TESO
BUKEDEA District

HAZARD, RISK AND VULNERABILITY

PROFILE
June 2014

Contents

Figure

Maps

Tables

Acronyms

BBW	Banana bacterial wilt
CBSD	Cassava brown streak disease
CFR	Central Forest Reserves
DDMC	District Disaster Management Committee
FIEFOC	Farm Income Enhancement and Forest Conservation Project
FMD	Foot and mouth disease
GIS	Geographical Information Systems
GPS	Global Positioning System
HCII	Health Centre II
LFR	Local Forest Reserves
MLND	Maize lethal necrotic disease
MS	Microsoft
NAADS	National Agriculture Advisory Services
NGO	Non-Governmental Organization
OPM	Office of the Prime Minister
TC	Town Council
UBOS	Uganda Bureau of Statistics
UNDP	United Nations Development Programme

Acknowledgements

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EXECUTIVE SUMMARY

This Bukedea District Hazard, Risk and Vulnerability Profile integrates scientific information provided by agencies at national and district levels, and local knowledge provided by communities on the district base map. This will contribute to a Ugandan atlas of disaster risks and vulnerabilities to support planning and decision-making processes for management of disaster risk in the District.

The district lies approximately between latitude 1°10'N and 1°35'N and longitude 33°30'E and 34°20'E. The district covers a total area of 1,049.34 km², of which 1,035.84 km² are dry land and 13.5 km² are mainly swamps and wetlands.

This hazard, risk and vulnerability profile was produced using a four-phased approach:

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

The report characterizes the district in terms of location, geography, climate, administrative arrangements, natural resources, gender demographics by sub-county, livelihoods, agricultural production, poverty and environmental degradation.

It also ranks endemic hazards in the district in terms of magnitude and frequency: floods, heavy storms and hail, drought and food insecurity, crop and animal disease, land conflict, environmental degradation, vermin, road accidents and bush fires.

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.

Kolir and Malera sub-counties experience the highest levels of flood hazard while Kodongole has low flooding incidence and Bukedea Town Council does not experience severe floods. Land conflicts stand out prominently in nearly all sub-counties in the district, particularly in Bukedea Town Council.

Environmental degradation is high in Kachumbala and Kidongole, as are road accidents in Kachumbala, Bukedea and Bukedea Town Council along the Mbale – Soroti highway.

All sub-counties register at least six of the nine hazards, making them prone to disasters of aggregated hazards. Kachumbala and Bukedea are the most vulnerable, with more high severity   hazards than the other sub-counties.

INTRODUCTION

Bukedea District is located in the Teso Sub-region, 285 km from the capital city (Kampala). The district and the sub-region as a whole have suffered from various disaster-related challenges that have affected progress in development. The sub-region suffered from cattle rustling and insurgency from 1985 to 1993. Food insecurity followed in 1992-94, worsened by an outbreak of the cassava mosaic viral disease. The disease led to the extinction of cassava varieties grown up to that time. In 2007 the entire sub-region experienced floods that destroyed lives and property. In 2009 the region was again affected by drought that destroyed 65 % of the crops planted.

Like other districts in the sub-region, Bukedea is prone to a range of hazards and associated disasters including floods, crop and animal epidemic, severe hails storms, land conflicts, pest infestation, environmental degradation, road related accidents, extended drought and food insecurity.

This multi-hazard hazard mapping profiles district disaster risks and vulnerabilities. It is a guide to aid decision making, development planning and design of interventions, to minimize loss of economic resources, infrastructure, physical assets, human resources and environmental capital, and to reduce the population's vulnerability to disaster.

Objectives

The objective of the hazard, risk, and vulnerability mapping is to produce a District Profile that will aid planning and decision-making processes which address disaster risks and reduce the vulnerability of households and communities in Bukedea District.

Methodology

The multi-hazard, risk and vulnerability mapping approach employed a people-centered, multi-sectoral, 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 Teso 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, and the districts in Teso 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.

Brief Overview of the District

Location

The Bukedea District is located in Eastern Uganda. It borders Mbale and Sironko districts in the East, Kumi district to the North, Katakwi and Nakapiripirit districts in the North East and Pallisa district in the South. The District headquarters is Bukedea Town Council, about 285 km from Kampala City.

The district lies approximately between latitude 1°10'N and 1°35'N and longitude 33°30'E and 34°20'E. The district covers a total area of 1,049.34 km², of which 1,035.84 km² are dry land and 13.5 km² are mainly swamps and wetlands.

Historical background and administrative set up

- Bukedea District is seven years old.
- Gazetted to a district status on 13th July 2006, took effect 1st July, 2006.
- Removed from Kumi District.
- One county, with five sub-counties and one Town Council.

Sources of revenue

Bukedea district's main sources of funding so far are Central Government conditional and unconditional transfers (99%), and revenue locally generated through taxes, rents, rates, fees, etc. (1%). No donors have so far committed to fund any district programmes and projects, although the district has a number of proposed programmes and projects in various sectors.

Climate and vegetation

The district has a modified equatorial climate with heavy rainfall and high temperatures. The rainfall pattern is characteristically bi-modal with peaks in April-May and July-August. The rest of the months are relatively dry and hot. The annual mean temperature is 24°C. The vegetation is generally savannah. There are woodlands at Malera, Kolir and Bukedea Sub-Counties, as well as forest plantations and reserves.

Topography

Bukedea District is in the plains of Teso sub-region, i.e., generally flat with few undulations, and pierced by isolated inselbergs, the most pronounced being Bukedea (Kocheka) and Kachumbala (Kongunga, Kongoidi, Komuge, Amus, Otimonga, Moru-Ateko, Kotia-Aligoi and Kongatuny). Inselburgs are a good resource for stone mining for the construction industry, are an African Monkey habitat and have caves which are attractive to tourists. They modify the micro-climate and contribute to soils fertility due to their volcanic origins.

Natural resources and utilisation

Bukedea District experiences environmental degradation, especially in wetlands, forests and range lands. Depending on location, various factors contribute to this continuous degradation. The population increase in the sub-counties of Kachumbala, Kidongole, and Bukedea forces unsustainable demands on ecological services. Kolir and Malera sub-counties presently have good biomass cover but face the threat of over-grazing which will become problematic if not immediately checked.

Wet lands

Rice growers have encroached on the Bukedea district wetlands, with the most severely affected in parts of Kidongole, Bukedea and Kachumbala sub-counties.

The main human activities that have degraded wetlands include cultivation and to a moderate extent brick making. The major crops in the wetlands are rice, sugarcane, millet, sorghum, maize and vegetables, all cultivated during the dry season. Rice and sugarcane grow in or near the core central portions of the wetlands while the other cereals are mostly cultivated at the wetland edges. The overall impact is high soil turnover and mixing and these contribute greatly to wetland siltation and drying, with consequent biodiversity reduction and habitat destruction increasing over time.

Forestry

The forest cover of the district is generally low due to population pressures and increasing demand for forest products within the district. There are two types of forest reserves;
   a) Forest on protected areas central forest reserve (CFR) or local forest reserves (LFR)
   b) Forest on public, private land and riverine forest.
There are two LFRs in Kachumbala (26 Ha) and Malera (Koreng 76 Ha) and one CFR located in Bukedea town council (16 Ha). The district has a number of private and community forests but most are poorly managed because plantation owners are generally ignorant of silviculture practice. Privatization of forest reserves and afforestation have been encouraged but have not yielded the expected results as the communities around the forests still burn or cut down trees illegally.

