THE REPUBLIC OF UGANDA

District Multi-hazard, Risk and Vulnerability Profile for Ibanda District

August, 2015

Acknowledgement

On behalf of office of the Prime Minister, I wish to express sincere appreciation to all of the key stakeholders who provided their valuable inputs and support to this hazard, risk and vulnerability mapping exercise that led to the production of comprehensive district hazard, risk and vulnerability profiles for the South Western districts which are Ibanda, Buhweju, Bushenyi, Mitooma and Kiruhura.

I especially extend my sincere thanks to the Department of Disaster Preparedness and Management in Office of the Prime Minister, under the leadership of the Commissioner, Mr. Martin Owor and the Assistant Commissioner, Mr. Gerald Menhya for the oversight and management of the entire exercise. My appreciation also goes to the District Teams:

1. Ibanda District: Mr. Nsubuga Saul Zirimenya-Deputy Chief Administrative Officer, Mr. Kirya Erry-Senior Forest Officer and Mr. Tom Wagira-Natural Resources Officer
2. Buhweju District: Mr. Ahimbisibwe Nathan- Ag. Chief Administrative Officer, Birungi Clemencia-District Environment Officer and Mr. Kintu David, Assistant Chief Administrative Officer.
3. Bushenyi District: Ms. Nakamate Lillian-Chief Administrative Officer, Mr. Vincent Kataate,-District Environment Officer and Mr. Natwebembera Amon - District Agricultural Officer.
4. Mitooma District: Mr.Turyaheebwa Kafureeka Willy-Chief Administrative Officer, Mr. Naboth Baguma-District Environment Officer and Dr. Muhumuza Godfrey-District Veterinary Officer.
5. Kiruhura District: Ms. Marion Pamela Tukahurirwa-Chief Administrative Officer, Ms. Namara Deborah-District Environment Officer and Kansiime Robertson-Senior Agricultural Officer and
6. The entire body of stakeholders who in one way or another yielded valuable ideas and time to support the completion of this exercise.

Our gratitude goes to the UNDP for providing funds to support the Hazard, Risk and Vulnerability Mapping. The team comprised of Mr. Gilbert Anguyo, Disaster Risk Reduction Analyst, Mr. Janini Gerald and Mr. Ongom Alfred for providing valuable technical support in the organization of the exercise.

Finally, the team led by Ms. Ahimbisibwe Catherine, Senior Disaster Preparedness Officer supported by Kirungi Raymond-Disaster Preparedness Officer, Kagoda Jacqueline-Disaster Management Officer and the team of consultants (GIS/DRR specialists): Dr. Barasa Bernard, Dr. Egeru Anthony, Mr. Senkosi Kenneth and Mr. Magaya John Paul who gathered the information and compiled this document are applauded.

Hon. Hilary O. Onek

Minister for Relief, Disaster Preparedness and Management

Executive Summary

Uganda has over the past years experienced frequent disasters that range from drought, to floods, landslides, human and animal disease, pests, animal attacks, earthquakes, fires, conflicts and other hazards which in many instances resulted in deaths, property damage and losses of livelihood. With the increasing negative effects of hazards that accompany population growth, development and climate change, public awareness and proactive engagement of the whole spectrum of stakeholders in disaster risk reduction, are becoming critical. The Government of Uganda is moving the disaster management paradigm from the traditional emergency response focus toward one of prevention and preparedness. Contributing to the evidence base for Disaster and Climate Risk Reduction action, the Government of Uganda is compiling a national atlas of hazard, risk and vulnerability conditions in the country to encourage mainstreaming of disaster and climate risk management in development planning and contingency planning at national and local levels.

This assignment was carried out by a team of consultants and GIS Specialists between June and July 2015 under the overall technical supervision by the Office of the Prime Minister. The assignment aimed at mapping and producing Multi Hazard, Risk and Vulnerability (HRV) Profiles for the districts of Mitoma, Buhweju, Ibanda, Kiruhura, and Bushenyi.

Hazard, risk and vulnerability assessment was done using a stack of methods including participatory approaches such as focus group discussions (FGDs), key informant interviews, transect drives and spatial and non-spatial modelling. Key informant interviews and Focus Group Discussions were guided by a checklist. Key informants for this assessment included: the Districts Senior Forest Officer, Production and Marketing Officer, Environment Officer, Veterinary Officer, Health centre medical workers and Sub-county/parish chiefs on multi-hazards, risks and vulnerability in the District. The information provided by key informants was used as basis for selection of two Sub Counties to conduct focus group discussions. During the FGDs, participants were requested through a participatory process to develop a community hazard profile map. The identified hazard hotspots in the community profile maps were visited and mapped using a handheld Spectra precision Global Positioning System (GPS) units, model: Mobile Mapper 20 for X, Y and Z coordinates. The entities captured included: hazard location, (Sub-county and parish), extent of the hazard, height above sea level, slope position, topography, neighbouring land use among others. This information generated through a participatory and transect approach was used to validate modeled hazard, risk and vulnerability status of the district. The spatial extent of a hazard event was established through modeling and a participatory validation undertaken.

In the case of Ibanda district, hazards can be classified as:

a. Geomorphological or Geological hazards including landslides and hilltop crack
b. Climatological or Meteorological hazards including drought, hailstorms, strong winds, lightening and hill-slope surface runoff
c. Ecological or Biological hazards including livestock pests and diseases, crop pests and diseases, bush fires
d. Technological hazards including road accidents.

Results reveal that it is drought that predisposes the Ibanda district community to a high vulnerability state.

It was established that Ibanda has over the last three decades years increasingly experienced hazards especially strong winds, crop and livestock pests, parasites and diseases; hail storms and lightening putting livelihoods at increased risk. However, the limited adaptive capacity (and or/resilience) and high sensitivity of households and communities in the districts increase its vulnerability to hazard exposure necessitating urgent external support. Indeed, counteracting vulnerability at community, local government and national levels should be a threefold effort hinged on:

i. Reducing the impact of the hazard where possible through mitigation, prediction, warning and preparedness;
ii. Building capacities to withstand and cope with the hazards and risks;
iii. Tackling the root causes of the vulnerability such as poverty, poor governance, discrimination, inequality and inadequate access to resources and livelihood opportunities.

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List of acronyms

GIS	:	Geographical Information Systems
UNDP	:	United Nations Development Programme
ToR	:	Terms of Reference
HRV	:	Multi hazard, Risk and Vulnerability
DLG	:	District Local Government
OPM	:	Office of the Prime Minister
NEMA	:	National Environmental Authority
DWRM	:	District Water Resources Management

Definition of key terms

Disaster Risk: Disaster risk signifies the possibility of adverse effects in the future. It derives from the interaction of social and environmental processes, from the combination of physical hazards and the vulnerabilities of exposed elements (Cardona et al., 2012). The hazard event is not the sole driver of risk, and there is high confidence that the levels of adverse effects are in good part determined by the vulnerability and exposure of societies and social-ecological systems (UNDRO, 1980; Cardona, 2011; UNISDR, 2009; Birkmann, 2006).

Disaster risk is not fixed but is a continuum in constant evolution. A disaster is one of its many 'moments' (ICSU-LAC, 2010), signifying unmanaged risks that often serve to highlight skewed development problems (Wijkman and Timberlake, 1984). Disasters may also be seen as the materialization of risk and signify 'a becoming real' of this latent condition that is in itself a social construction (Renn, 1992).

In a nutshell, **risk** is the probability of harmful consequences, or expected losses (deaths, injuries, property loss, livelihoods and economic activity disruption or environment damage) resulting from interactions between hazards (natural, human-induced or man-made) and vulnerable conditions.

Hazard: Hazard refers to the possible, future occurrence of natural or human-induced physical events that may have adverse effects on vulnerable and exposed elements (UNDRO, 1980; UNDHA, 1992; Birkmann, 2006). Although, at times, hazard has been ascribed the same meaning as risk, currently it is widely accepted that it is a component of risk and not risk itself. Generally, **the hazard** is a potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

Exposure: Exposure refers to the inventory of elements in an area in which hazard events may occur (UNISDR, 2009). Hence, if population and economic resources were not located in (exposed to) potentially dangerous settings, no problem of disaster risk would exist. While the literature and common usage often mistakenly conflate exposure and vulnerability, they are distinct. Exposure is a necessary, but not sufficient, determinant of risk. It is possible to be exposed but not vulnerable (for example by living in a floodplain but having sufficient means to modify building structure and behavior to mitigate potential loss). However, to be vulnerable to an extreme event, it is necessary to also be exposed.

Vulnerability: Vulnerability refers to the propensity of exposed elements such as human beings, their livelihoods, and assets to suffer adverse effects when impacted by hazard events (UNDRO, 1980; Blaikie *et al*., 1994). Vulnerability is related to predisposition, susceptibilities, fragilities, weaknesses, deficiencies, or lack of capacities that favor adverse effects on the exposed elements.

Coping and adaptive capacity: Capacity refers to the positive features of people's characteristics that may reduce the risk posed by a certain hazard. Improving capacity is often identified as the target of policies and projects; based on the notion that strengthening capacity will eventually lead to reduced risk. In a nutshell, coping capacity also refers to the ability to react to and reduce the adverse effects of experienced hazards, whereas adaptive capacity refers to the ability to anticipate and transform structure, functioning, or organization to better survive hazards (Saldaña-Zorrilla, 2007).

CHAPTER ONE

Background and context

1.1 Introduction

Uganda has over the past years experienced frequent disasters that range from drought, to floods, landslides, human and animal disease, pests, animal attacks, earthquakes, fires, conflicts and other hazards which in many instances resulted in deaths, property damage and losses of livelihood. With the increasing negative effects of hazards that accompany population growth, development and climate change, public awareness and proactive engagement of the whole spectrum of stakeholders in disaster risk reduction, are becoming critical. The Government of Uganda is moving the disaster management paradigm from the traditional emergency response focus toward one of prevention and preparedness. Contributing to the evidence base for Disaster and Climate Risk Reduction action, the Government of Uganda is compiling a national atlas of hazard, risk and vulnerability conditions in the country to encourage mainstreaming of disaster and climate risk management in development planning and contingency planning at national and local levels.

From 2013 UNDP has been supporting the Office of the Prime Minister to develop district hazard risk and vulnerability profiles in the Sub-regions of Rwenzori, Karamoja, Teso, Lango, Acholi and West Nile covering 42 districts. During the exercise above, local government officials and community members actively participated in the data collection and analysis. The data collected was used to generate hazard risk and vulnerability maps and profiles. Validation workshops were held in close collaboration with ministries, district local government (DLG), development partners, agencies and academic/research institutions.

The developed maps show the geographical distribution of hazards and vulnerabilities up to Sub county level for each district. The analytical approach to identify risk and vulnerability to hazards in the pilot Sub-regions visited (Rwenzori and Teso), was improved in Subsequent Sub-regions. Based on lessons learnt, UNDP engaged an Individual Consultant to facilitate the process of conducting and producing HRV profiles and maps for 5 districts in Western Uganda. The districts considered included Mitoma, Buhweju, Ibanda, Kiruhura and Bushenyi.

1.2 Overview of the complex interaction of disaster/hazard, risk and vulnerability

The severity of the impacts of extreme and non-extreme weather and climate events depends strongly on the level of vulnerability and exposure to these events. Trends in vulnerability and exposure are major drivers of changes in disaster risk and of impacts when risk is realized. Understanding the multi-faceted nature of vulnerability and exposure is a prerequisite for determining how weather and climate events contribute to the occurrence of disasters, and for designing and implementing effective adaptation and disaster risk management strategies (Lundgren and Jonsson, 2010; Cardona *et al*., 2012).

