

Table 7 expresses the communities' assessment of severity and likelihood of risk in their respective sub-counties. Each of the columns in table 7 below translates into respective hazard risk maps in the following section. The colours red, yellow, and green showing the severity of the hazard risk in the table are, also reflected in the corresponding maps.

RISKS

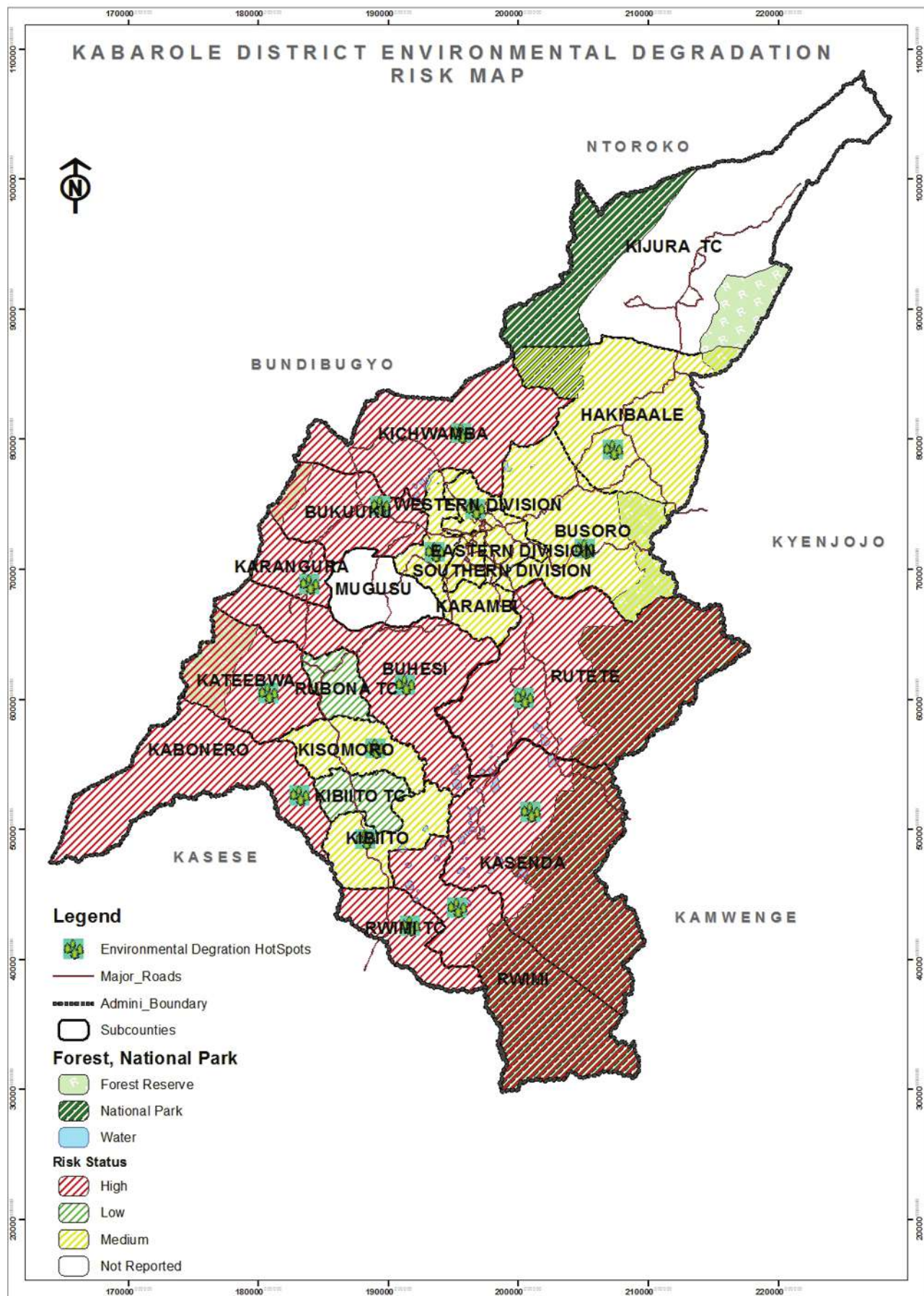


Figure 1 Environmental Degradation Risk Map

Figure 1 above shows the status of environmental degradation in Kabarole District. Environmental degradation is ranked as the most significant hazard in Kabarole District because it aggravates several other hazards. It is widespread in the district whereof, Kabonero, Kichwamba, Rwimi, Kasenda, Kateebwa, Karangura, Bukuuku, Buheesi, Ruteete sub counties as well as Kiko TC, Rwimi TC and Fort Portal MC are prone to high risk of environmental degradation; Kibiito and Rubona Town Councils are prone while Mugusu sub county and Kijura Town Council are not prone to the risk.

Environmental degradation in Kabarole takes several forms: pozolana rock mining for cement making, sand and stone mining, deforestation, wetlands encroachment and encroachment on Crater Lakes.

For example, sand and rock mining causes material to wash into streams, increasing their sediment load, raising the elevation of the stream beds, reducing the discharge capacity of streams and therefore increasing the risk of flooding when the streams overflow their banks. Similarly, deforestation increases surface runoff, carrying away topsoil; this reduces soil fertility and washes material into streams. Deforestation also increases risk of wind storm damage to crops and houses. Rock mining involves use of heavy equipment with jack-hammers and blasting with dynamite which increase the seismic load on nearby structures and landforms, with risk of damage.

Wetland encroachment is mainly perpetrated by rice cultivators. This human activity displaces wild species of plants and animals, reducing biodiversity. Pozolana is a volcanic ash used in the manufacture of cement, and mined on the edges of craters, affecting the touristic value of the Crater Lakes. Unplanned development in the Crater Lakes area is introducing pollution which persists because the lakes generally have no surface outlets to carry away or dilute the garbage and foreign chemicals introduced by the population.

These hazards occur in the 14 lower local governments of Katebwa, Kabonero, Bukuuku, Rwimi Town Council and sub-county, Kibiito, Buheesi, Ruteete, Kasenda, Fort Portal Municipal Council West Division, Busoro and Karambi.