Other than the above protected forests, the district has privately owned forests in farm lands or communal lands which the community exploits unsustainably for firewood, charcoal and brick burning. Wild fires are also a problem. There is therefore a need to train communities on development of woodlots, use of energy saving stoves, nursery practices and storage of fuel wood as a strategy to eliminate degradation of the existing natural and artificial plantations. Such an initiative would promote community-owned woodlots maintained at the household level.

Bukedea is one of the districts benefiting from the Farm Income Enhancement and Forestry Conservation project (FIEFOC) forestry component. The project has two sub-components: watershed management and tree planting. It provides the planting materials which most of the farmers were lacking. Awareness-building by the project has led to increasing numbers of people requesting tree planting support. Many farmers have developed big plantations, for example, in Kolir and Kidongole, through their own initiatives. With sustained support by the project, significant increases in tree cover may be expected during the next five years.

Population

The population projections shown in Table 2 for the district are based on the 2002 Census.

Table 1 Gender composition of the population from 2008-2012

	2008	2009	2010	2011	2012
Male	75,100	77,000	82,300	86,100	90,100
Female	81,900	83,900	88,700	92,400	96,300
Total	157,000	160,900	171,000	178,500	186,400

Source: UBOS

Population growth

The Population and Housing Census of 2002 revealed a total population of 122,433 persons, a 4.2% increase since the previous census in 1991. The sub-counties of Kachumbala, Kidongole and Bukedea have a high growth rate with changing demographics featuring lower average age and consequent skewing of social service provision in favour of children.

Table 2 Sub-county populations at 2002 census

Sub-county	Population
Kachumbala	36366
Malera	26669
Bukedea	25456
Kidongole	16971
Kolir	16971
Total	122433

Population density

The population density of Bukedea District has risen sharply from 117 people per km^2 in 2002 to 173 people per km^2 in 2011, leading to a steep fall in farm holding and increased vulnerability of the farming population. Figure 1 shows the Bukedea population trends. Increasing population density affects the district negatively in many aspects; among them, land disputes and farm size reduction reduce agricultural productivity.   Remedial options include adoption of new technologies for higher cultivation yields, and improved educational opportunities for girls.

Chart data: $y = 18545e^{0.3128x}$, $R^2 = 0.9871$

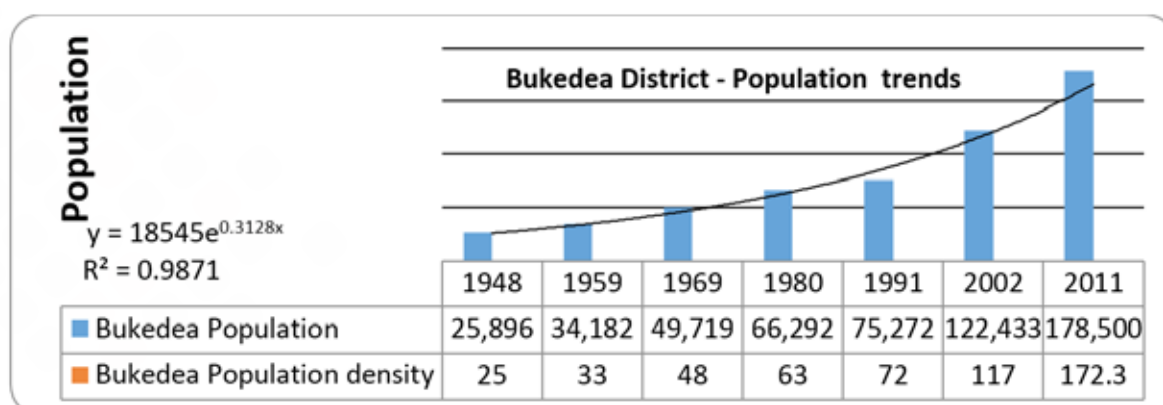|	1948	1959	1969	1980	1991	2002	2011
Bukedea Population	25,896	34,182	49,719	66,292	75,272	122,433	178,500
Bukedea Population density	25	33	48	63	72	117	172.3

Figure 1 Bukedea district population trends

The Economy

The climate and vegetation has had a direct bearing on the economic activities of the majority of the population. Agriculture forms a base of the mainstream economic life of the people. Over 84% of the households are engaged in agriculture, though mainly practicing subsistence farming this is according to various reports. There is limited application of modern techniques of production this leaves farmers operating below their potential. Besides crop farming is animal rearing of mainly local zebu cattle, goats, sheep, pigs and poultry.

Poverty trends

Bukedea District is not exceptional in terms of poverty, with 54% of the population in absolute poverty, and 20% malnourished.

Gender

Hazards affect the roles of both men and women differently. For grazing, men are greatly affected in terms of pastures and water for livestock. Women are affected in their roles to collect water and cooking fuel, take children to health units and other activities such as threshing and drying of produce. Concerned with household food security, they suffer most in times of drought and food insecurity.

Table 4 shows the stark disparity between male and female literacy. Improved literacy in both genders, but particularly female, could lead to more livelihood options and consequent poverty reduction.

Table 3 Literacy and illiteracy levels by 2002 for 10+ years

Literacy/ illiteracy	Male total	%	Female total	%	Overall total	%
Literacy	22,759	69	19,687	28	22,226	57.6
Illiteracy	11,050	31	21,606	52	32,656	22.2

Land Conflict

Population pressure on arable land has pushed people to the wetlands, with continued upland loss of soil fertility, resulting in failure to sustainably meet household requirements and increasing resource conflicts between users as seen in Table 1.

Table 4 Natural resource conflicts in Bukedea district

Nature of Conflict	Resource of conflict	Level of conflict	Area of Occurrence
Water collectors vs cattle keepers	water	very high	All sub-counties
Cattle keepers vs builders	grass	high	Malera ,kolir
Charcoal burners vs brick makers	fuel wood	high	All sub-counties
Sand miners vs cultivators	land	moderate	Kidongole, Bukedea, kachumbala
Brick makers vs developers	land	moderate	Town council

HAZARDS

Table 5 shows the hazards endemic in each sub-county and indicates the possibility of aggregate disaster.

Table 5 Hazard summary

Sub-county	Floods	Crop and animal disease	Land conflict	Bush fires	Hailstorms and lightning	Environmental degradation	Drought / food insecurity	Vermin	Road accidents
Malera	✓	✓	✓	✓	✓	✓	✓	✓	
Kolir	✓	✓	✓	✓	✓	✓	✓	✓	
Kachumbala	✓	✓	✓		✓	✓	✓	✓	✓
Kidongole	✓	✓	✓		✓	✓	✓	✓	
Bukedea	✓	✓	✓		✓	✓	✓	✓	✓
Bukedea TC	✓	✓	✓		✓	✓	✓		✓
Total	5	6	6	2	6	6	6	5	3

Table 6 discusses the nature of the hazards experienced by communities in Bukedea District and links each hazard to a risk map which shows the extent of the hazard on a base map with respect to geographic features and infrastructure. It ranks the hazards by decreasing risk, as perceived by the communities.