Vulnerability and exposure are dynamic, varying across temporal and spatial scales depending on economic, social, geographic, demographic, cultural, institutional, governance, and environmental factors (Cardona *et al.*, 2012). Individuals and communities are differentially exposed and vulnerable and this is based on factors such as wealth, education, race/ethnicity/religion, gender, age, class/caste, disability, and health status. Lack of resilience and capacity to anticipate, cope with, and adapt to extremes and change are important causal factors of vulnerability.

Extreme and non-extreme weather and climate events also affect vulnerability to future extreme events, by modifying the resilience, coping, and adaptive capacity of communities, societies, or social-ecological systems affected by such events. At the far end of the spectrum – low-probability, high intensity events – the intensity of extreme climate and weather events and exposure to them tend to be more pervasive in explaining disaster loss than vulnerability in explaining the level of impact. But for less extreme events – higher probability, lower intensity – the vulnerability of exposed elements plays an increasingly important role. The cumulative effects of small or medium-scale, recurrent disasters at the Sub-national or local levels can substantially affect livelihood options and resources and the capacity of societies and communities to prepare for and respond to future disasters (Füssel, 2007).

High vulnerability and exposure are generally the outcome of skewed development processes, such as those associated with environmental mismanagement, demographic changes, rapid and unplanned urbanization in hazardous areas, failed governance, and the scarcity of livelihood options for the poor (Cees, 2009; Cutter *et al*., 2003).

The selection of appropriate vulnerability and risk evaluation approaches depends on the decision making context. Vulnerability and risk assessment methods range from global and national quantitative assessments to local-scale qualitative participatory approaches. The appropriateness of a specific method depends on the adaptation or risk management issue to be addressed, including for instance the time and geographic scale involved, the number and type of actors, and economic and governance aspects. Indicators, indices, and probabilistic metrics are important measures and techniques for vulnerability and risk analysis. However, quantitative approaches for assessing vulnerability need to be complemented with qualitative approaches to capture the full complexity and the various tangible and intangible aspects of vulnerability in its different dimensions. Appropriate and timely risk communication is critical for effective adaptation and disaster risk management.

Effective risk communication is built on risk assessment, and tailored to a specific audience, which may range from decision makers at various levels of government, to the private sector and the public at large, including local communities and specific social groups. Explicit characterization of uncertainty and complexity strengthens risk communication. Impediments to information flows and limited awareness are risk amplifiers. Beliefs, values, and norms influence risk perceptions, risk awareness, and choice of action. Adaptation and risk management policies and practices will be more successful if they take the dynamic nature of vulnerability and exposure into account, including the explicit characterization of uncertainty and complexity at each stage of planning and practice. However, approaches to representing such dynamics quantitatively are currently underdeveloped. Projections of the impacts of climate change can be strengthened by including storylines of changing vulnerability and exposure under different development pathways.

Appropriate attention to the temporal and spatial dynamics of vulnerability and exposure is particularly important because vulnerability, hazards and vulnerability have a temporal and spatial character. In that case, the design and implementation of adaptation and risk management strategies and policies that take into consideration spatial and temporal characteristics of vulnerability are pivotal to addressing short to medium term risks and set a foundation for building longer term community and ecosystems resilience to vulnerability and exposure. For instance, in low land areas prone to intermittent flood events, dike systems have proven to be innovative and cost effective structures in reducing hazard exposure by offering immediate protection against rising tides (Cardona *et al*., 2012). Vulnerability reduction is imperative to building sustainable adaptation and foster disaster risk reduction and management that draw on a consistent merger policy and practice.

The interface between policy and practice is an important institutional framework whose cohesiveness and coherence provides a fundamental threshold for vulnerability reduction, implementation of planed adaptation mechanisms and a strategic focus on resilience building through disaster risk reduction and management. Strong institutions (e.g. laws, policies, Acts, social systems that govern social interactions, values and attitudes) have been found to improve community level hazard, risk and vulnerability reduction efforts. For instance, in South East Asia (Nepal, Malaysia and Bangladesh), instructional frameworks the support community level participation have led to an established community based disaster risk reduction mechanisms that have strengthened their livelihoods and built their resilience to extreme events (Cees, 2009; Cutter *et al*., 2003).

1.3 Rationale for the assignment

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". Additionally, UNDP's DRM project 2015 Annual Work Plan; Activity 4.1 mandates conducting a national hazard, risk and vulnerability (HRV) assessment including sex and age disaggregated data and preparation of district profiles.

1.4 Objectives of the assignment

The objectives of the assignment were to:

1. Collect and analyse field data generated using GIS in close collaboration and coordination with OPM in the targeted districts of Mitoma, Buhweju, Ibanda, Kiruhura, and Bushenyi.
2. Develop district specific multi hazard risk and Vulnerability profiles using a standard methodology.
3. Preserve the spatial data to enable use of the maps for future information, and
4. Produce age and sex disaggregated data in the HRV maps.

1.5 Scope of the assignment

This assignment was carried out by a team of consultants and GIS Specialists between June and July 2015 under the overall technical supervision by the Office of the Prime Minister. The assignment aimed at mapping and producing Multi Hazard, Risk and Vulnerability (HRV) Profiles for the districts of Mitoma, Buhweju, Ibanda, Kiruhura, and Bushenyi (Figure 1).

In order to effectively generate District Multi Hazard, Risk and Vulnerability (HRV) Profiles, the following specific tasks will be undertaken:

1. Collection of field data using GIS in close collaboration and coordination with OPM in the target districts of Mitoma, Buhweju, Ibanda, Kiruhura and Bushenyi; and quantify them through a participatory approach on a scale of “not reported”, “low”, “medium” and “high”, consistent with the methodology that was specified in Annex 3 to the ToR.
2. Analysis of field data and review of the quality of each hazard map accompanied by a narrative that lists relevant events of their occurrence including 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.
3. The entire district HRV Profiles were completed within the time frame provided.
4. Softcopies of the complete HRV profiles and maps for all the 5 districts were submitted for printing by the end of the duration assigned to this activity.
5. Generated and Submitted shape files for all the districts visited showing disaggregated hazard risk and vulnerability profiles to OPM and UNDP, and
6. The process of generating HRV maps and profiles was from time to time quality checked and assured by a team selected by the supervisor Subject to completion of the assignment.

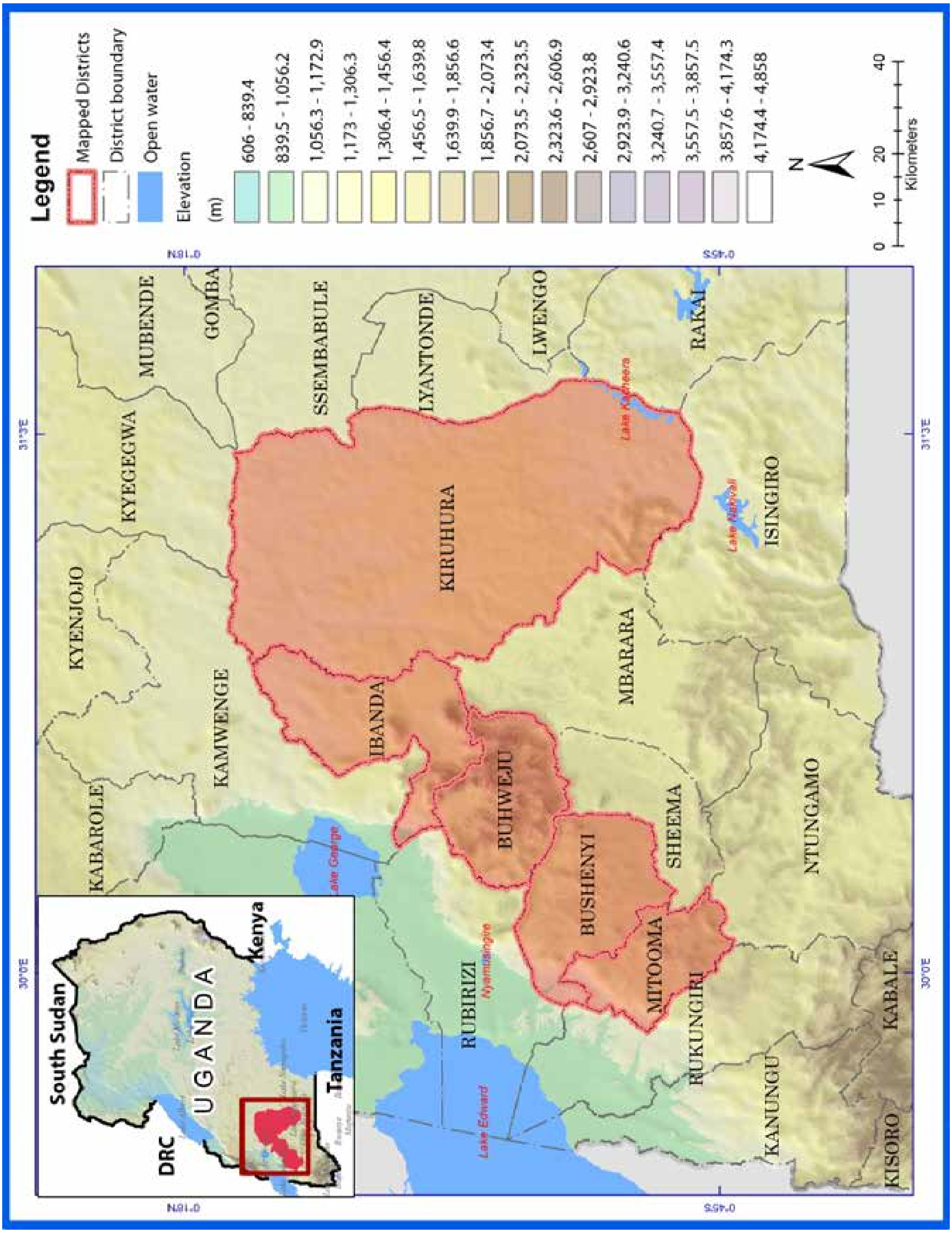


Figure 1: Study Districts

To fully deliver on each of the above activities, the following tasks were undertaken:

1. Close consultation with OPM, UNDP DRM Team and district focal persons in selected districts;
2. Review and critical analysis of the information generated from the field data collection exercise and consolidating it into the standard format for developing profiles as provided, and;
3. Facilitation of a five days regional data verification and validation workshop organized by UNDP in Mbarara drawing key district DDMC focal persons for the purpose of creating local/district ownership of the profiles.

1.6 Organisation and delivery of assignment

The consultant formed a data collection team composed of GIS specialists for the work to be thoroughly carried in a span of 31 working days across the five districts. Cognisant of the fact that the success of this assignment depended on the quality, content and coverage of the data captured and entered in the database, the consultant trained data collectors in GIS and GPS mapping using modern automated error minimising techniques. Before conducting the hands-on training, a context specific training guide was developed and agreed upon with the client to ensure that it was relevant to the assignment.

The training guide covered GIS Basics; GPS Care, Reading, Calibrating and GPS Data Uploading; Issues for Mapping Uganda at National Level such as UTM Zone 35, Zone 36 and areas North and South of the Equator; validating GPS position readings with survey control points, and quick validation of data using GIS data in ArcPAD.