Heavy Storms

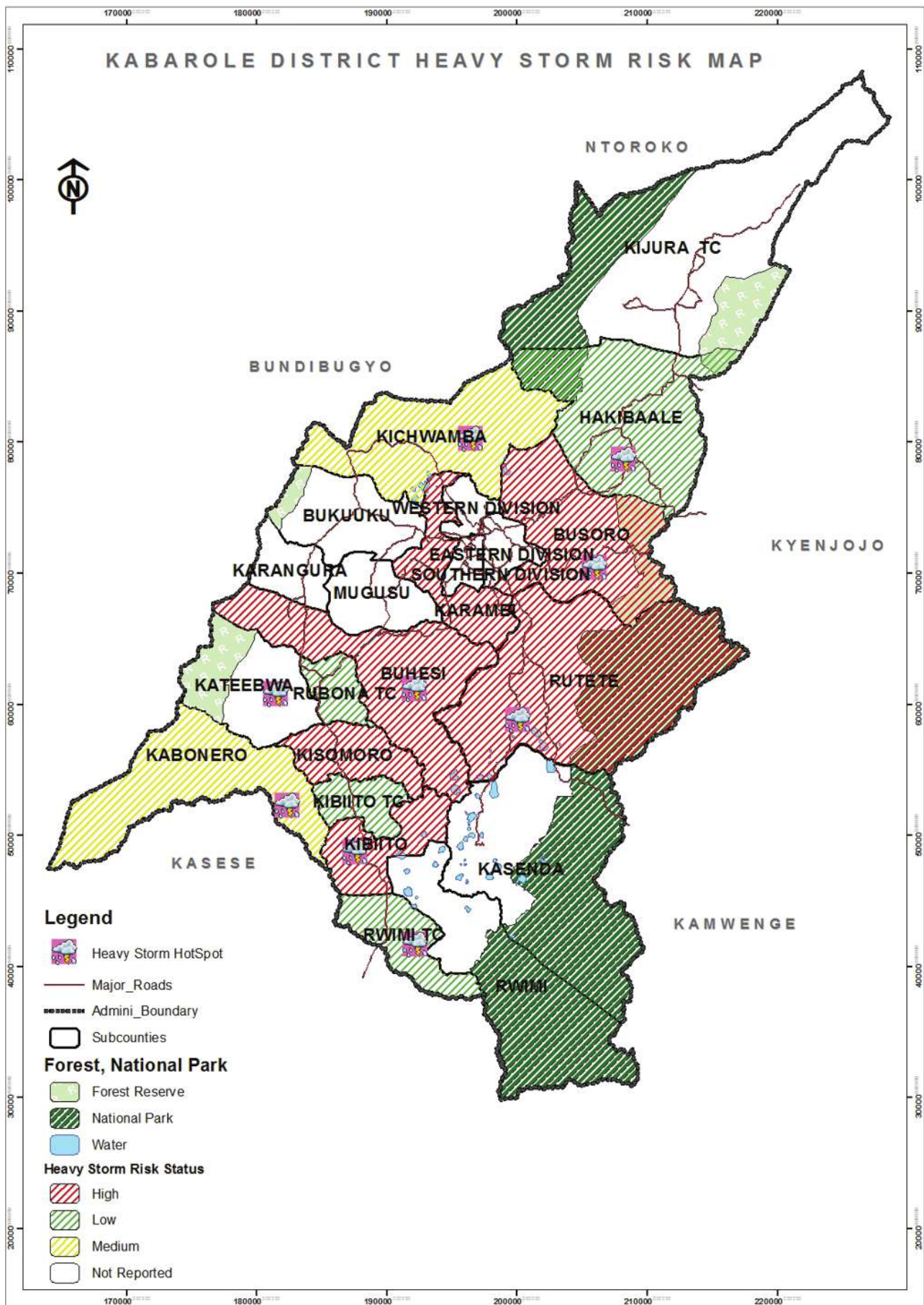


Figure 2 Heavy Storm Risk Map

Figure 2 above shows the status of storms risk in Kabarole District. Storms which produce hail, strong winds, torrential rains and/or lightning are the second most destructive hazard in Kabarole District. They strike intermittently with severe impacts on safety, livelihoods, property and the environment at large. In Kisomoro, Kibiito, Busoro, Ruteete, Buheesi, Karambi sub-counties the risk is high while RwimiS/C, Rwimi T/C, Kasenda, Kateebwa, Karangura, Bukuuku, Fort Portal MC, Mugusu, Kijura TC are not prone to heavy storms.

Deforestation aggravates the risk by leaving the majority of the affected places bare without wind breaks or capacity to absorb rain runoff.

Hail often accompanies the severe storms that occur at the onset of the wet season, when crops are well developed and vulnerable to damage. A hail storm can completely strip a plant of its leaves, resulting in the failure of an entire planting season. This is a significant setback to a subsistence farmer. Strong winds blow roofs off buildings and fell trees, with risk to human and animal lives, and infrastructure damage. Tall plants like maize, sorghum, simsim, millet and sunflower can be flattened by wind and torrential rain, with productivity losses. Heavy rains contribute to flash flooding in steep terrain and water logging in low-lying areas.