Table 6 Hazard

Hazard	Status	Sub-Counties	Rank
Floods See Figure 2	Increasing flooding from 2007 to date relate to increases in malaria, typhoid, cholera, domestic water contamination, destruction of crops and livestock destruction, destruction of infrastructure (e.g., Tajar Primary school, Busano HCII, Busano Primary school, Okula Primary school, among others). Difficulty in construction works in the district as was experienced at Tajar Primary school, Kamutur tajar road development. Poor access to community services as bridges are destroyed (e.g. to Tajar P/S).	The main sub-counties affected are Malera and Kolir. Bukedea, Kachumbala, Kidongole sub-counties equally suffer from floods.	1
Severe storms and hail See Figure 3	Wind, hail and electrical storms affects most parts of the district, causing destruction of property and to some extent loss of life. Reported instances include Kangole primary school roof was blown off due to heavy storms that also destroyed property at Katekwan village in 2010. Storms usually affect cultivation yields, livestock life and household incomes. Storms mainly occur at the beginning of the rainy seasons.	District wide	2
Drought and food insecurity See Figure 4	Drought has afflicted in all the sub-counties for the last several years, leading to inadequate food at household level. Particularly in 2009, a total of 14,182 households (70,911 people) were without food and in dire need of help. Droughts often destroy crops and animals.	District wide	3

Hazard	Status	Sub-Counties	Rank
Crop and animal disease See Figure 5	Crop and livestock pests and diseases have increased significantly in the district. Pests that devastate households include the army worm and fruit flies. Crop diseases include BBW, MLND, CBSD (has greatly affected most grown cassava varieties), Fruit and leaf spots, FMD that resulted into quarantine in 2012 (this being the worst).	These diseases and pests cut across all sub-counties and have a potential to reach disaster levels	4
Land Conflict See Figure 6	Incidences of land conflicts are both in urban and rural settings. These range from ownership, boundary to user rights. The conflicts exist between households, clans, institutions and communities, and between individuals. The land cases form about 90% of the court cases reported in the district. However the time taken by courts to judge land cases remains wanting as some take over 10 years hence resulting into a number of deaths through poisoning and murder especially in Malera Sub-County. Institutions like churches, schools, government are losing land.	District wide and hot spot recorded in Malera Sub-County	5
Environmental Degradation See Figure 7	Deforestation, wetland degradation, poor farming practices and loss of soil fertility are serious problems in the district. Population increase is attributed as the major factor which has pushed people to carry out degrading activities while striving to meet their needs. The lack of a waste disposal site in town council greatly contributes to the poor environment. Brick making, charcoal burning, sand mining, indiscriminate tree cutting, uncontrolled bush burning in the sub-counties of Malera and Kolir, and poor farming practices by farmers in all the sub-counties in spite the existence of NAADS programme, contribute to loss of biodiversity.	Kachumbala, Kidongole and Bukedea, Malera and Kolir sub-counties.	6

Hazard	Status	Sub-Counties	Rank
Vermin See Figure 8	The district experiences incidences of vermin, mainly mole rats and monkeys, which affect crops such as sweet potato, cassava, maize, fruits and groundnuts.	Mainly a problem in Kachumbala, Kidongole and Bukedea sub-counties, with a few cases in Kolir and Malera	7
Road accidents See Figure 9	The district often experiences road accidents include overturning of fuel tankers causing oil spillages on roads sides, loss of lives and property. This is often caused by speeding, lack of speed control humps at critical points, ill-maintained roads, and inadequate road signage.	Bukedea Town Council	8
Bush fire See Figure 10	Households tend to use burning as a way to clear farm fields, rejuvenate pal-atable pastures and discourage preda-tors. These fires can get out of control resulting in crop destruction, biodiver-sity loss, destruction of property, loss of soil nutrients and loss of carbon sequestration capacity. For example, in Kolir, over 15 acres of pine plantation was lost to fire by a farmer.	Kolir and Malera sub-counties	9

Flood risk

BUKEDEA DISTRICT FLOOD RISK MAP

Figure 2 Bukedea district flood risk map

Floods have become almost annual events during the wet season, affecting farmers especially those in the valleys and wetland areas. Adjacent to wetlands, the sub-counties worst affected are Malera and Kolir, all reporting high risk. Risk hot spot parishes are Kochot, Aminit, Apopong, Kolir and Komongomesi in Koliri Sub-County and Kangole, kakori, Kachede, Koreng, Kotiokot, Kotide and Kobaale parishes in Malera Sub-County respectively. The impacts of floods are felt especially when roads are submerged and bridges washed away.   Floods also destroy crops, kill livestock and damage property.
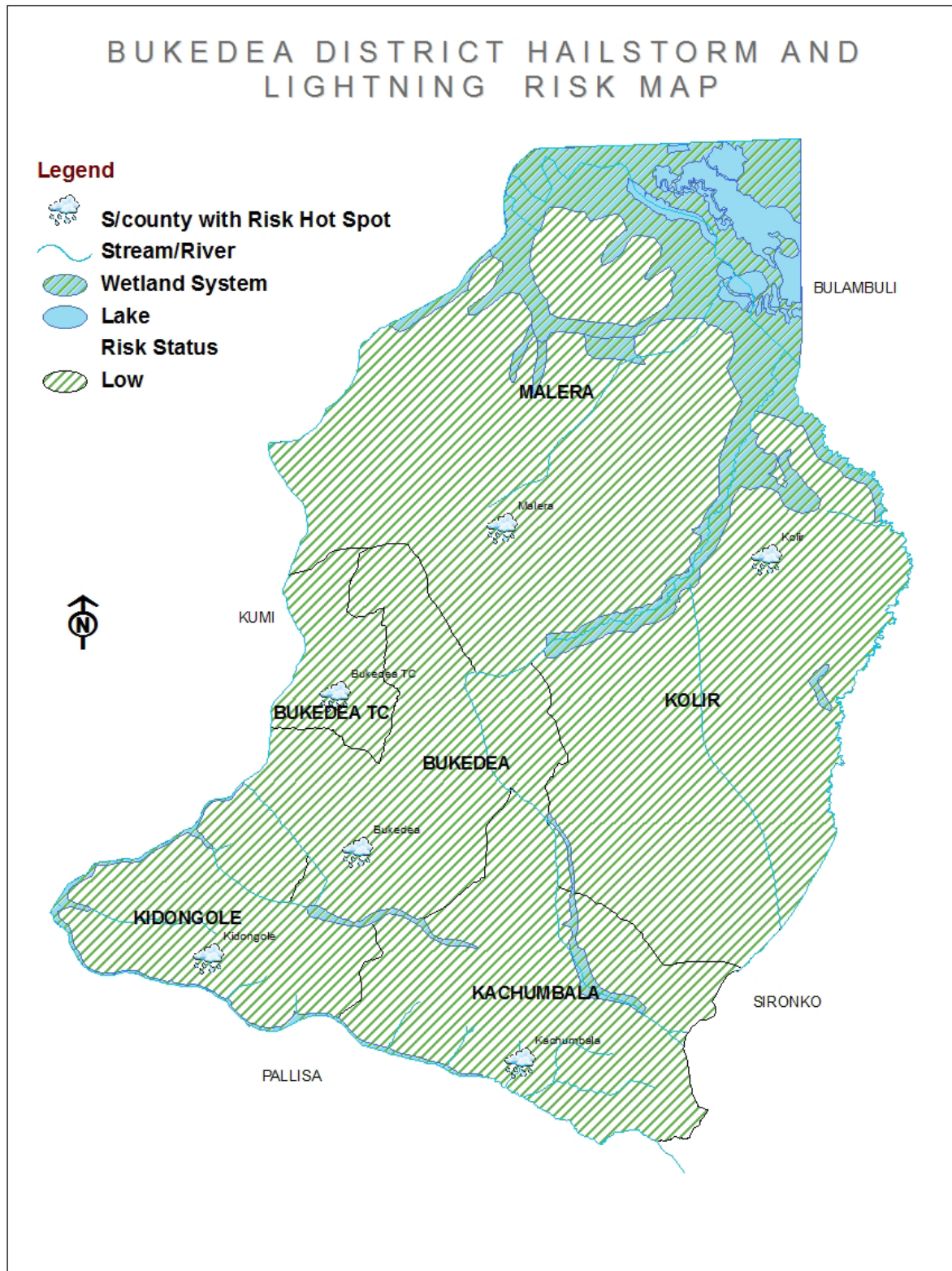
Hailstorm and lightning risk