CHAPTER TWO

Ibanda District Multi-hazard, Risks and Vulnerability profiles Mapping and Production

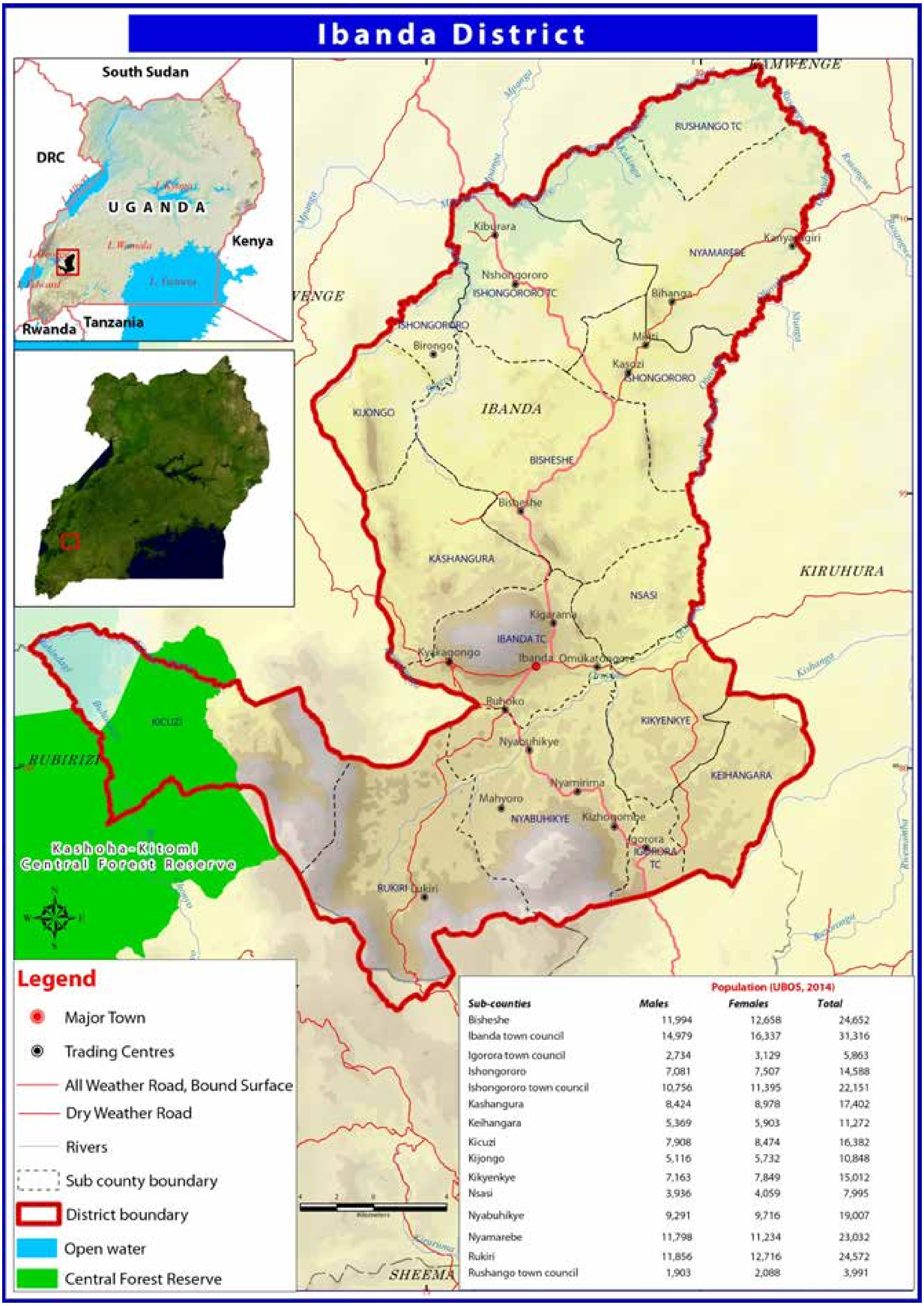
2.1 Overview of Ibanda District

Ibanda District is located (UTM, 0220745; 9985008) in South Western Uganda and bordered by Buhweju, Kamwenge, Rubirizi, Mbarara, Kiruhura (Figure 2). It has 11 Sub Counties and 4 town councils. Nearly 90% of the households are engaged in Subsistence agriculture with the major crops being banana, maize, sweet potatoes, cassava and vegetables; and livestock rearing (cattle, goats).

The district has an undulating landscape with conical hills (e.g., Bwahwa, Ibava and Kijugo) covered with grassland as the predominant vegetation biome punctuated with scattered trees,tropical forests, agro-forestry plantations of pine and eucalyptus. The district is mainly composed of a dendritic drainage pattern flowing from the south to the north joining the trellis drainage pattern of the Mpanga river system composed of the tributaries of Oruyubu, Kitomi, Bigera and Kakinga. The district also has a number wetlands with peat soils covered with a mash of papyrus, palms and thickets.

The district is composed of three soil classification units with Luvisols being dominant in the eastern to central part of the district; while Acric ferralsols predominate central to the northern western part of the district. Small patches of dystric regosols can be observed in the central part of the district and in the south western boundary with Buhweju district.

The district receives a bimodal rainfall with an annual average of 1100 mm. The temperature ranges between 12.5°C to 30°C. Like most of the highland areas of south western Uganda, the district has similarly experienced a rise in temperature.



Population (UBOS, 2014)

Sub-counties	Males	Females	Total
Bisheshe	11,994	12,658	24,652
Ibanda town council	14,979	16,337	31,316
Igorora town council	2,734	3,129	5,863
Ishongororo	7,081	7,507	14,588
Ishongororo town council	10,756	11,395	22,151
Kashangura	8,424	8,978	17,402
Keihangara	5,369	5,903	11,272
Kicuzi	7,908	8,474	16,382
Kijongo	5,116	5,732	10,848
Kikyenkye	7,163	7,849	15,012
Nsasi	3,936	4,059	7,995
Nyabuhikye	9,291	9,716	19,007
Nyamarebe	11,798	11,234	23,032
Rukiri	11,856	12,716	24,572
Rushango town council	1,903	2,088	3,991

Figure 2: Ibanda district map

2.2 Methodology

2.1.1 Hazard, risk and vulnerability assessment

Hazard, risk and vulnerability assessment was done using a stack of methods including participatory approaches such as focus group discussions (FGDs), key informant interviews, transect drives and spatial and non-spatial modelling. Key informant interviews and Focus Group Discussions were guided by a checklist (Appendix 1 and 2). Key informants for this assessment included: the Districts Senior Forest Officer, Production and Marketing Officer, Environment Officer, Veterinary Officer, Health centre medical workers and Sub-county/ parish chiefs on multi-hazards, risks and vulnerability in the District. The information provided by key informants was used as basis for selection of 2 Sub Counties to conduct focus group discussions. Two FGDs comprising of 15 respondents (crop farmers, local leaders, nursing officers, police officers and cattle keepers) were conducted in Rukiri Sub-county (UTM, 0214659; 9973033) and Ishongororo Sub county (UTM, 0221558; 0005529). Each Parish of the selected Sub-Counties was represented by at least one participant and the selection of participants was engendered. This allowed for comprehensive representation as well as provision of detailed and verifiable information.

During the FGDs, participants were requested through a participatory process to develop a community hazard profile map (Plate 1). The identified hazard hotspots in the community profile maps were visited and mapped using a handheld Spectra precision Global Positioning System (GPS) units, model: Mobile Mapper 20 for X, Y and Z coordinates. The entities captured included: hazard location, (Sub-county and parish), extent of the hazard, height above sea level, slope position, topography, neighbouring land use among others. This information generated through a participatory and transect approach was used to validate modelled hazard, risk and vulnerability status of the district. The spatial extent of a hazard event was established through modelling and a participatory validation undertaken.

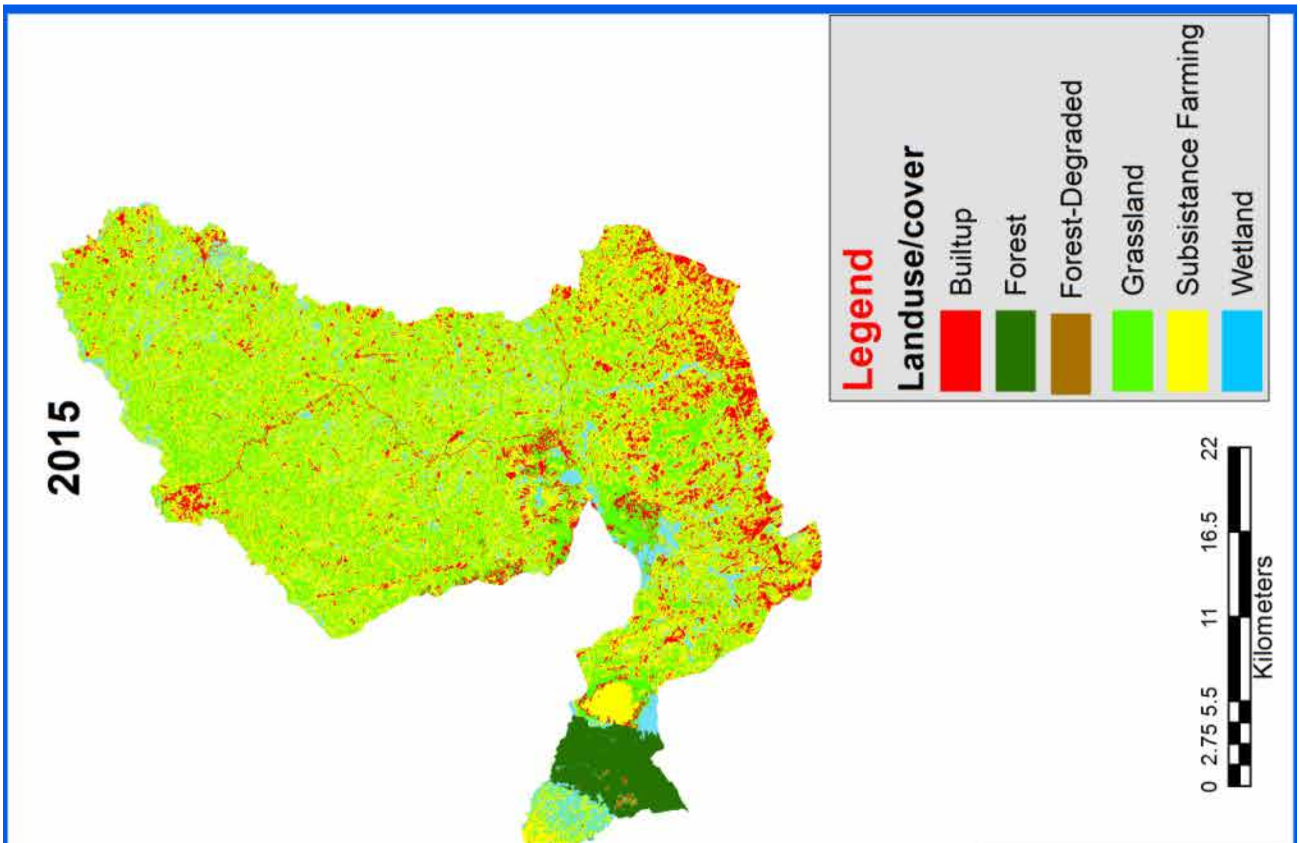
Plate 1: Participatory community hazard map in Rukiri sub-county

2.1.2 Land use and land cover assessment

An important imperative in understanding the spatial determinants of hazards and risks is the spatial and temporal extent of land use and land cover of a given location. Thus; an assessment of land use and land cover (Figure 3) for Ibanda district was undertaken using a two period series of Landsat satellite imagery. Table 1 shows the seven classifications of land use and land cover types determined. Ground truthing was undertaken to validate the classified images to improve on the classification accuracy.