Floods

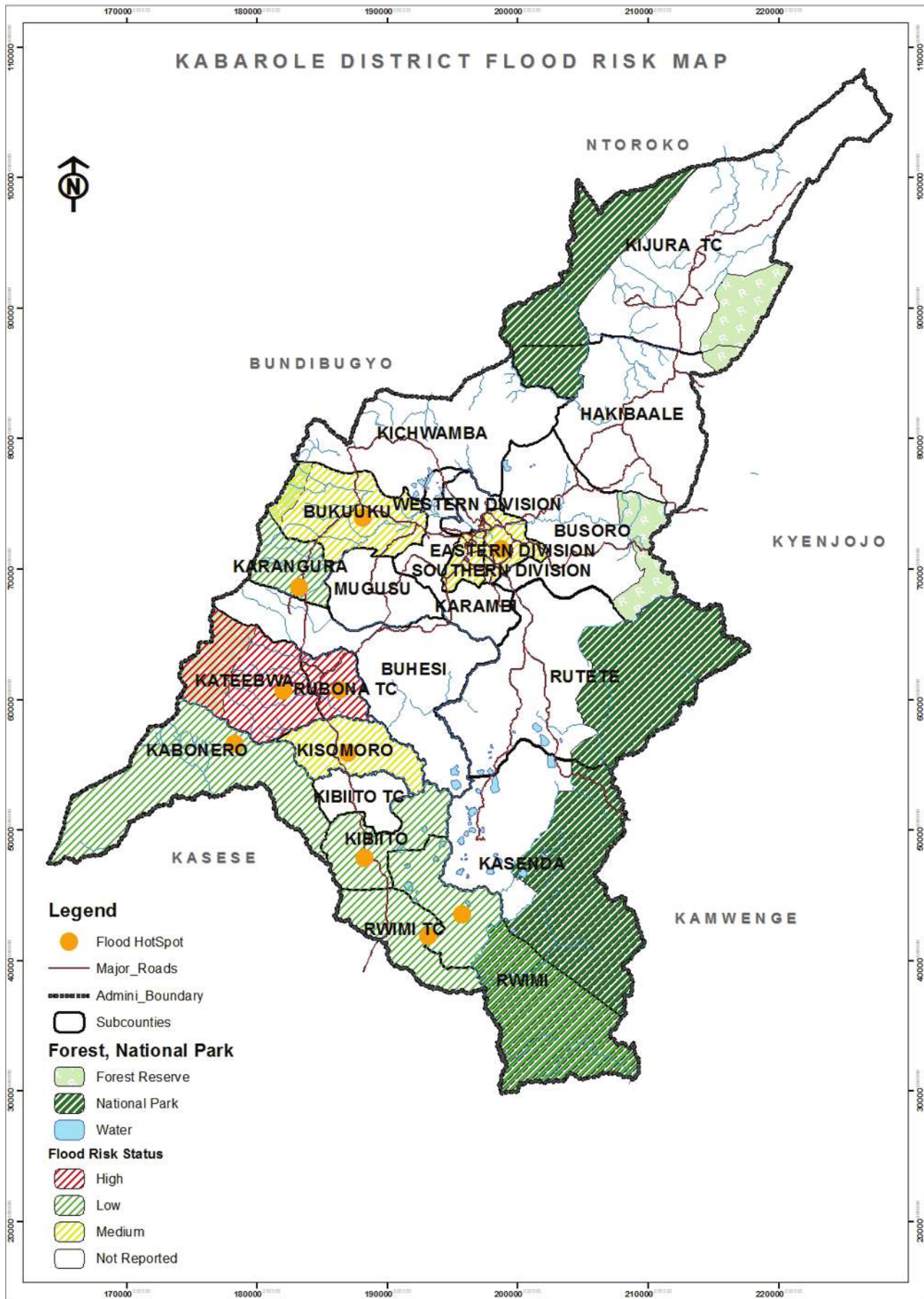


Figure 3 Flood Risk Map

Figure 3 above shows the status of floods risk in Kabarole District. In this District, flash flooding occurs along major rivers, causing damage where the river bank overflows and the river takes new courses. Sediment deposits in inundated gardens may affect agricultural productivity.

Kateebwa S/C and Rubona T/C are prone to high risk of floods while Kichwamba, Busoro, Hakibaale, Kasenda, Buheesi, Ruteete, Karambi, Mugusu, Kijura TC, Kiko TC and West Division of Fort Portal Municipality are not prone. The rivers that flood the affected sub counties and town councils are Rwimi, Nsongya, Yerya, Igasa and Mpanga.

Landslides

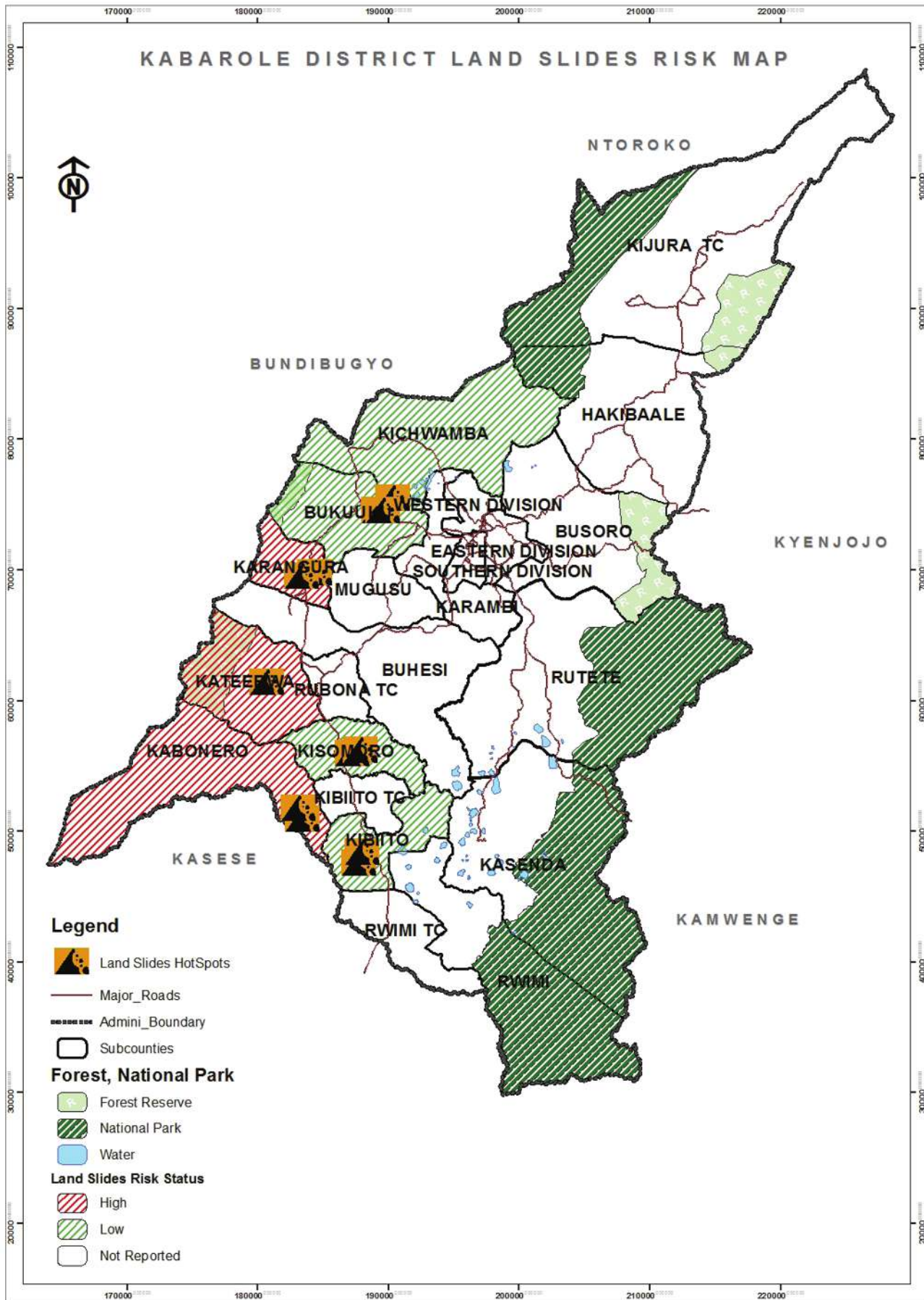


Figure 4 Landslide Risk Map

Figure 4 above depicts the risk levels of Kabarole District to landslides. The District experiences landslides on the deforested slopes of Mt. Rwenzori, when the loose sandy loam soils absorb heavy rains and slide down the slope when gravitational force exceeds the strength of the material. Earth tremors also dislodge dangerous masses of rock and/or mud.