Figure 3 Bukedea district hailstorm and lightning risk map

Storms with high winds, lightning and hailstorms throughout the district affect crop yields and can cause loss of life. Fortunately, severity is low district wide. Never the less, risk hot spots are variously distributed in the district devastating lives and property.

Drought risk map

BUKEDEA DISTRICT DROUGHT AND FOOD INSECURITY RISK MAP

Legend
- S/County with Risk Hot spot
- Stream/River
- Wetland System
- Lake
- Risk Status
- Medium

BULAMBULI

MALERA

Malera

Kolir

KUMI

Bukedea TC

BUKEDEA TC

KOLIR

BUKEDEA

Bukedea

KIDONGOLE

Kidongole
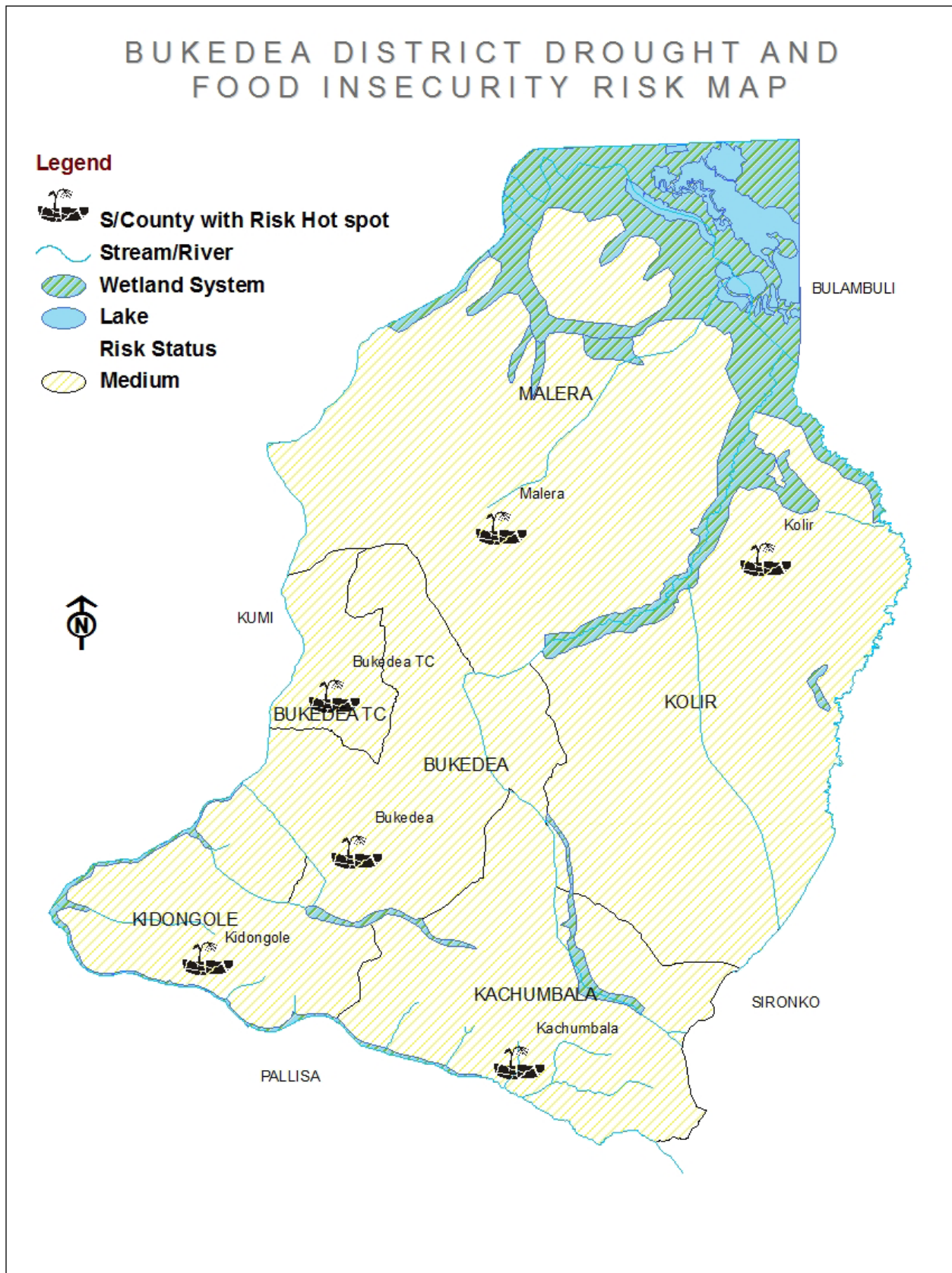
KACHUMBALA

SIRONKO

Kachumbala

PALLISA

Figure 4 Bukedea drought risk map

Drought and food insecurity are widespread throughout the entire district mainly during the dry season. Prolonged dry spells result in loss of human and livestock life, increased rural-urban migration, family breakdown, outward migration to neighbouring districts, early marriages of children between 12-18 years in exchange for food, and women and elderly exchanging labour for food and basic needs.

Water for livestock is generally inadequate throughout the year because of intensive wetland cultivation and drought in the sub-counties of Malera and Kolir. Watering points for livestock (cattle) used to be the swamps, which are now for rice cultivation. Watering cattle just once a day contributes to low productivity. There is one valley dam in Malera bordering Ongino called Odouno; others are Kakere dam and Akero dam, and need to be desilted.

Pastures are of poor quality and quantity. Grazing land is scarce during the first rain season when most fields are starting cultivation, especially in the sub-counties of Kachumbala and Kidongole. The animals are grazed along the roadside. Farmers in Kachumbala have been taking their animals for pasture to the neighbouring sub-county of Kolir during this season.

Generally, combinations of drought, soil degradation, pests and diseases have been the major causes of food shortages in the district.