Table 1: Description of land use and cover changes

Land use/cover types	Description	Landscape position
Wetlands	Papyrus, palms and thickets	Valleys
Grasslands	Pasture with scattered trees	Hillslopes, valleys
Small scale farming	Banana plantations mixed with maize	Hillslopes, valleys
High tropical forest	Intact forest (broad leaved)	Valleys, moderate hills
Degraded forest	Tree samples, bushlands	Valleys, moderate hills
Tree plantations	Community forest reserves, pine and eucalyptus plantations	Valley, Hilltops
Bushlands	Shrubs and thickets	Valleys



Landuse	1984 (Sq.km)	%	2015 (Sq.km)	%
Builtup	1.6	0.1	114.8	7.6
Forest	85.4	5.7	49.5	3.3
Forest-Degraded	0.0	0.0	0.2	0.0
Grassland	978.1	64.7	454.2	30.0
Subsistance Farming	118.2	7.8	693.9	45.9
Wetland	328.4	21.7	199.0	13.2

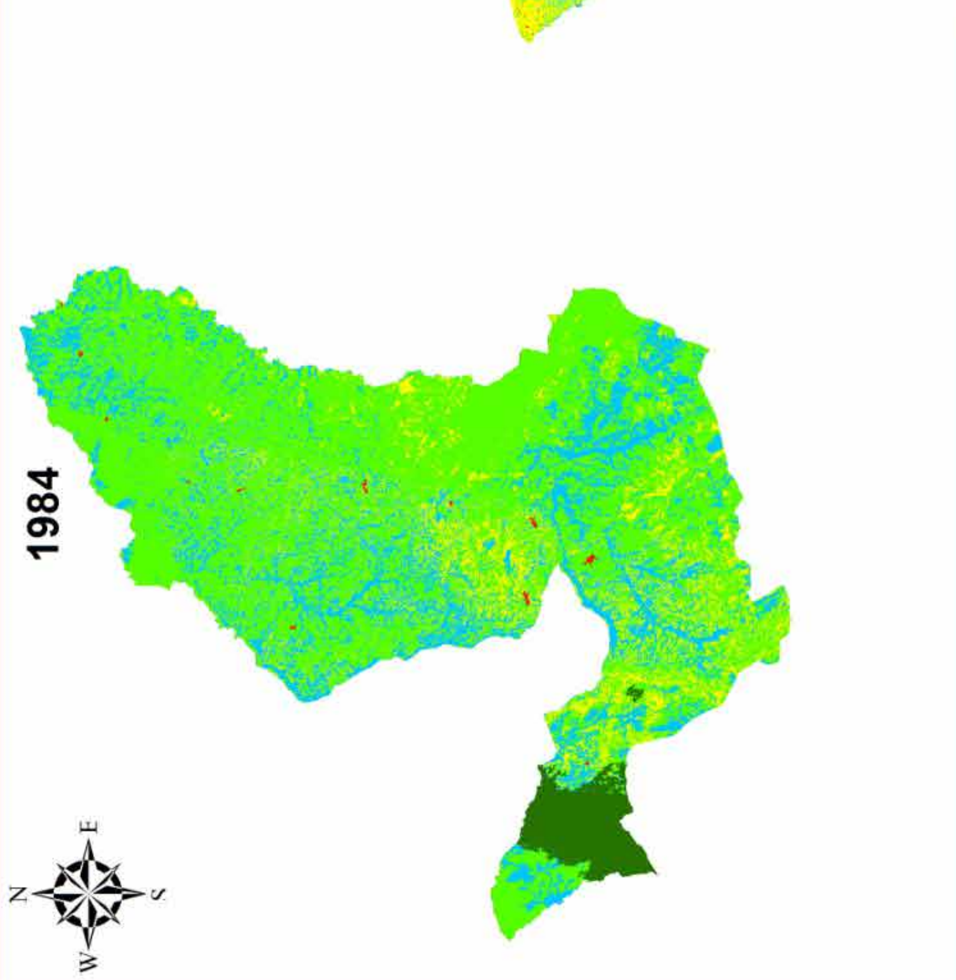


Figure 3: Land Use/Cover Changes

2.3 Multi-hazards

A hazard is a potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. A hazard, and the resultant disaster can have different origins: natural (geological, hydro-meteorological and biological) or induced by human processes (environmental degradation and technological hazards). Hazards can be single, sequential or combined in their origin and effects. Each hazard is characterised by its location, intensity, frequency, probability, duration, area of extent, speed of onset, spatial dispersion and temporal spacing (Cees, 2009).

In the case of Ibanda district, hazards can be classified following main controlling factors:

i. Geomorphological or Geological hazards including landslides and hilltop cracks;
ii. Climatological or Meteorological hazards including drought, hailstorms, strong winds, lightening and hill-slope surface runoff;
iii. Ecological or Biological hazards including livestock pests and diseases, crop pests and diseases, bush fires;
iv. Technological hazards including road accidents.

2.3.1 Pests, parasites and diseases

Participatory assessment through the FDG discussions held in Ishongororo and Rukiri sub-counties revealed that; pest and disease incidences in terms of frequency, destructiveness and extent for both crops and livestock have been on the increase over the last 35 years (1980-2015). The participatory assessment process also showed that community ranking of the three dimensions (frequency, destructiveness and extent) for assessing the pest and disease incidences followed the same trend. For example, between 1980 to1989, a 60% occurrence, extent and damage was perceived by the participants whereas between 1990-to present the evaluation of the three components stands at 100 percent. This reveals a consistent and in-depth understanding of the socio-ecological and climatic system in the district. It also reveals that nearly all farmers face similar challenges such as pests and diseases thus explaining the vivid account. This requires strategic intervention.

Pests and diseases for both crops and livestock are prevalent throughout the year. The crop pest with the highest economic significance is the black coffee twig borer whiles coffee leaf rust and coffee wilt are the major diseases in the sub-counties of Kijongo, Ishongororo and Kicuzi (Figure 4). Participants also identified ticks, heart water worms, and biting flies as the major threat for livestock both cattle and small ruminants. Besides, the overall specifications of pests and diseases identified by the participants, participants were also categorical on the New castle disease, East Coast fever and Anaplamosis as diseases of economic importance due to the associated losses. Also, in Kikyenkyo sub-county, key informants noted that Kitalle mines harbours bats which are renowned vectors for Marburg, a highly contagious and infectious disease.