Deforestation, which is prevalent in the district, is a major causal factor in landslide incidence, because the tree root systems which give strength to the soil have been removed. Cultivation on hillsides weakens the soil further. As the material sags with the weight of rainwater saturating it, cracks can form uphill of the deforested area, providing an unreliable indicator of landslide risk. Landslides may contribute to siltation in the watercourses, resulting in increased flood risk downstream.

Katebwa and Kabonero sub counties are prone to high risk of landslides; Kisomoro, Kichwamba, Kibiito and Bukuuku sub-counties are prone to low risk of landslides while the rest of the sub counties, town councils and municipal divisions are not prone to any risk of landslides. Much as no lives have been lost to the hazard in the recent past, the damage to farm lands is immense.

Crop Pests and Diseases

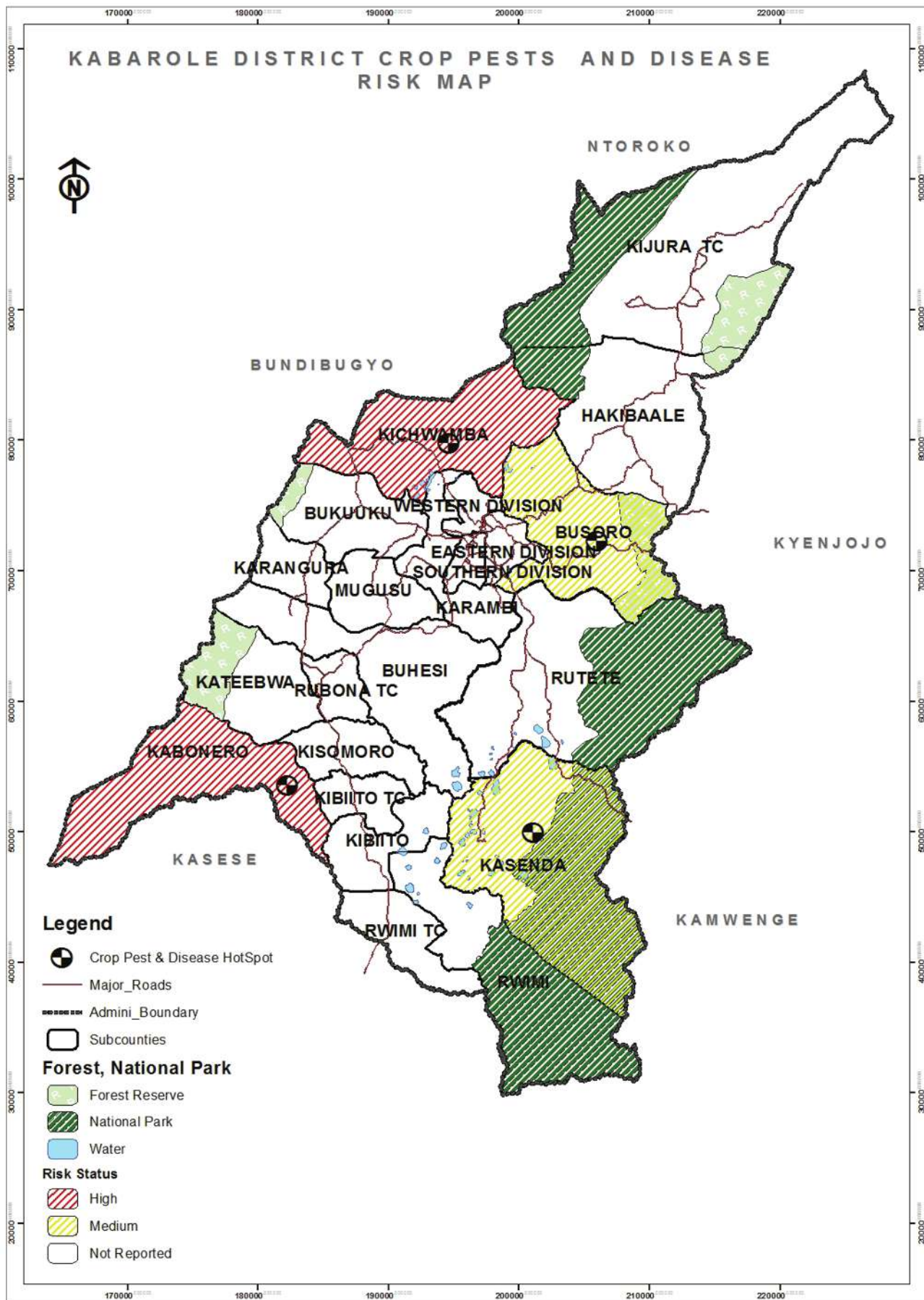


Figure 5 Crop Pests and Diseases Risk Map

Figure 5 above shows the risk status of crop diseases in Kabarole District. The communities in Kicwamba and Kabonero sub-counties are prone to high risk of crop diseases while those in Busoro, Kasenda sub counties and also Kiko Town Council are moderately prone crop diseases. The rest of the sub counties including the municipal divisions are safe from the risk of crop diseases.

The common diseases include banana bacteria wilt, cassava mosaic and coffee leaf rust. The introduction of new resistant varieties under the NAADS is containing them to some extent however reinfection occurs. Bananas are the district's main crop, for sale to other districts including Kampala, so banana bacteria wilt is a major threat to the livelihoods of the people of Kabarole as a whole.