All sub-counties in the entire district reported a medium risk of drought and have suffered particularly in the past two years, resulting in food insecurity affecting more than 71,000 persons.
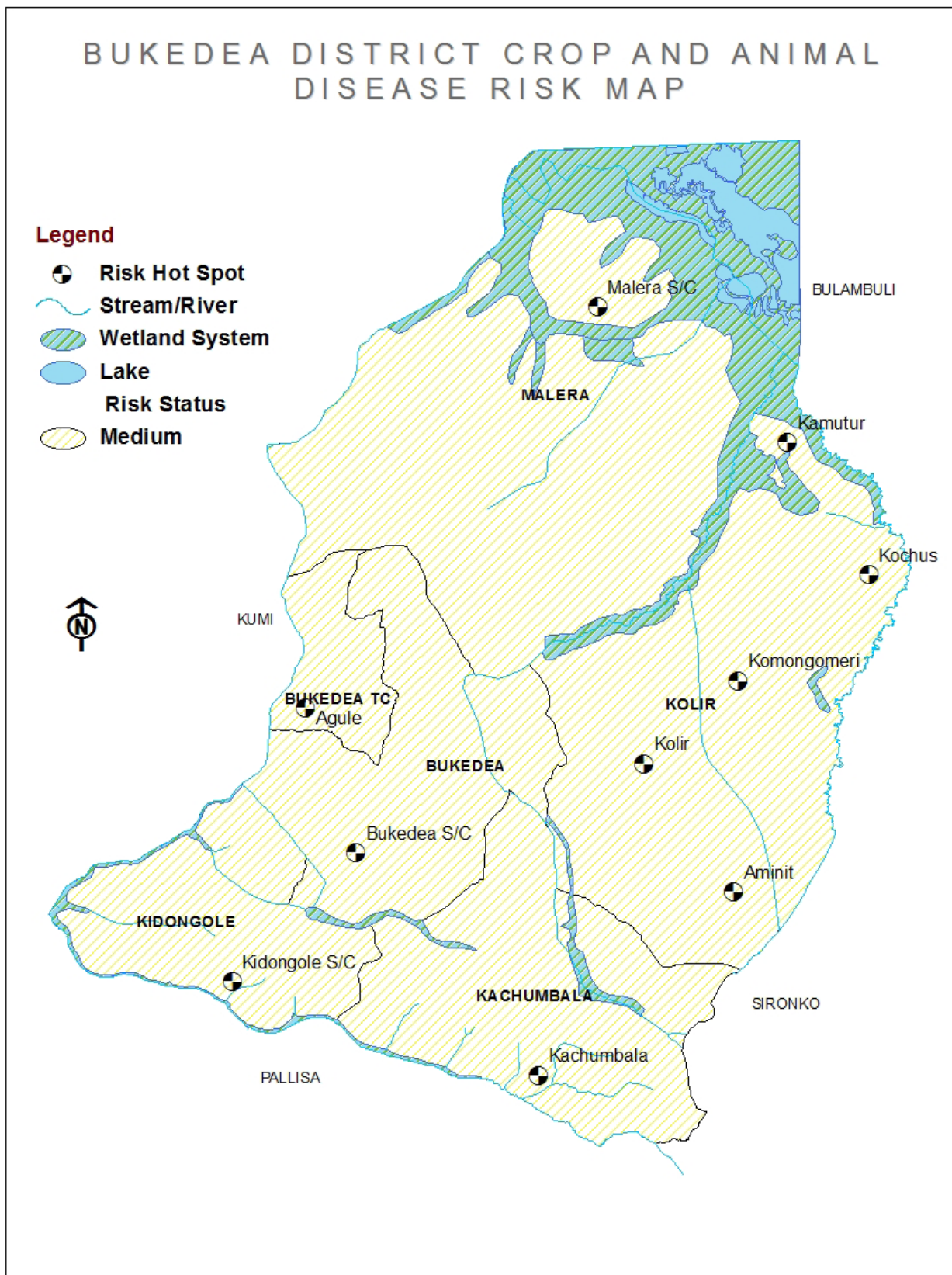
Crop and animal disease risk

Figure 5 Bukedea district crop and animal disease risk map

Crop and animal diseases affect the entire district, with potential to reach disaster levels. Since crops and animals are important elements of diet and livelihoods, these hazards have significant impacts on food security and economic security. In recent times crops have been infested by various crop pest and diseases including army worms, horny worms, meal bugs, stalk borers aphids, leaf minors and viruses like cassava mosaic, cassava brown streak disease and groundnuts rosette.

The prevalent diseases are tick-borne taking a toll on cattle, especially calves. Six cattle dips were constructed from 1998 – 2000 and each of the sub-counties has at least one cattle dip. Malera Sub-County has 2 cattle dips. None of the dips is functional and very few farmers spray their animals.

Worms and clostridia infections are a problem in small livestock rearing and vaccinations against previously neglected diseases like CCPP and PPR have been conducted in the sub-counties of Kolir and Malera. In pigs, worms and African swine fever are a hindrance. Newcastle disease, fowl pox and infectious rural hepatitis are major challenges in poultry production.

Risk hot spots are distributed all over the district including Malera, Kamutur, Kachumbala, Kidongole sub-counties, Bukedea Town Council, and Aminit, Kolir, Agule, Kochus, Komongomeri parishes.
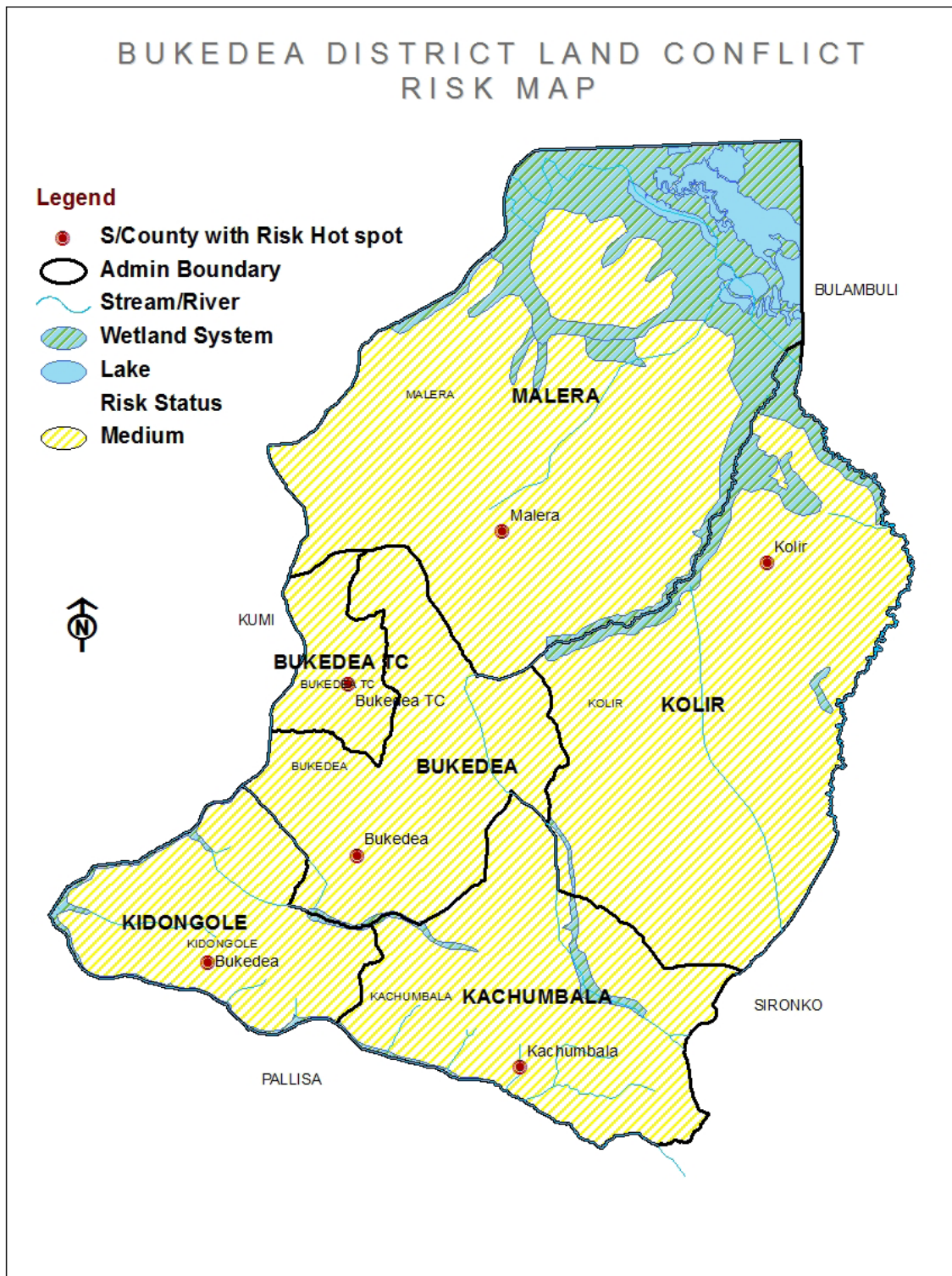
Land conflict risk