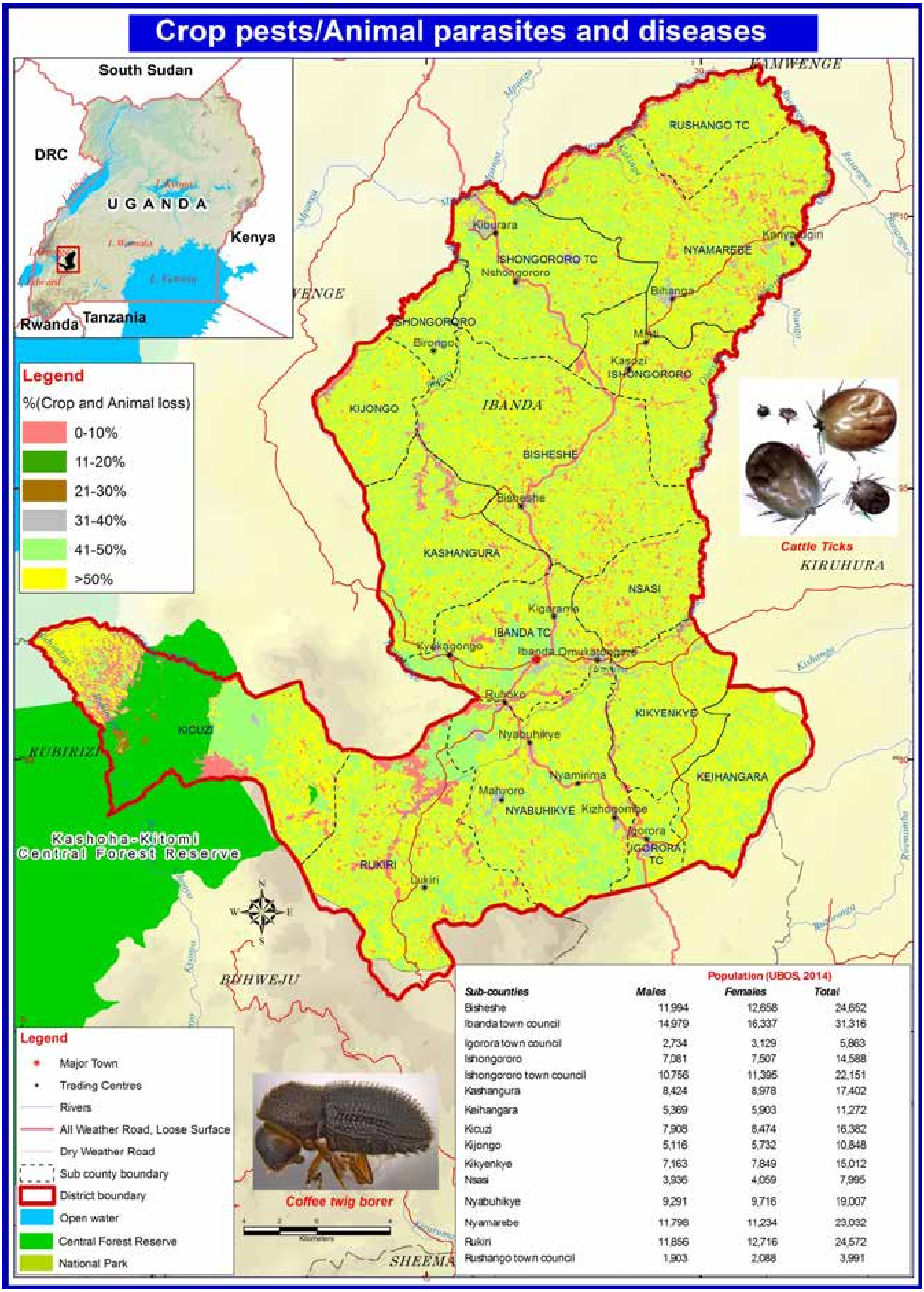


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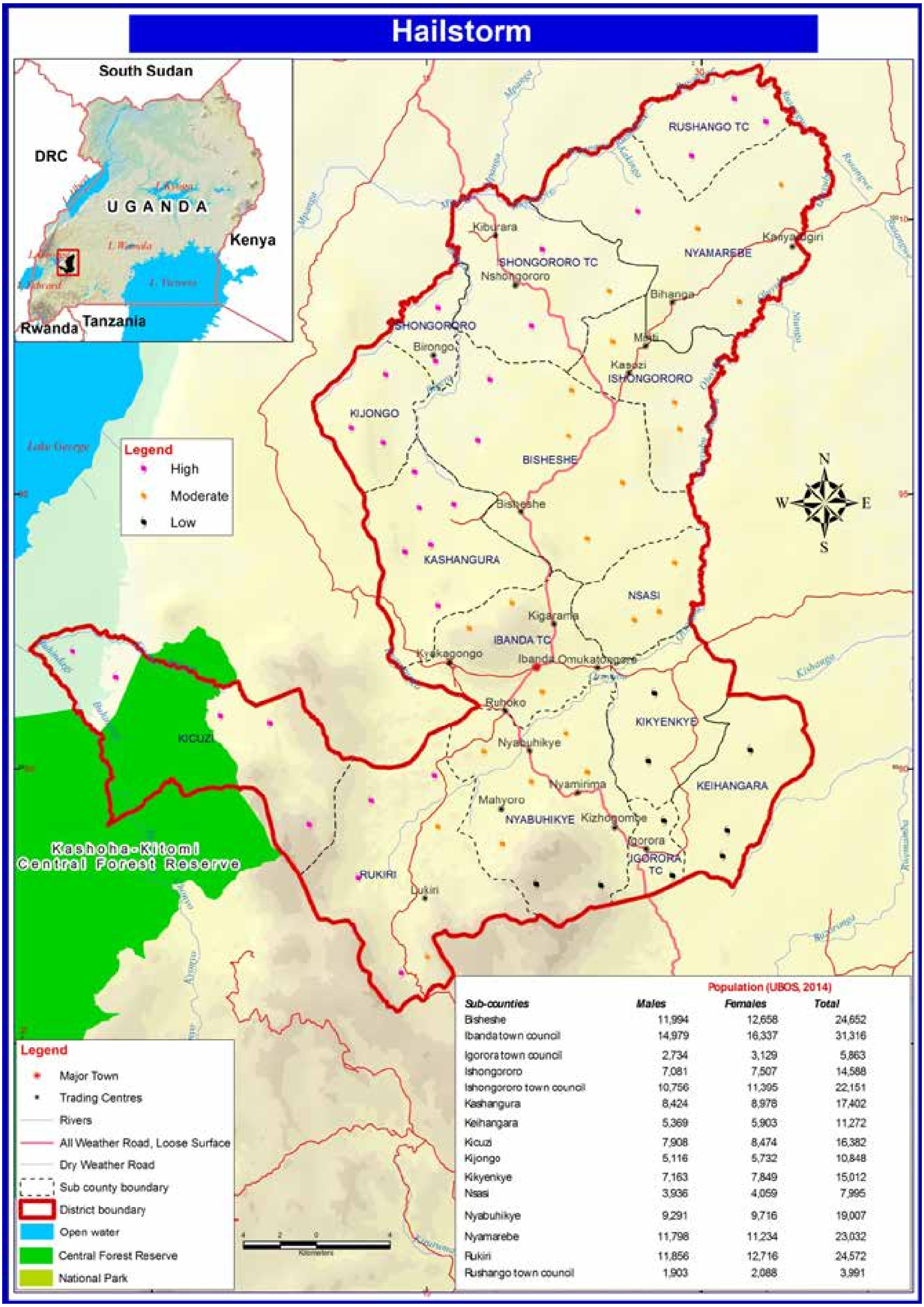
Figure 4: Hotspots for pests and diseases in Ibanda district

2.3.2 Hailstorms

Participants observed that hailstorms have become persistent in the district. The particle size of hailstones has also increased compared to the past in the 1990s. Besides, in the 1990s, the prevalence of hailstorms was limited. In the present period; hailstorms are experienced every season with devastation on crops. This devastation causes considerable economic losses across the season particularly if they occur at a critical phonological stage of plant growth such as at flowering of beans. In addition, the rainfall associated with hailstorms often last approximately 2 hours. Participants identified the sub-counties of Kashangura, Kijongo, Nyabahikye and Ishongororo (Figure 5) as most affected by hailstorms in the district. Participants also observed additional string of impacts arising from hailstorms including: animal deaths, soil erosion as well as destruction of houses and health centre.



Population (UBOS, 2014)

Sub-counties	Males	Females	Total
Bisheshe	11,994	12,658	24,652
Ibanda town council	14,979	16,337	31,316
Igorora town council	2,734	3,129	5,863
Ishongororo	7,081	7,507	14,588
Ishongororo town council	10,756	11,395	22,151
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Nyabuhikye	9,291	9,716	19,007
Nyamarebe	11,798	11,234	23,032
Rukiri	11,856	12,716	24,572
Rushango town council	1,903	2,088	3,991

Figure 5: Hotspots for hailstorms in Ibanda district

2.3.3 Strong winds

Participants in the FGDs also indicated that the prevalence of strong winds was a concern particularly during the transitionary period between the dry and wet seasons. However, the predictability of the strength and return time of these strong winds events is not considerably difficult. Participants noted that the sub-counties of Kikyenkye, Ishongororo and Kijonjo (Figure 6) are the most affected. Participants also observed that during a strong wind event, roof-tops and crop logging especially banana plantations are the common negative impacts.

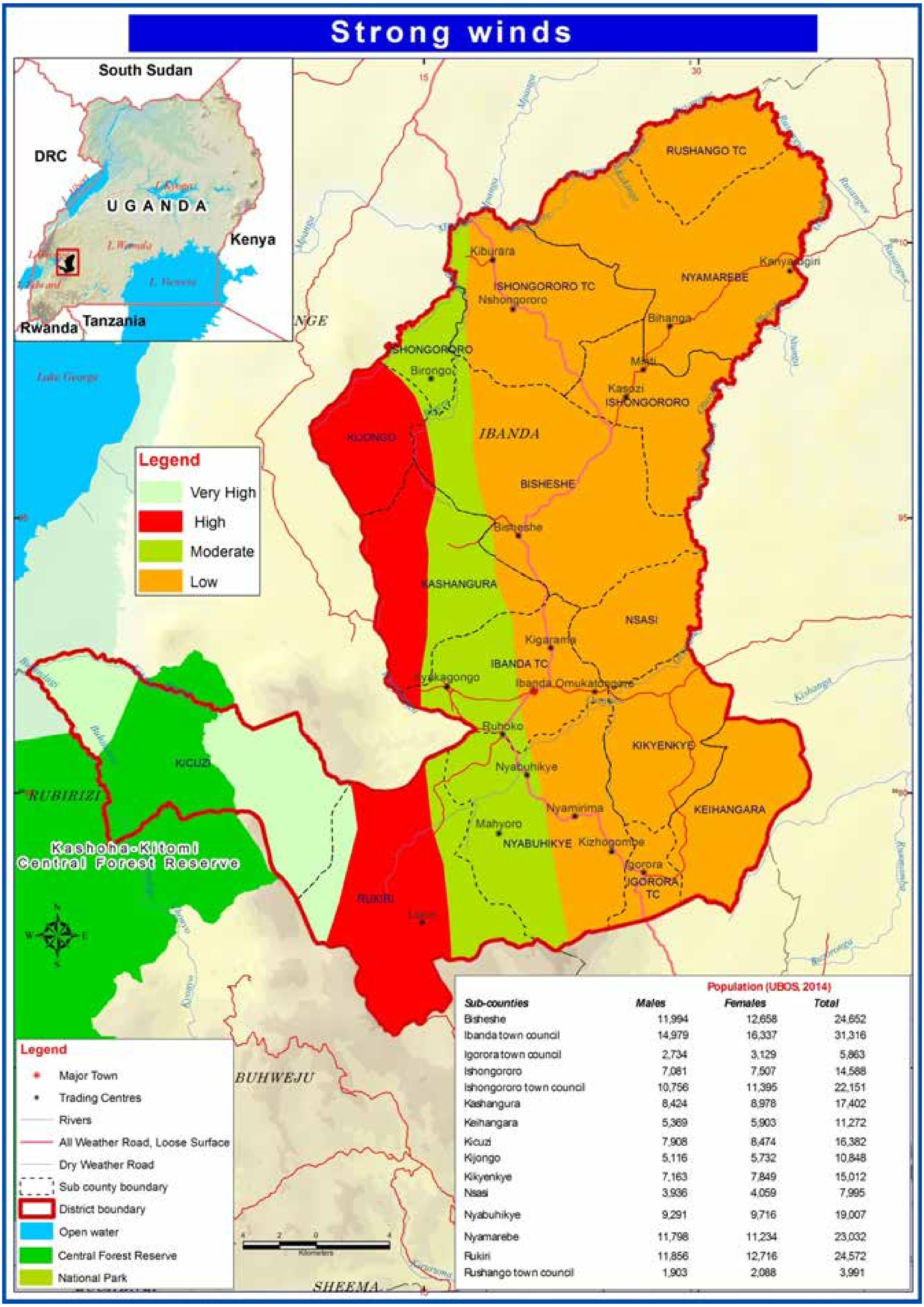

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Figure 6: Hotspots for strong winds in Ibanda district

2.3.4 Lightening

In the series of FGDs conducted, participants observed an increased evidence of lightning and thunder in the district during rainfall events. They were however non-committal on the possibility of the cause of an increased occurrence of lightening in the area. Participants identified Rukiri, Ibawa T/C, Kijongo and Nyabuhikye sub-counties (Figure 7) as the most affected. Participants observed that in the recent past, one person had been killed by lightening and unconfirmed number of the livestock also killed as well as crops and vegetation destroyed.