Animal Vector and Diseases

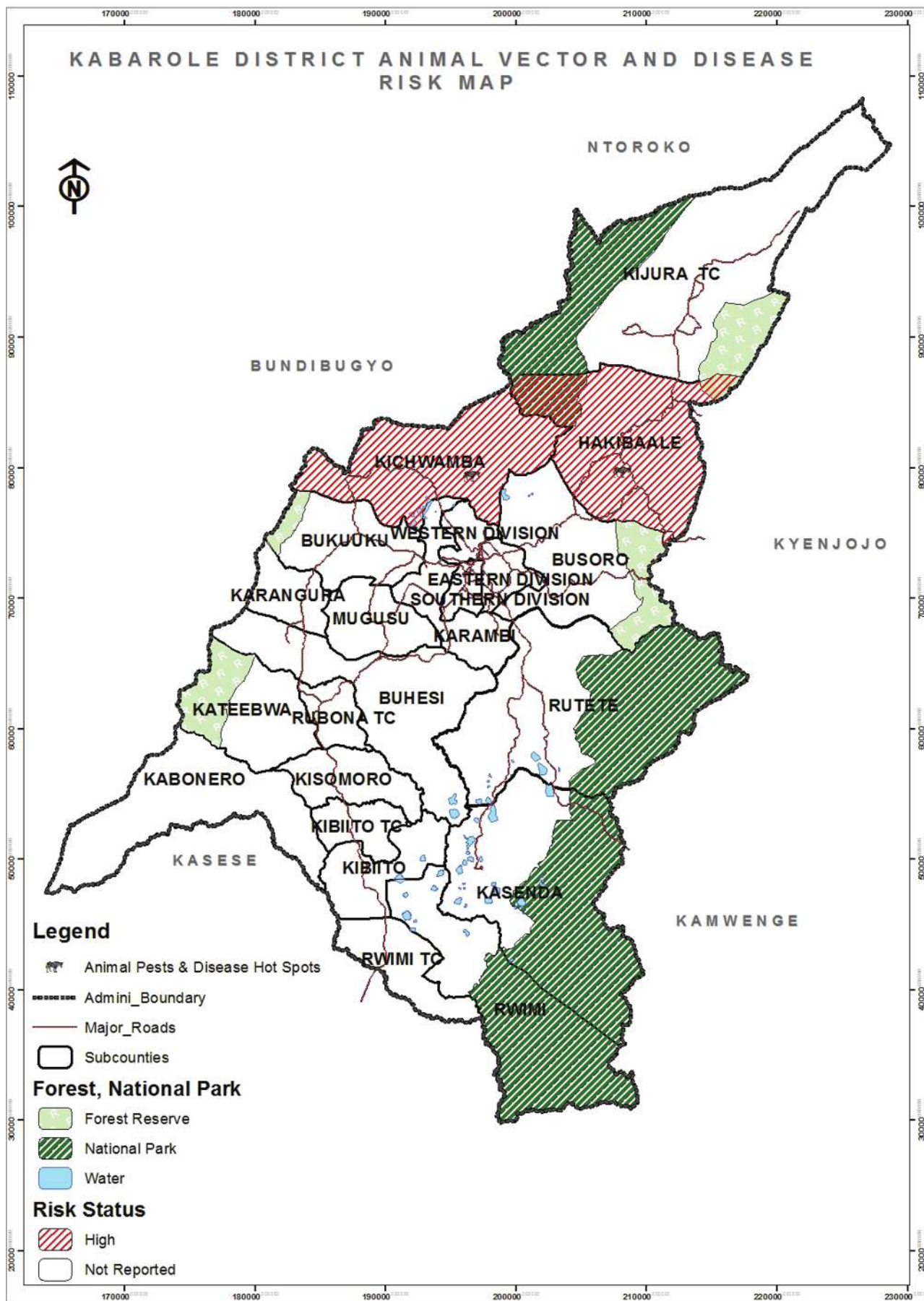


Figure 6 Animal Pests and Diseases Risk Map

Figure 6 above depicts the risk status of animal vector and diseases in Kabarole District. The District like other districts in the sub-region, suffers from animal vector and diseases, most notably contagious bovine pleurapneumonia and black quarter. These diseases are rampant in Hakibaale and Kicwamba sub-counties, which are prone to high risk of animal diseases while the rest of the district is safe from the risk of the hazard.

Hakibaale and Kicwamba are the only two subcounties in the district where livestock rearing is predominant, and they are adjacent to forest reserves and national parks, so are susceptible to contagion by domestic animals introduced from other areas and by wild animals from the forest reserves and game parks.

Earthquake

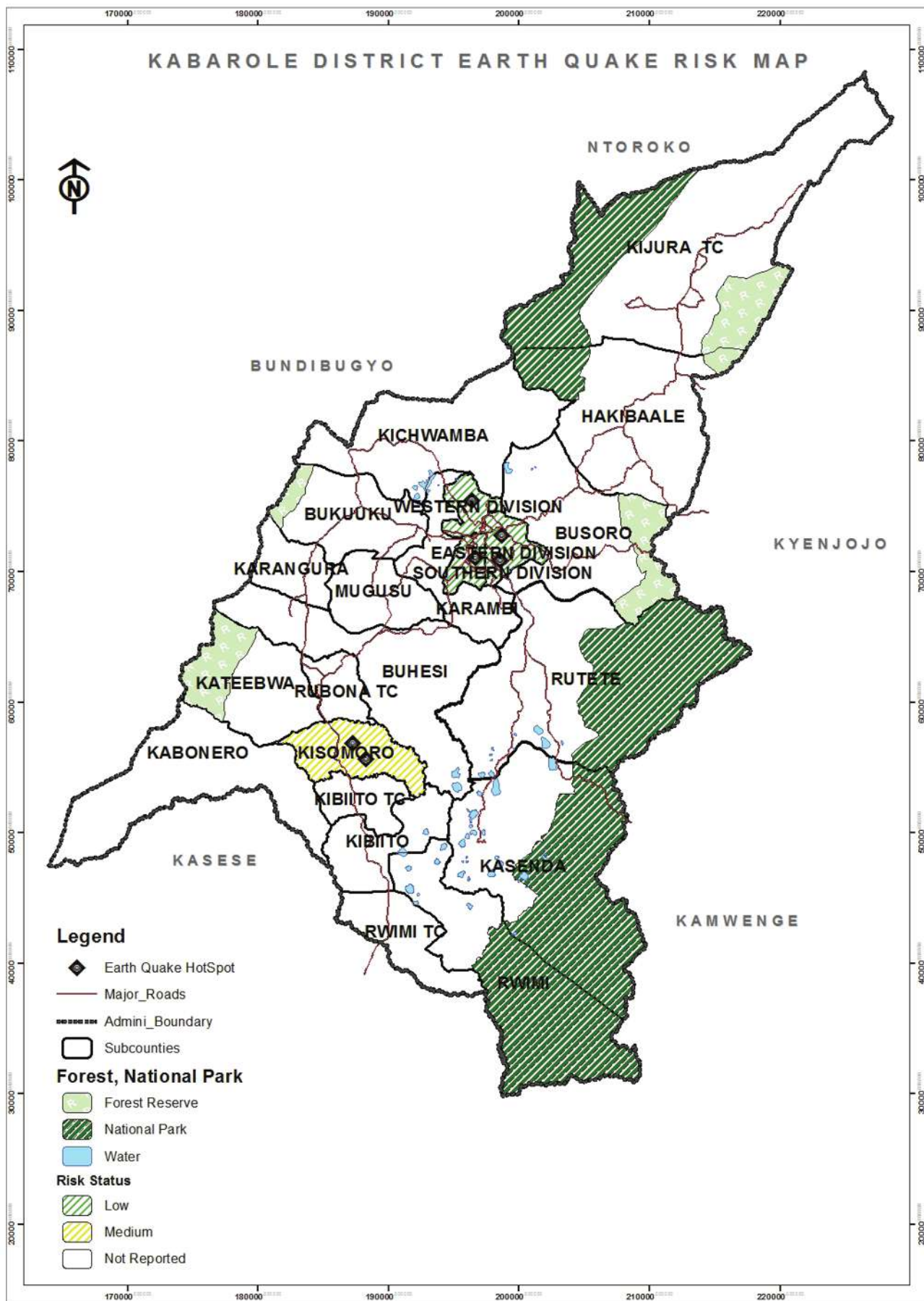


Figure 7 Earthquake Risk Map

Figure 7 above shows the risk status of earthquakes in Kabarole District. The district suffered more than 20 earthquakes with magnitudes between 4.2 and 5.9 that shook the Rwenzori region in 1966 and 1994 respectively. Kisororo sub-county and Fort Portal Municipality (Western, Eastern and Southern Divisions) were the most severely damaged. All the other sub-counties did not report any effects of the incidences.