Figure 6 Bukedea district land conflict risk map

Land disputes occur throughout the district. The slow rate of resolution due to land court inefficiency sometimes results in violence and murder. The hotspot in Bukedea Town Council reflects the higher population density and land prices in the urbanized area. Land disputes within wetlands have also increased over the years, fuelled by encroachment and wetland reclamation by households.

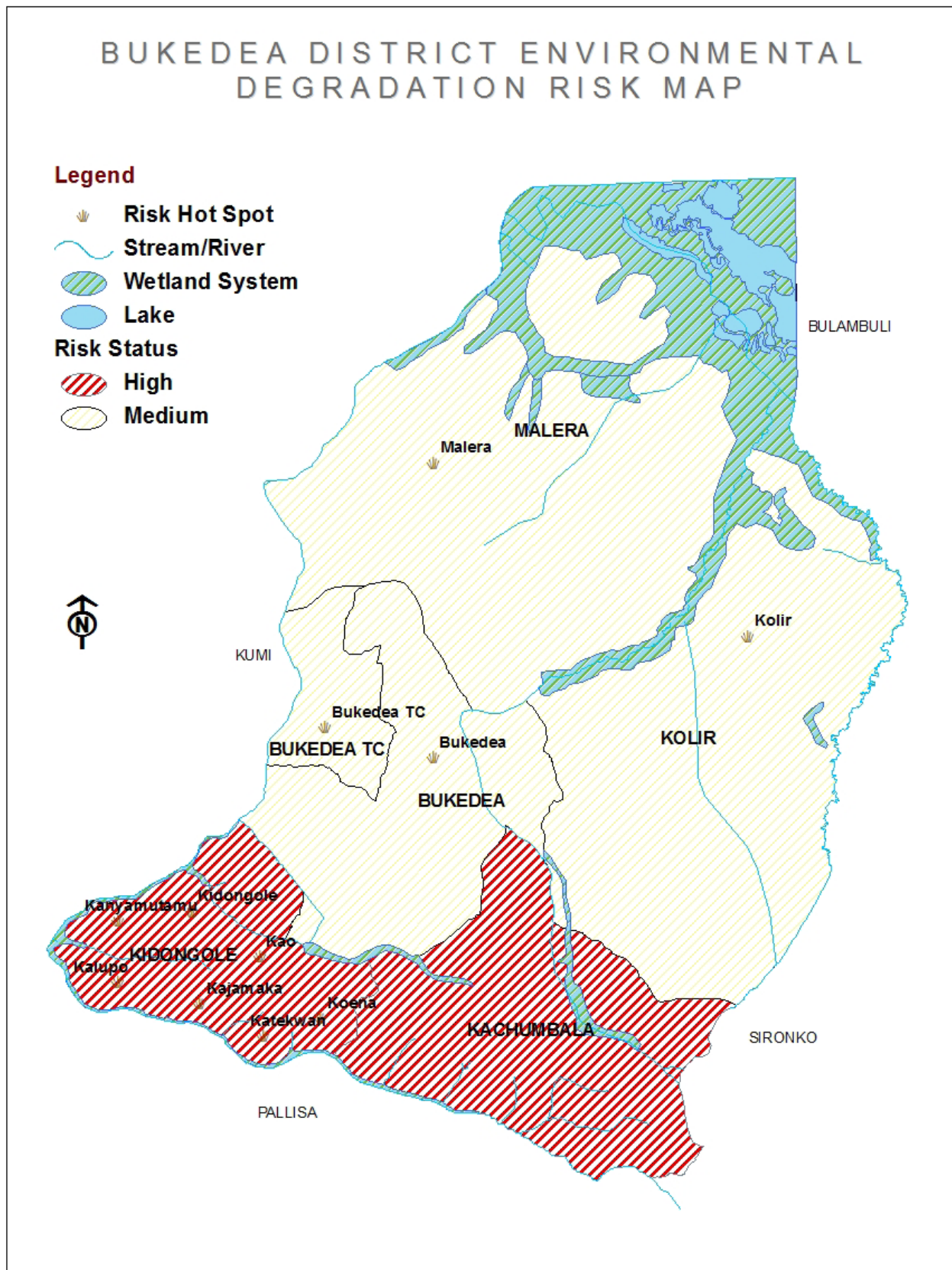## Environmental degradation risk

Figure 7 Bukedea district environmental degradation risk map

The district suffers from severe environmental degradation. Most wetlands have been destroyed due to paddy rice growing resulting in some of them completely drying up. In some sub-counties like Kakomongole and Kacumbala, the wetlands have been over cultivated leaving no area for cattle grazing or access to water for humans or animals. Deforestation, wetland degradation, bush burning and loss of soil fertility are also serious problems in Kachumbala, Kidongole and Bukedea.

There are two local forest reserves (LFRs) in Kachumbala (26 Ha) and Malera (Koreng 76 Ha) and one central forest reserve (CFR) 16 Ha located in Bukedea Town Council. However, the forest cover of the district is diminishing, mainly due to unsustainable utilisation activities within the district and the neighbourhood.