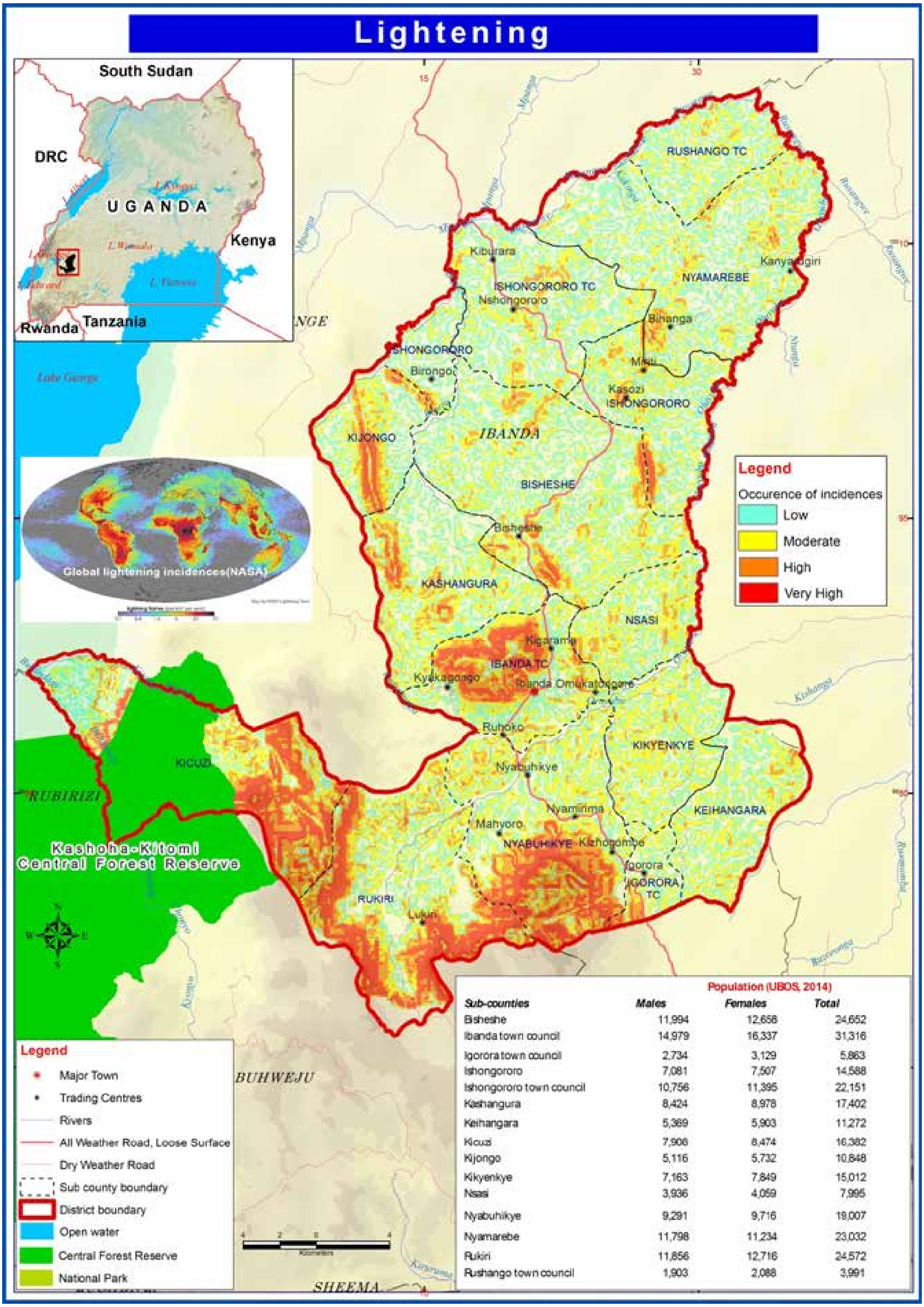

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Figure 7: Hotspots for lightening in Ibanda district

2.3.5 Soil erosion

The district experiences high surface runoff from the hills (especially Bwahwa hills) causing mild flash floods in low valleys. However, the hill-slope surface runoffs are localised events in Rukiri, Nyabuhikye, Kicuzi, Kijongo and Ibanda Town Council (Figure 8) experienced during the two rainy seasons especially between September and December. These wash away storms from hill-slopes to valleys and causing siltation in the nearby streams and dams; damaging farmlands, e.g. banana plantations, houses and roads along their paths.

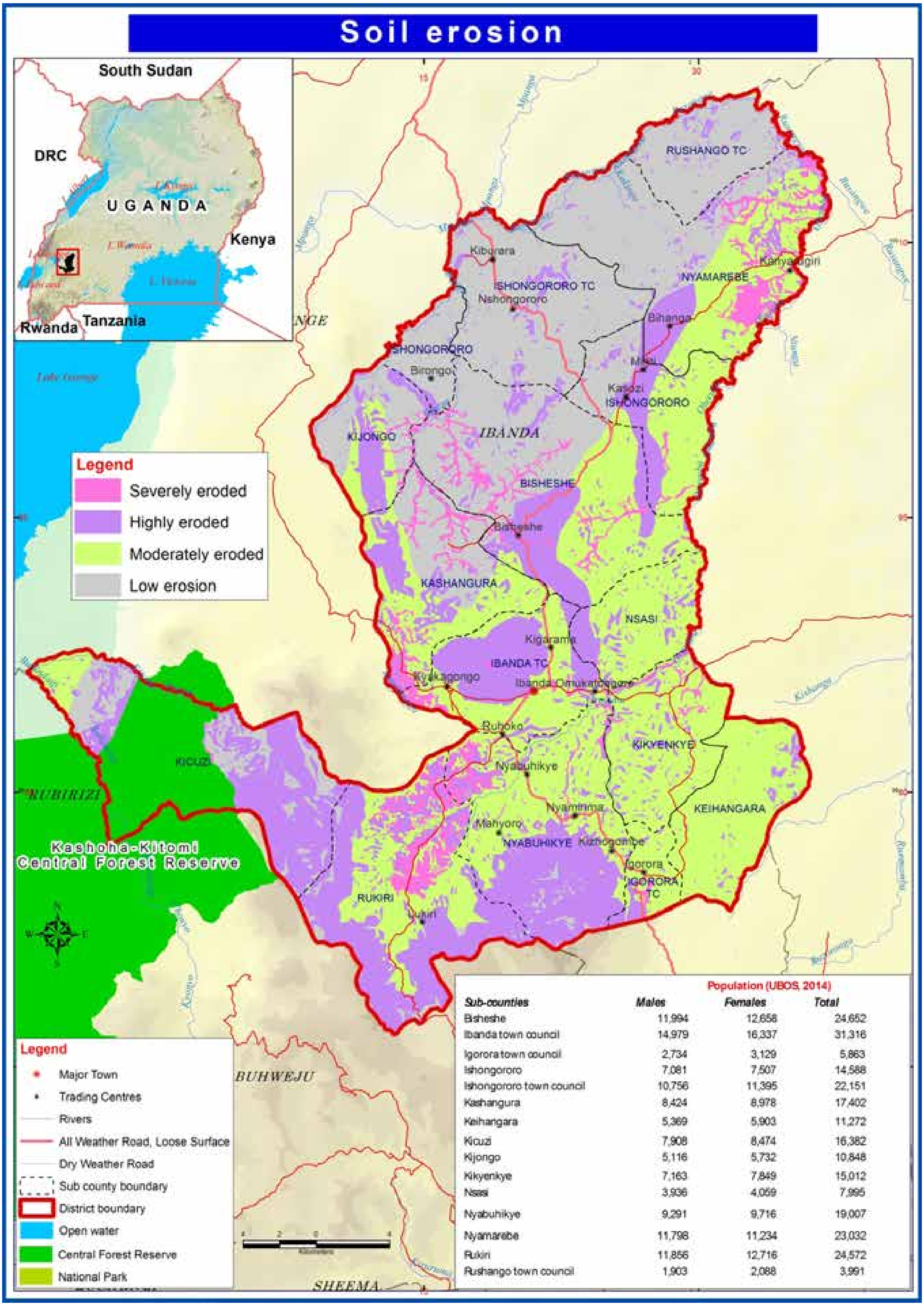

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Figure 8: Hotspots for hillslope surface runoff in Ibanda district

2.3.6 Drought

Droughts are experienced in June to mid-August with very little rain; and a mild drought from January to March. From 1980 to date, drought events have been on the increase in terms of frequency (experienced every rainy season), destructiveness and extent. However, severe drought events are mainly experienced in the northern part of the district and affected Sub Counties include Nyamerebe, Ishongororo, Rushango, Kijonjo and Kashangura (Figure 9). These have led to famines, scarcity of water, low incomes, increased disease occurrences, reduced pastures and dust pollution.

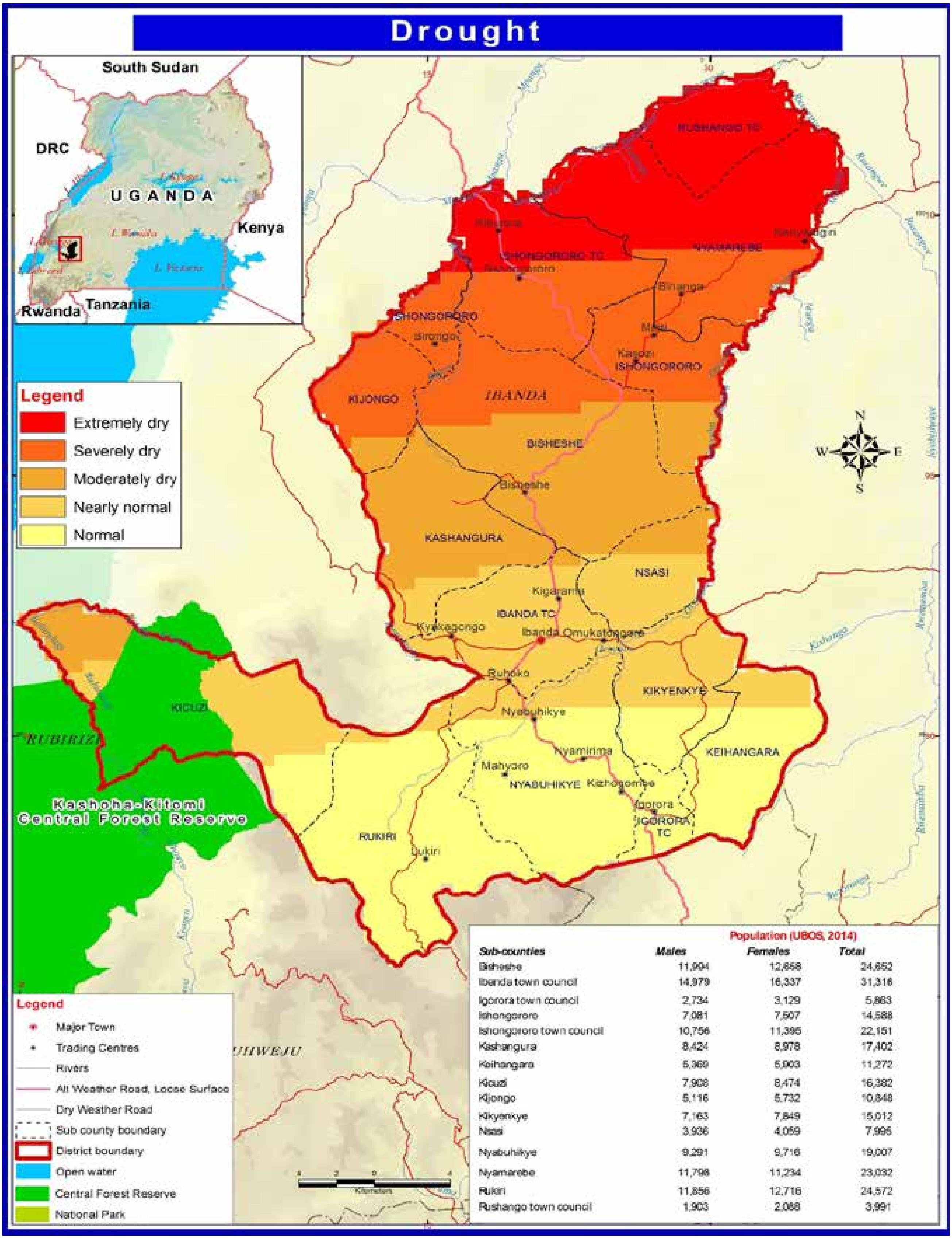

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Figure 9: Hotspots for drought in Ibanda district

2.3.7 Mudslides

According to key informants, landslides are experienced during heavy rain events (between Mid-August and Mid December) in Rukiri, Nyabuhikye on Butahira hills and Ibara Town Council around Ibara hills.