Reliable technology to forecast seismic activity does not yet exist. Historical records can give an indication of earthquake risk based on the frequency and severity of tremors. By these measures, the risk is moderate in Kabarole. Unplanned development and inadequate building technologies contribute to vulnerability to significant mortality and infrastructure loss. In 2002 the government established a regional laboratory in Fort Portal, to test contractors' materials for earthquake resistant structures.

Drought

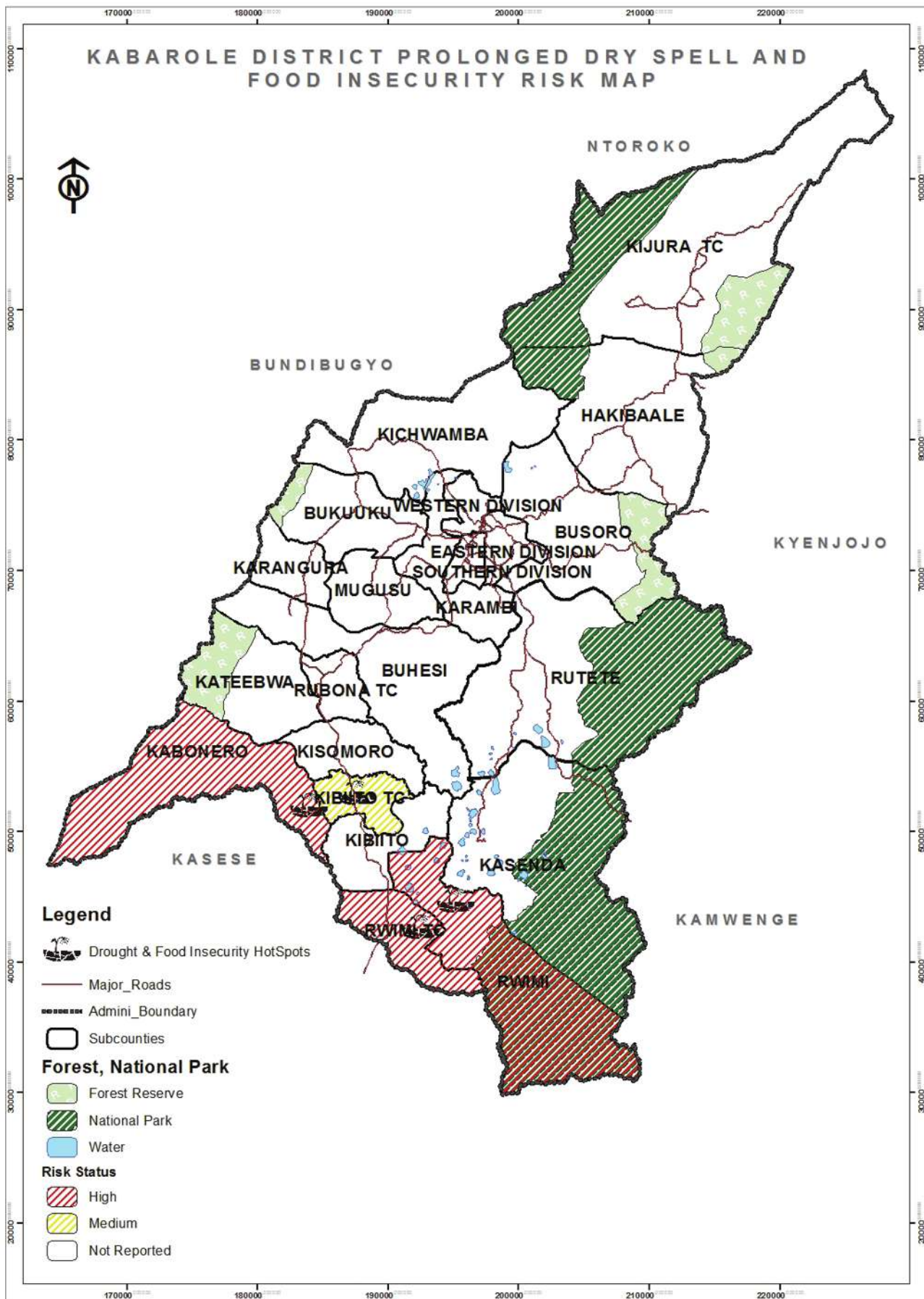


Figure 8: Extended dry spell Risk Map

Extended dry spells risk status in Kabarole District are shown on figure 8 above. Rwimi and Kabonero sub-counties and Rwimi Town Council are the most affected by extended dry spell, leading to frequent crop failures (maize, potatoes, tomatoes) and reduced agricultural incomes. These sub-counties, on the southern border with Kasese, may be in a rain shadow of the Rwenzori ranges. The rest of the sub-counties did not report any effects of extended dry spell thus they are not prone to the risk of prolonged dry spell.