Risk levels are high in Kachumbala, Kidongole and Bukedea sub-counties. Unsustainable exploitation of ecosystem services in Malera and Kolir sub-counties is causing biodiversity loss.
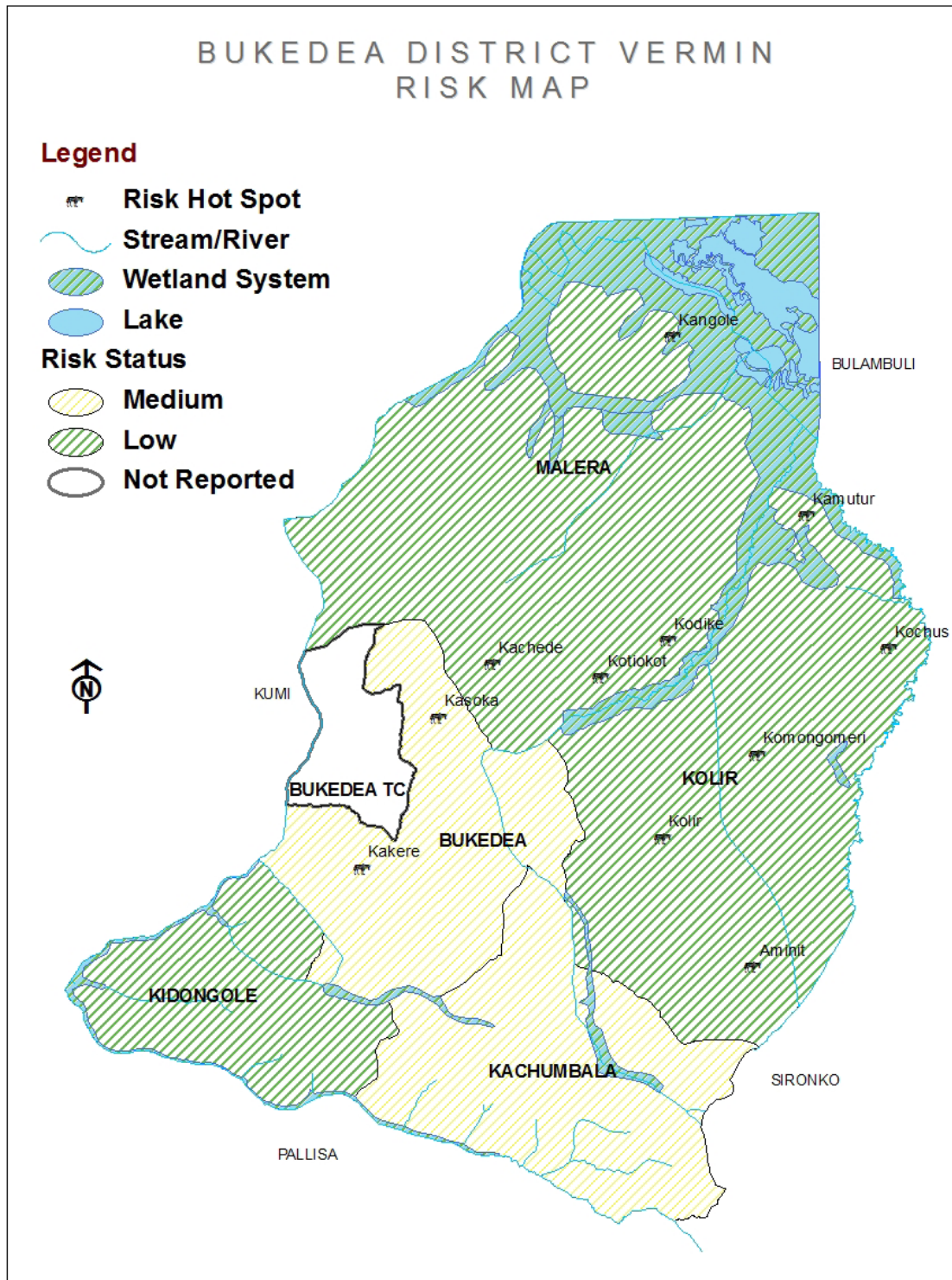
Vermin risk

Figure 8 Vermin risk map

Vermin and problem animals affect the people of Bukedea, especially mole rats and monkeys, which ravage sweet potato, cassava, maize, fruit and groundnut crops. These are the main problem in Kachumbala, Kidongole and Bukedea sub-counties, and to a lesser extent in Kolir and Malera. Risk hot spots are reported in Kakere and Kasoka (Bukedea Sub-County), Kangole, Kachede, Kotiokot and Kodike (Malera Sub-County), Kochus, Komongomeri and Kamutur (Kolir Sub-County).

Road accident risk

Figure 9 Bukedea district road accident risk map

Frequent road accidents have occurred in Bukedea District in recent years. Bad roads, speeding and lack of warning signage cause road accidents throughout the district, with a high incidence in Bukedea Town Council, and in Bukedea and Kachumbala sub-counties.
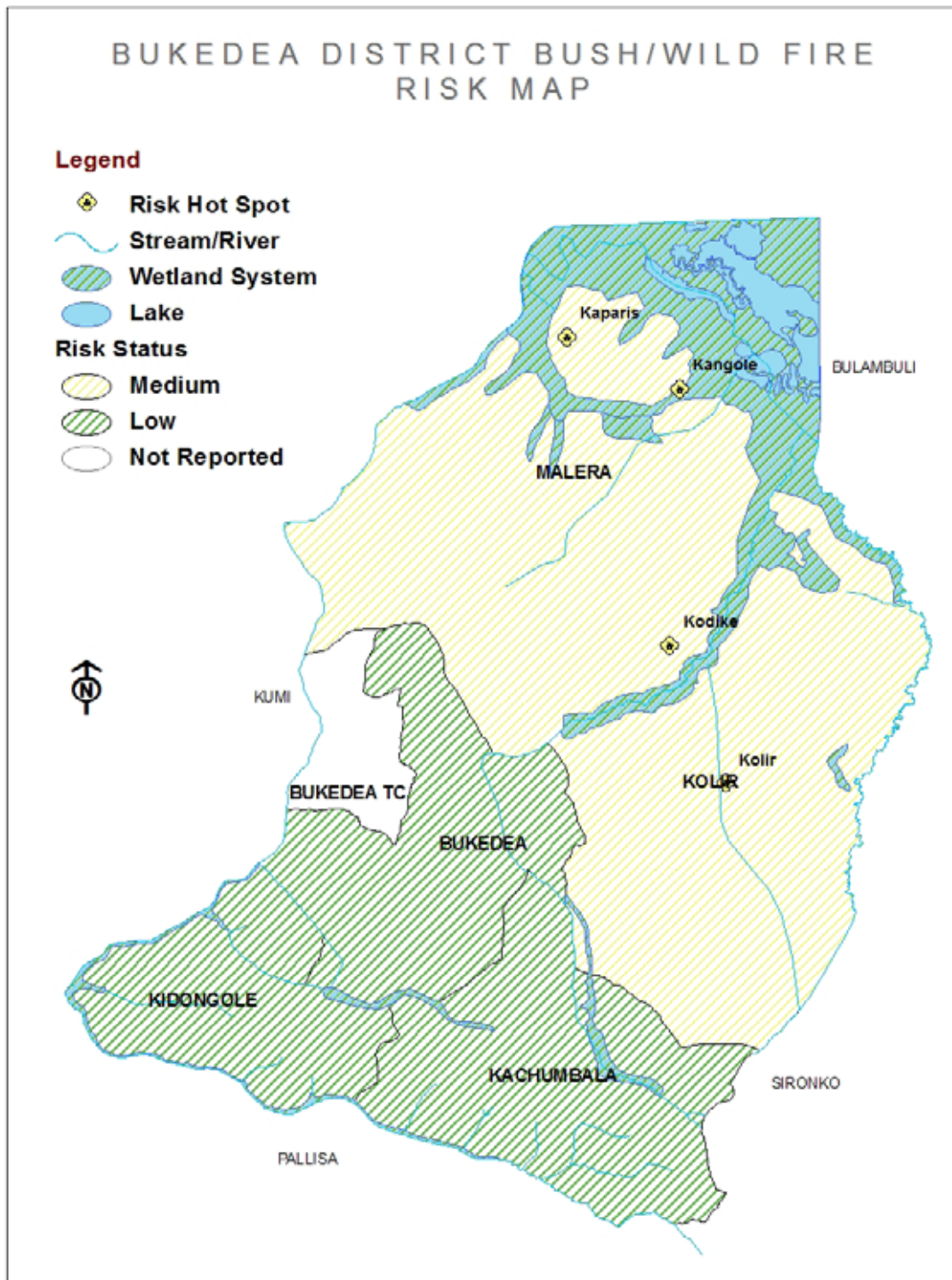
Bush Fire Risk

Figure 10 Bukedea district bush fire risk map

Bush fires caused by uncontrolled agricultural burning are a medium risk in Malera and Koler sub-counties and a low risk elsewhere in the district.