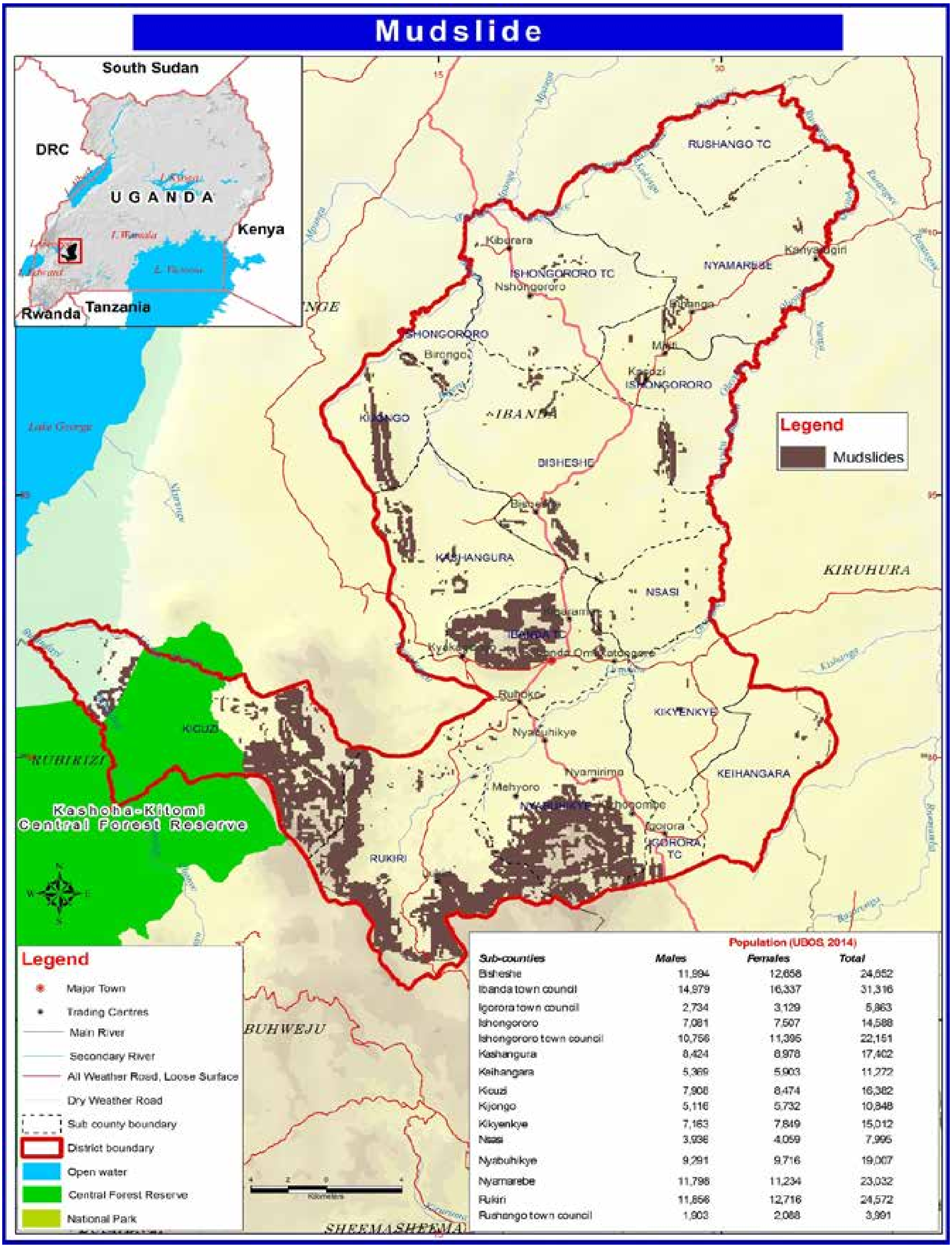
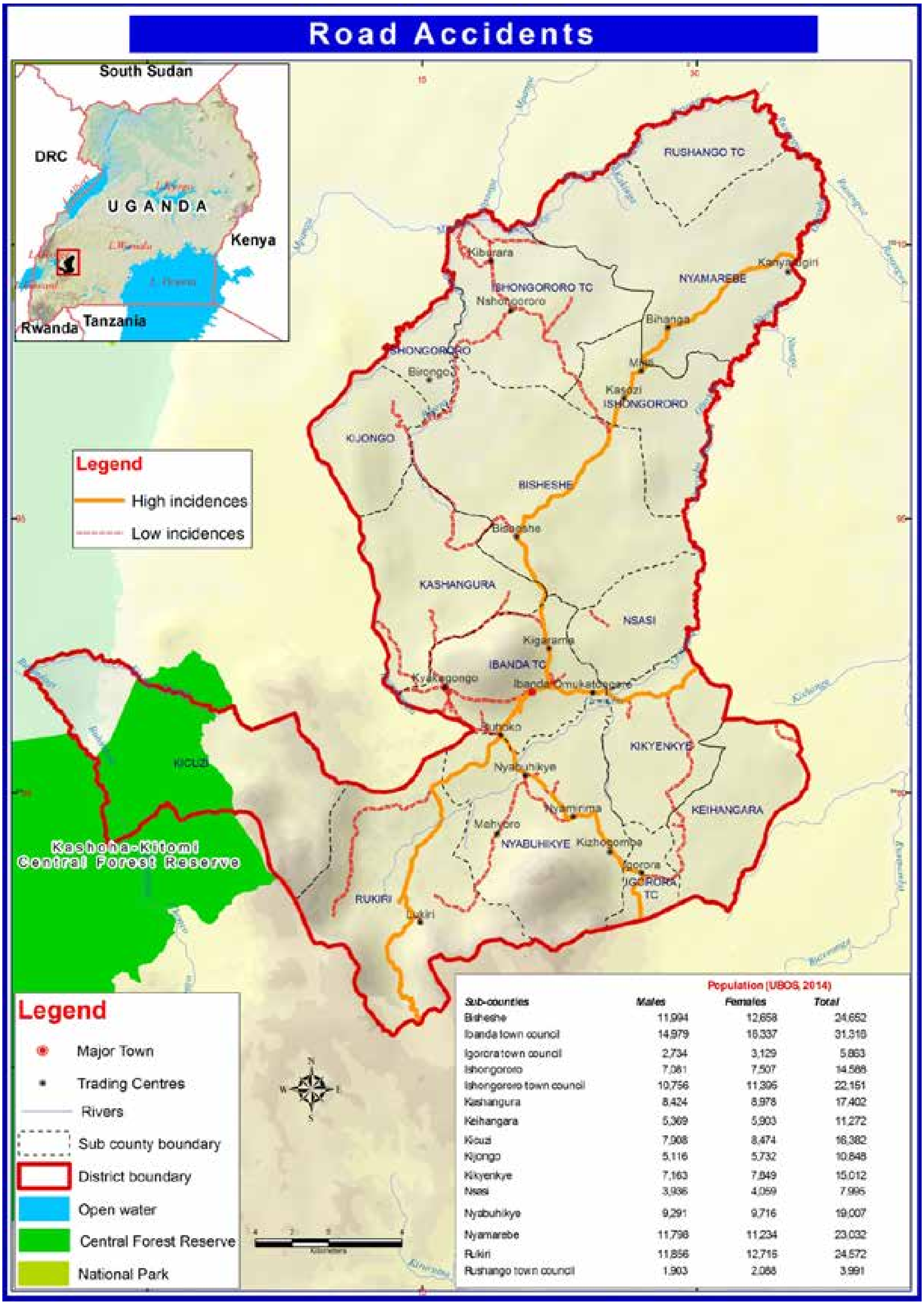


Figure 10: Hotspots for mudslides in Ibanda district

2.3.8 Road accidents

Road accidents mainly occur on the highway routes of Mbarara-Ibanda and Ibanda-Kamwege leading loss of human lives. These are common in populated Sub Counties i.e. Ibanda town council, Ishongororo, Igorora town council and Kikyenkye (Figure 11) due to over speeding.



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Population (UBOS, 2014)

Figure 11: Hotspots for road accidents in Ibanda district

2.3.9 Hilltop crack

One hilltop crack was observed on Kigunga hill in Kigunga parish, Rukiri Sub County covering an approximate distance of one kilometre with a depth of about 2m and width of 3m. However, It presents no significant threat to property, human life and livestock at the moment (as of June, 2015) but likely to cause huge damages in any eventuality of high rainfall runoff and earth quake.

2.4 Coping strategies

In response to the various hazards, participants identified a range of coping strategies that the community employs to adjust to, and build resilience towards the challenges. The range of coping strategies are broad and interactive often tackling more than one hazard at a time and the focus of the communities leans towards adaptation actions and processes including social and economic frameworks within which livelihood and mitigation strategies take place, ensuring extremes are buffered irrespective of the direction of climate change and better positioning themselves to better face the adverse impacts and associated effects of climate induced and technological hazards (Table 2)

Table 2: Coping strategies to climate change induced and technological hazards in Ibanda District

No	Multi-Hazards	Coping strategies
1	Slope surface rainfall	- Digging up of trenches - Migration - Seek for government food aid
2	Drought	- Community out sourcing - Community tanks in Ibanda North - Buy water from the nearby areas - Storage of grains - Food storage
3	Rockslides	- Migration - Removal of storms from banana farmlands
4	Hilltop crack	- No actions taken; people are yet to be relocated
5	Hailstorms	- Removal of destroyed crops - Request for aid from the Office of the Prime Minister
6	Lightening	- Installation of lightening conductors on newly constructed schools - Staying indoors when raining
7	Pests and diseases	- Spraying pests - Vaccinations - Burning of affected crops - Use of mosquito nets - Visiting health centres
8	Road accidents	- Construction of humps - Sensitisation
9	Strong winds	- Plating of tree as wind brakes, - Changing building designs and roof types

2.5 Risks

A risk is the probability of harmful consequences, or expected losses (deaths, injuries, property loss, livelihoods and economic activity disruption or environment damage) resulting from interactions between hazards (natural, human-induced or man-made) and vulnerable conditions.

2.5.1 Wetland degradation

The status of wetland degradation is still mild though it is more pronounced at the foot of hillslopes. The degradation was prominent in Ibanda Town Council, Rukiri, Nyabuhikye and Kijonjo (Figure 12) where the following are easily observed: increased siltation rates of rivers and dams, bare lands due to loss of vegetation and low crops yields.