Crop Raiding

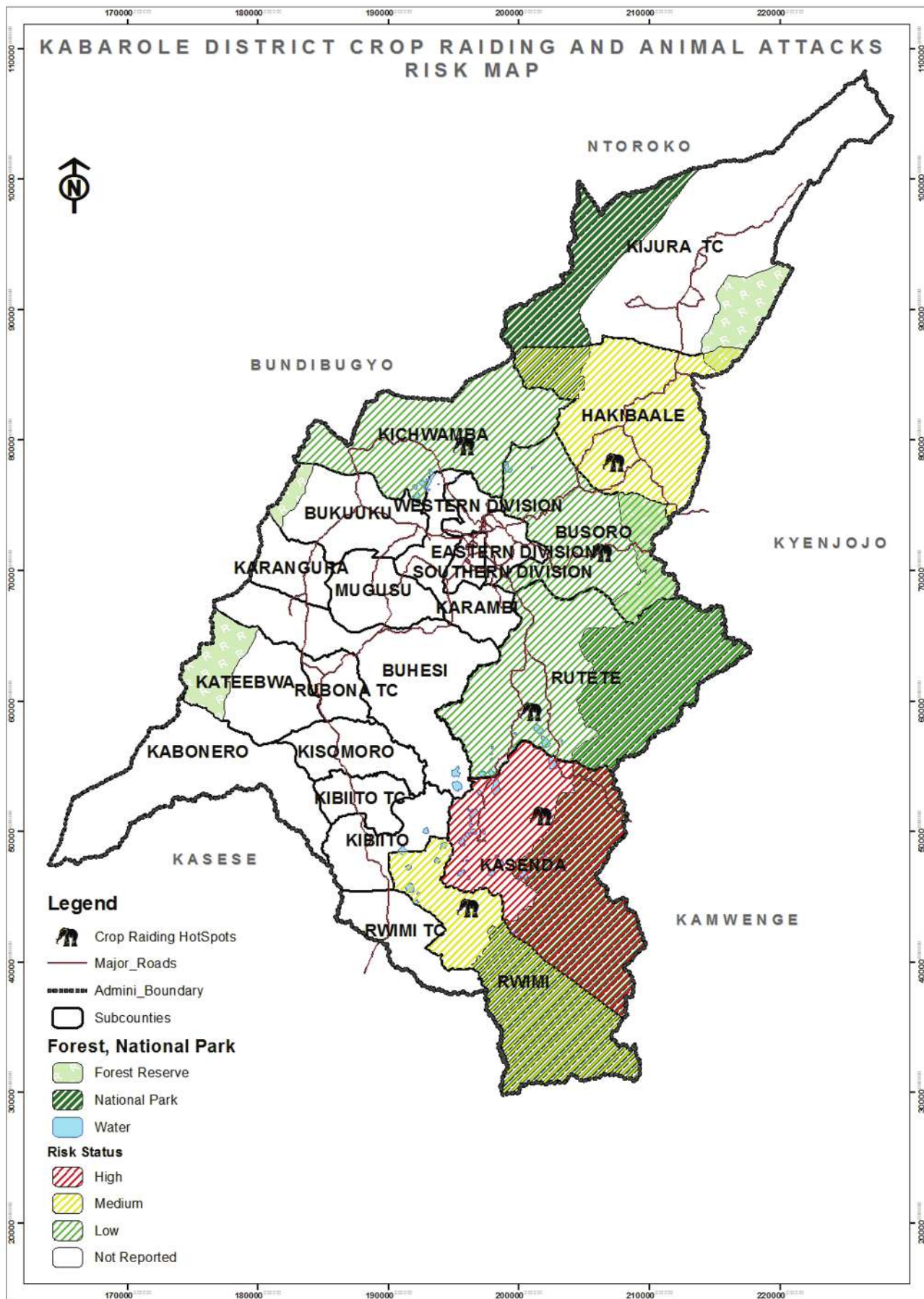


Figure 9 Crop Raiding Risk Map

Animal attacks on crops, livestock and human beings risk status in Kabarole District is presented in figure 9 above. The risk level is high in Kasenda, while in Rwimi and Hakibaale there is moderate risk and the rest of the district is free from animal attacks.

The problem animals include: baboons, monkeys and warthogs, mostly from Kibaale National Park, are a menace to the communities. Whereas tea plantations are effective buffers to settlements from wild animals in other parts of the district, it's not the case in these sub counties. Trenches and bonfires as barrier to animals require ongoing maintenance effort which is not sustainable.

VULNERABILITY

Table 7 summarizes the communities' assessment of hazard severity and frequency in the sub-counties. Table 8 transforms those qualitative low/medium/high judgements to numerical values 1/2/3 which when summed vertically show the relative risk per hazard. The horizontal sums show both cumulative and weighted vulnerability.

Table 8: Risk and vulnerability assessment

Sub-county	Hazards									Cumulative vulnerability (Absolute)	Weighted vulnerability (Cumulative/3)
	Environmental degradation	Severe storms	Floods	Landslides	Crop pests and diseases	Drought	Crop, Livestock and Human attacks	Animal vector and diseases	Earthquakes		
Kabonero	3	2	1	3	3	3	0	0	0		5
Kisomoro	2	3	2	1	0	0	0	0	1		3
Kichwamba	3	2	0	1	3	0	0	3	0		4
Rwimi	3	0	1	0	0	3	2	0	0		3
Kibiito	2	3	1	1	0	0	0	0	0		2
Busoro	2	3	0	0	2	0	1	0	0		3
Hakibaale	2	1	0	0	0	0	2	3	0		3
Rwimi TC	3	0	1	0	0	3	0	0	0		2
Kasenda	3	0	0	0	2	0	3	0	0		3
Kibiito TC	1	1	0	0	0	2	0	0	0		1
Kateebwa	3	0	3	3	0	0	0	0	0		3
Rubona TC	1	1	3	0	0	0	0	0	0		2
Karangura	3	0	1	3	0	0	0	0	0		2
Bukuuku	3	0	2	1	0	0	0	0	0		2
Buheesi	3	3	0	0	0	0	0	0	0		2
Ruteete	3	3	0	0	0	0	0	0	0		2
Karambi	2	3	0	0	0	0	0	0	0		2
Mugusu	0	0	0	0	0	0	0	0	0		
Kijura TC	0	0	0	0	0	0	0	0	0		
Kiko TC	3	2	0	0	2	2	0	2	0		4
East Division	2	0	2	0	0	0	0	0	0		1
South Division	2	0	2	0	0	0	0	0	0		1
West Division	2	0	0	0	0	0	0	0	0		1
Karago TC	2	0	2	0	2	0	0	2	0		3
Total		24		13		13	8		1		