VULNERABILITY

Table 7 Risks vulnerability

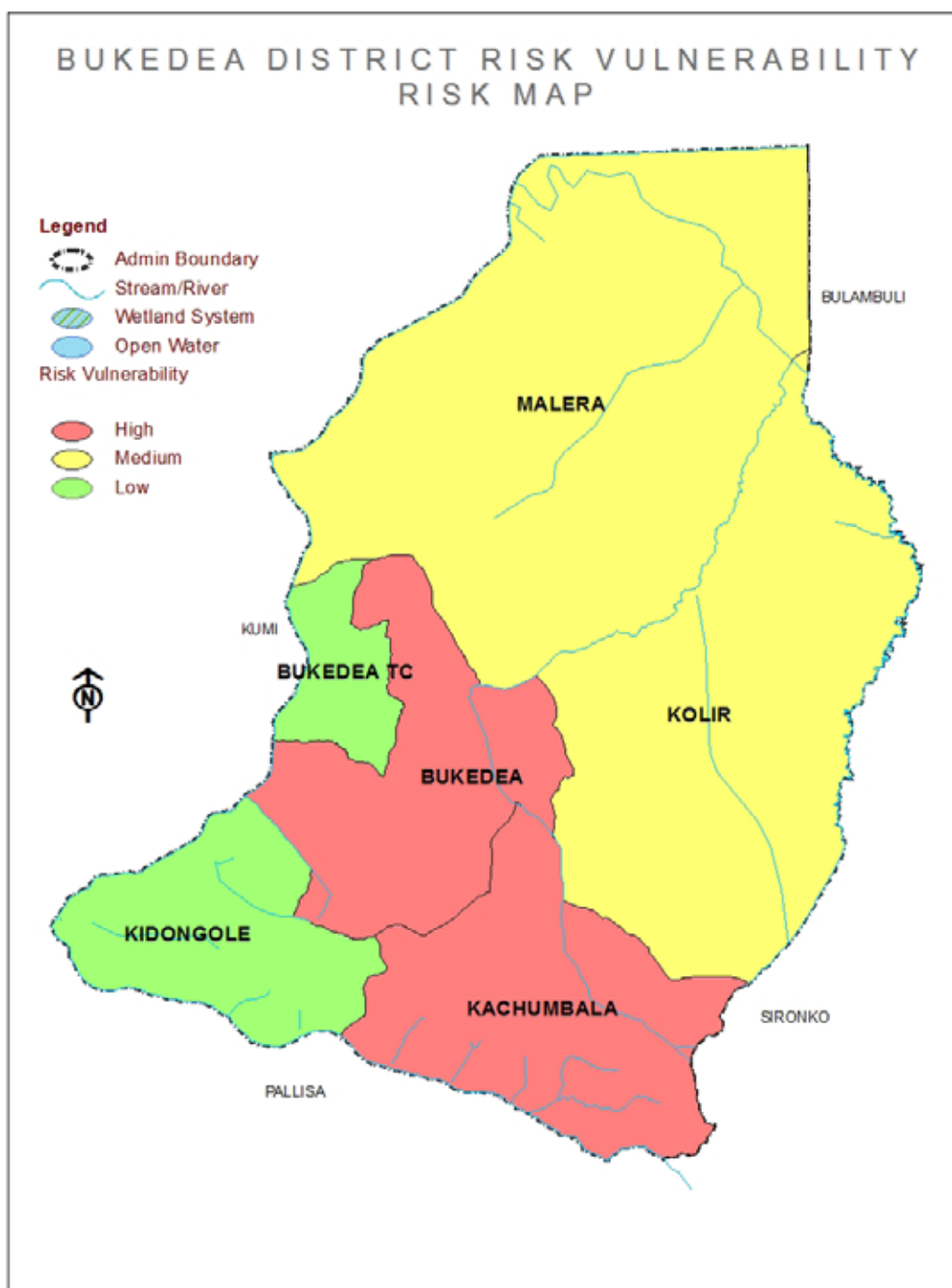| Hazard	Malera	Kolir	Kachumbala	Kidongole	Bukedea	Bukedea TC
Floods	3	3	2	1	2	
Crop and animal epidemics	2	2	2	2	2	2
Land conflicts	3	3	3	3	3	2
Bush fires	2	2	1	1	1	
Hailstorms and lighting	1	1	1	1	1	1
Environmental degradation	2	2	3	3	2	2
Drought and food insecurity	2	2	2	2	2	2
Vermin	1	1	2	1	2	
Road accidents			3		3	3
Score: High = 3, Medium = 2, Low = 1, Not reported = Blank						

Risk and vulnerability

Figure 11 Bukedea district risk and vulnerability map

Bukedea and Kachumbala Sub-Counties are assessed at high risk and vulnerability levels, based on the frequency of hazard events and the magnitudes of losses suffered. Malera and Kolir sub-counties have moderate vulnerability levels, and Kidongole and Bukedea Town Council rate lowest.

Land conflicts, road accidents and environmental degradation are the major risks registered in the most vulnerable sub-counties of Kachumbala and Bukedea. Floods and land conflicts are of high risk in Kolir and Malera sub-counties.

CONCLUSIONS

The multi-hazard vulnerability profile resulting from this mapping exercise combines spatial data and information captured with participatory methods in communities in Bukedea District. The profile shows how communities in each sub-county perceive each hazard based on likelihood of occurrence and severity of impact on them.

Clearly floods are the most significant hazard for people in Bukedea district, although the severity and vulnerability vary across sub-counties. Nine types of hazards are endemic in Bukedea District. Kolir and Malera sub-counties experience the worst flooding while Kodongole has low flooding incidence and Bukedea Town Council does not experience severe floods. Land conflicts stand out as prominent risks in nearly all sub-counties in the district.

Some sub-counties, such as Kachumbala and Bukedea, are more vulnerable than others, suffering from the cumulative impacts of several hazards, some of which may occur simultaneously. As in neighbouring districts, flooding is most pronounced, with high vulnerability levels in all sub-counties in the district compared to other hazards. The Bukedea Town Council has the lowest composite vulnerability.

The hazard mapping exercise shows the importance of spatial information to characterize disasters in Bukedea District. The hazard, risk and vulnerability profile information should be reflected in the disaster mitigation plans developed by the Bukedea district local government to plan action to minimize hazard impacts.

DEFINITIONS 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 lose 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, marbug, 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.