Key: 3 = High, 2 = Medium, 1 = Low, 0 = Not reported

Risk Vulnerability

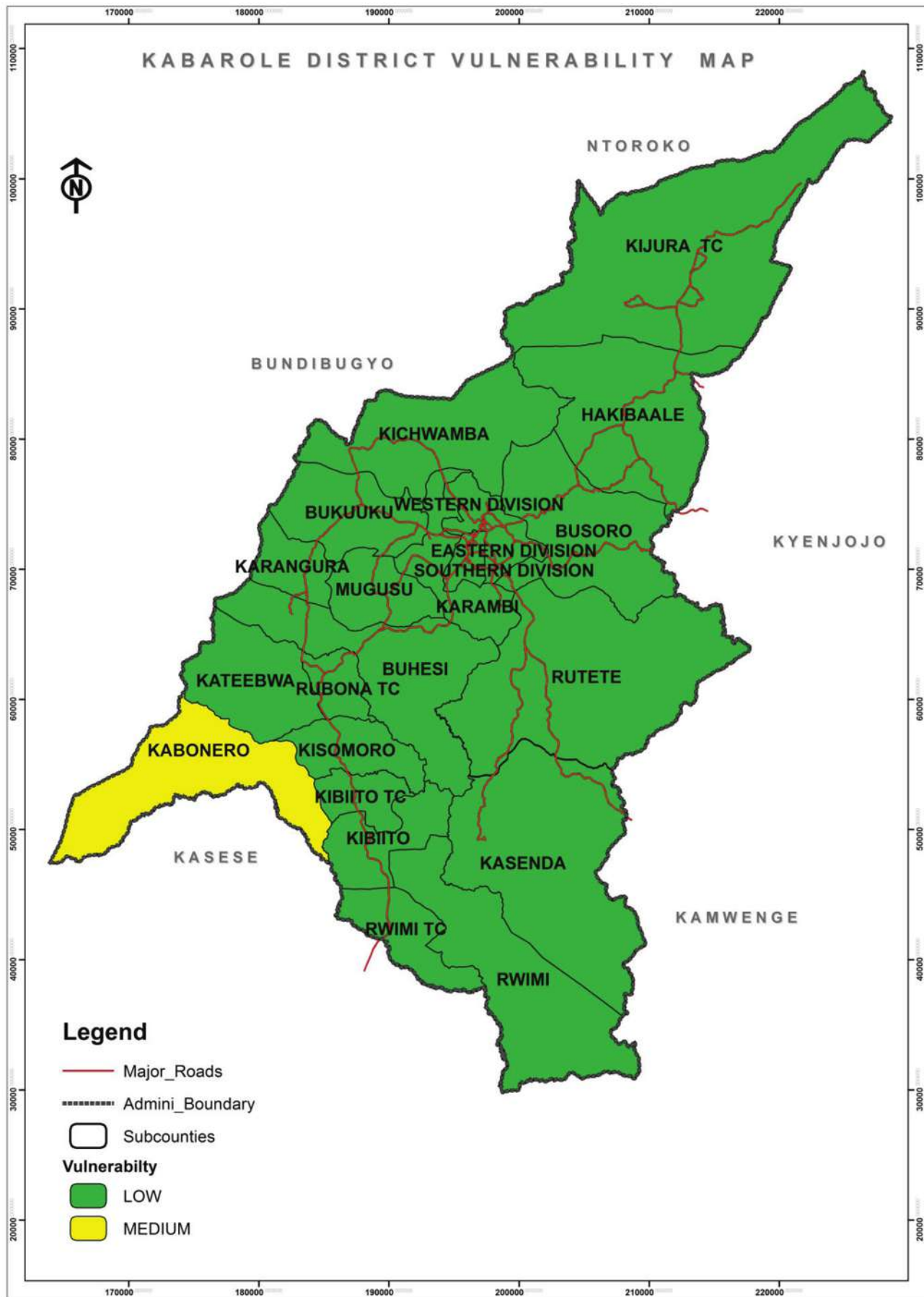


Figure 10 Vulnerability map

The vulnerability map in Figure 10 above shows the areas of low, medium and high vulnerability according to the risk and vulnerability table (Table 8) above. In this analysis, the cumulative vulnerability of each sub-county is calculated and then weighted to provide weighted vulnerabilities for individual sub-counties. Therefore sub-counties with weighted vulnerability values less than 4 are coded “low”, termed low vulnerability areas and are assigned green, those from 5 to 7 are coded “medium”, termed medium vulnerability areas and are assigned yellow while those whose weighted vulnerabilities are 8 or more are coded “high”, termed high vulnerability areas and are represented by red.

Kabarole district is exposed to 9 hazards namely environmental degradation, severe storms, floods, crop pests and diseases, landslides, drought, animal vector and diseases, crop, livestock and human attacks and earthquakes arranged in their order of risk from highest to lowest with risk totals of 53, 24, 21, 14, 13, 13, 10, 8, and 1 respectively. These are exacerbated by continuing destructive human activities on the Rwenzori mountain slopes, farming in the flood plains, poor housing design and construction, and poor soils with less protective vegetation on slopes.

There was no sub-county that reported high (red) vulnerability in the district. With a cumulative vulnerability of 15 and weighted vulnerability of 5, Kabonero Sub-county was most vulnerable in the whole district ranking medium (yellow) at the vulnerability scale. The rest of the sub-counties displayed low (green) vulnerabilities with Kicwamba and Kiko TC having the highest (4) weighted vulnerabilities in the low vulnerability category while Kibiito TC, West division, South division, and East division had the lowest (1) weighted vulnerabilities therefore were the least vulnerable sub-counties to the hazards resident in this district.

Though all communities are vulnerable to the a fore mentioned hazards, the burden lies heaviest on the elderly, the children and the women. The school children and the farmers are especially vulnerable to floods than any other groups. The poor of these communities too feel the pinch of the hazards more than their wealthy counterparts therefore are more vulnerable.

CONCLUSION

This multi hazard, risk and vulnerability profile for Kabarole District was produced after conducting a rigorous people centred, multi-sectoral, and multi stakeholder field data collection/mapping, analysis, and map production. It is therefore a synthesis of primary data, secondary data and the perception/experiences of the local people, the community leadership at all levels. Thus it portrays how the people of Kabarole perceive each of the hazards based on the past trends and the predicted likelihood of their occurrences and impacts on the communities.

It was established that Kabarole District is vulnerable to nine hazards: environmental degradation, severe storms, floods, landslides, crop pests and diseases, animal vector and diseases, earthquakes, drought, and crop, livestock and human attacks by problem animals. Environmental degradation, severe storms and floods were ranked as the most widespread and important of the nine hazards.

The district has a fairly low level of cumulative vulnerability to the hazards except Kabonero Sub-county which is at the medium level of the vulnerability scale. Though Kicwamba and Kiko Sub-counties are at the lowest (green) level of the vulnerability scale, they should be closely monitored since they have higher cumulative and weighted vulnerabilities compared to their counterparts in the same category. The rest of the sub-counties with quite low vulnerabilities to the hazards should be fortified against occurrences of new hazards and exacerbation of resident hazards now occurring at lower magnitudes but which may be worsened by climate extremes expected in the near future.

Early warning systems and other DRR interventions would be able to enhance the resilience of the people of Kabarole to the effects of climate change.

This profile is therefore a valid outcome of an integration of the spatial information obtained from the mapping exercise and the community perception of the hazards. It should henceforth inform the contingency planning, district development planning process towards disaster proof plans.

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