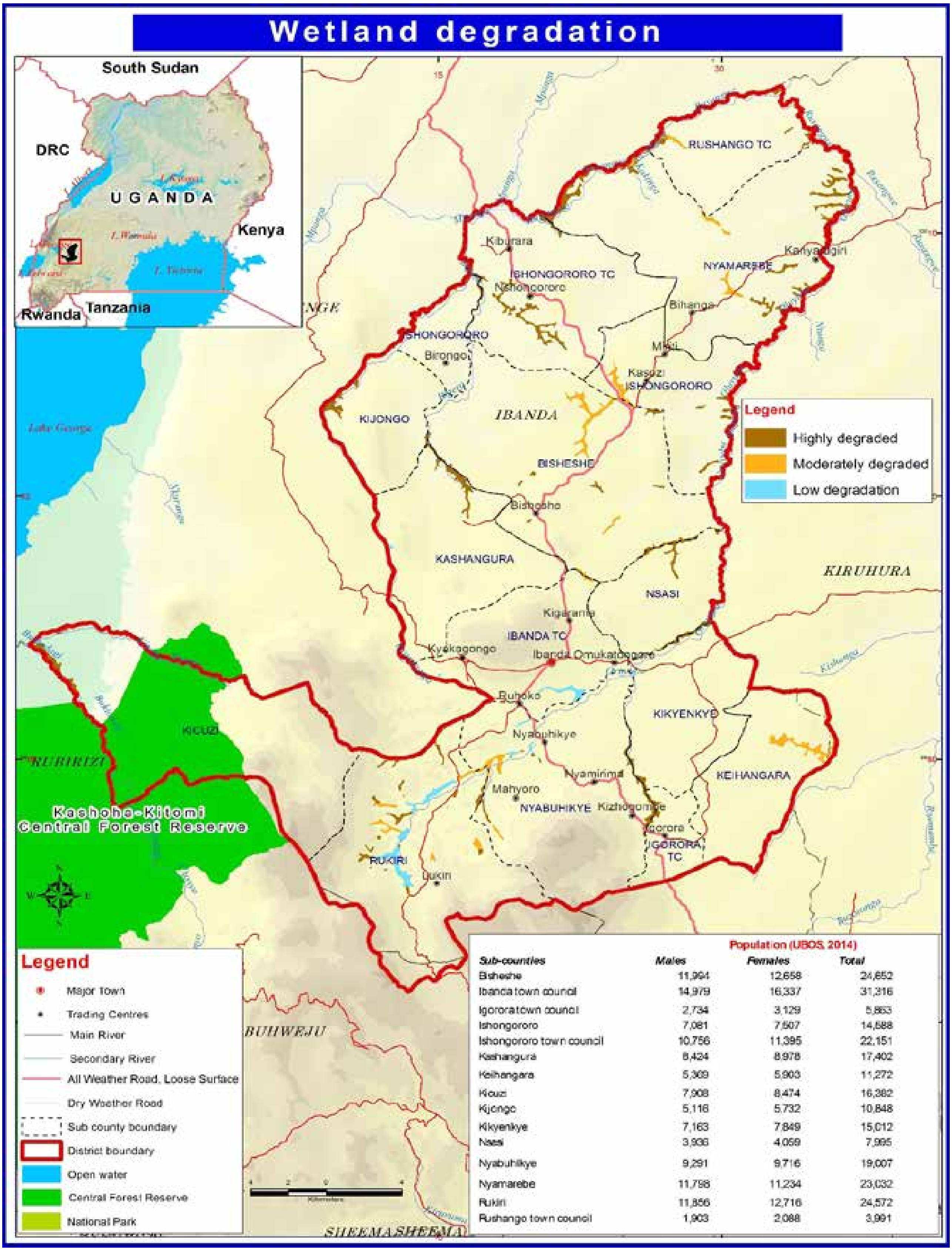

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Figure 12: Hotspots for wetland degradation in Ibanda district

2.5.2 Land conflicts

Land conflicts are rampant in the district ranging from those between households, communities as well as between government and communities. According to key informants, land conflicts have majorly been triggered by increased population growth rates, family misunderstandings, and un-documented land titles among others. These are more pronounced in Bisheshe Sub County (Figure13). Extreme cases have resulted into loss of land, human death, and migrations.

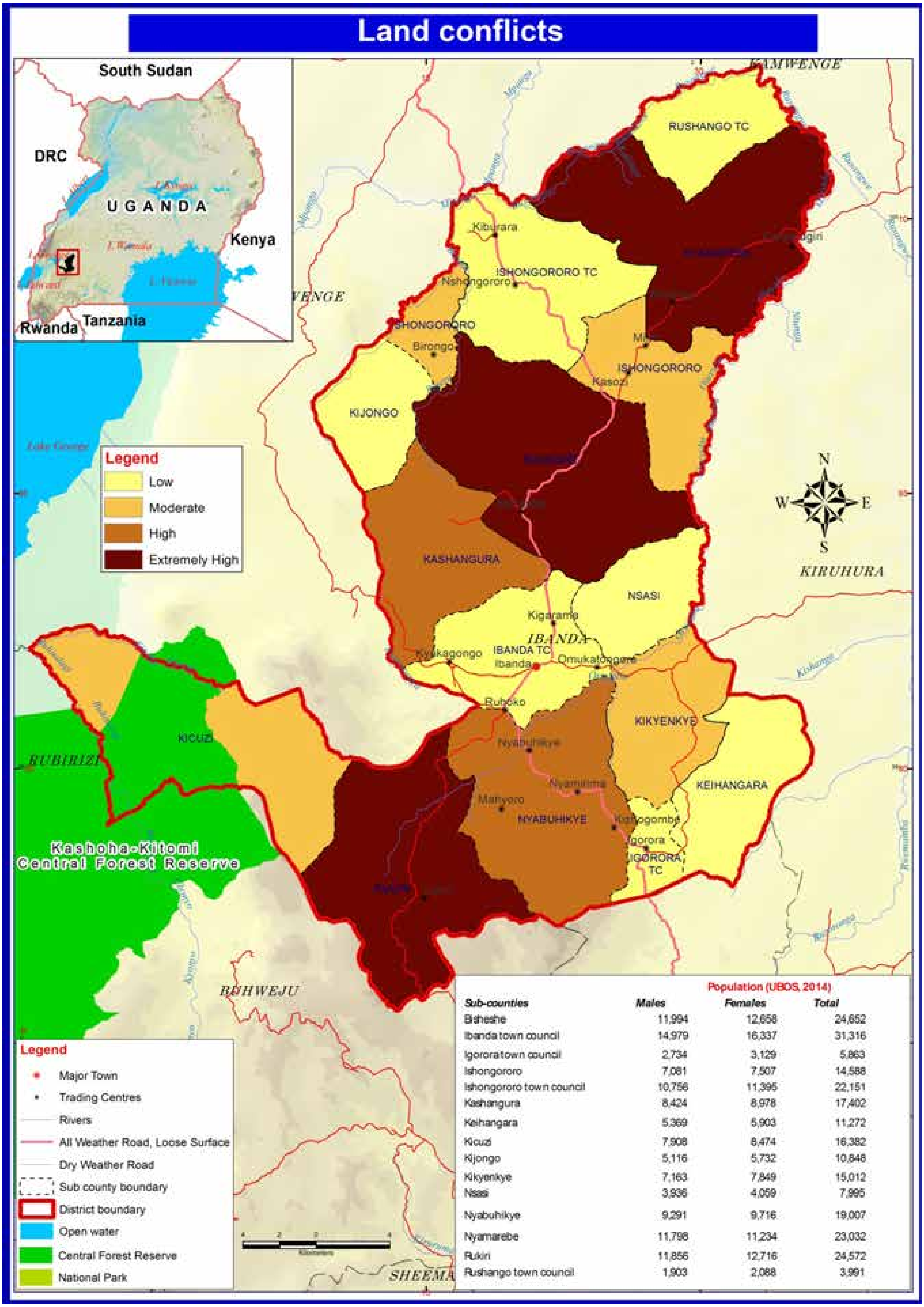

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Figure 13: Hotspots for land conflicts in Ibanda district

2.5.3 Uncontrolled bush fires

Most of the fires experienced are man-made especially on hillslopes. This is done in anticipation that burning allows for regeneration of forage for livestock. Most fires are observed during the dry seasons (June to mid-August and January to March). Fires are more common in Ibanda Town Council, Rukiri, Kashongura, Kijongo, Nyamerebe and Kicuzi Sub Counties (Figure 14). These have caused loss of forests, increased occurrence of rockslides and soil erosion.

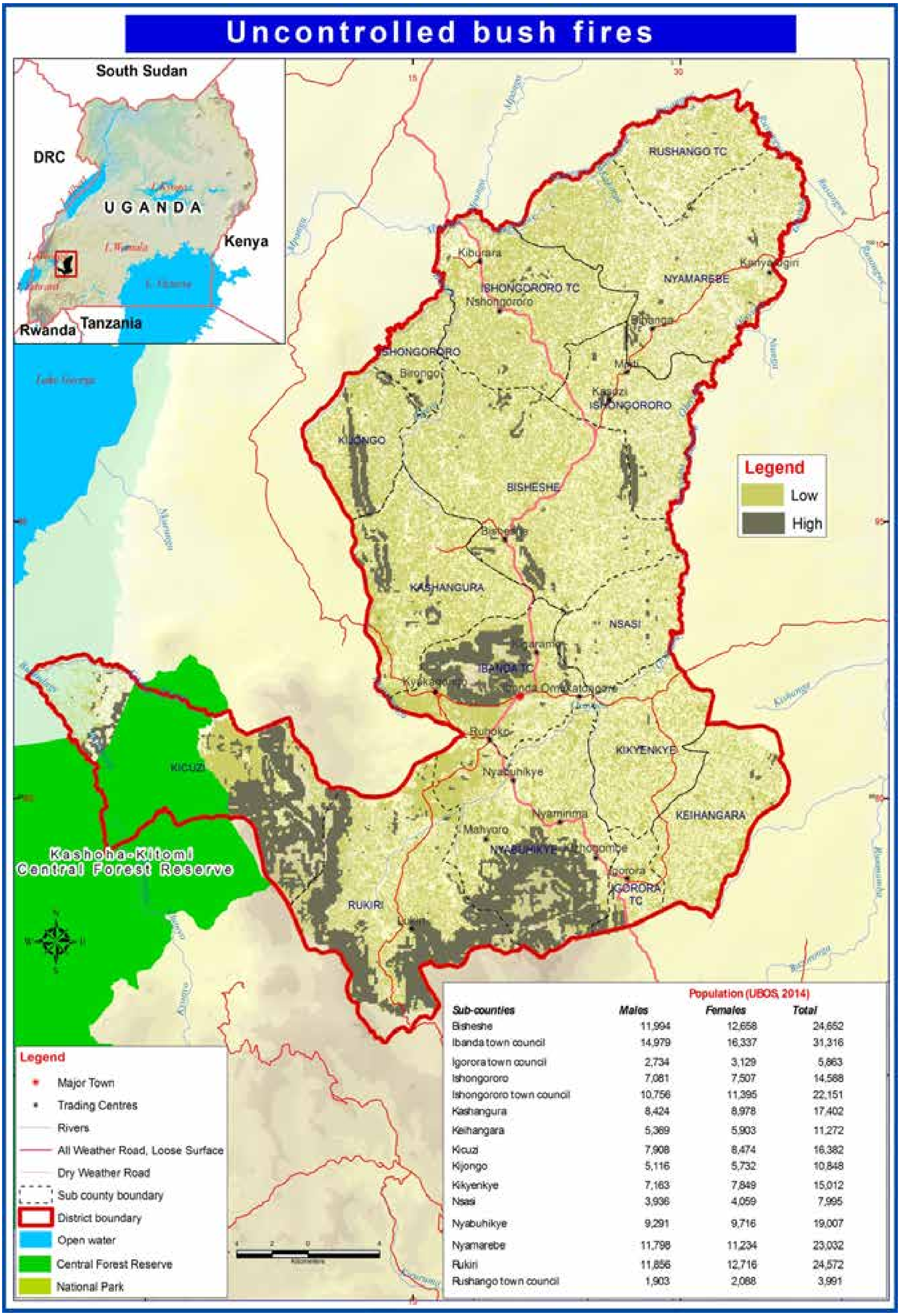

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Figure 14: Hotspots for uncontrolled bush fires in Ibanda district

2.5.4 Human and wildlife conflicts

Human-wildlife conflicts results from wildlife invasion of farmlands especially elephants, buffaloes and monkeys. These are communities around the Queen Elizabeth National Park and Kashoha-Kitomi Central Forest Reserve and are more severe in Kicuzi Sub County (Figure 15). Kikyenkye sub-county and Ibanda Town Council are hotspots for Vervet Monkeys. The wildlife invasions have led to reduced crop yields especially for banana.

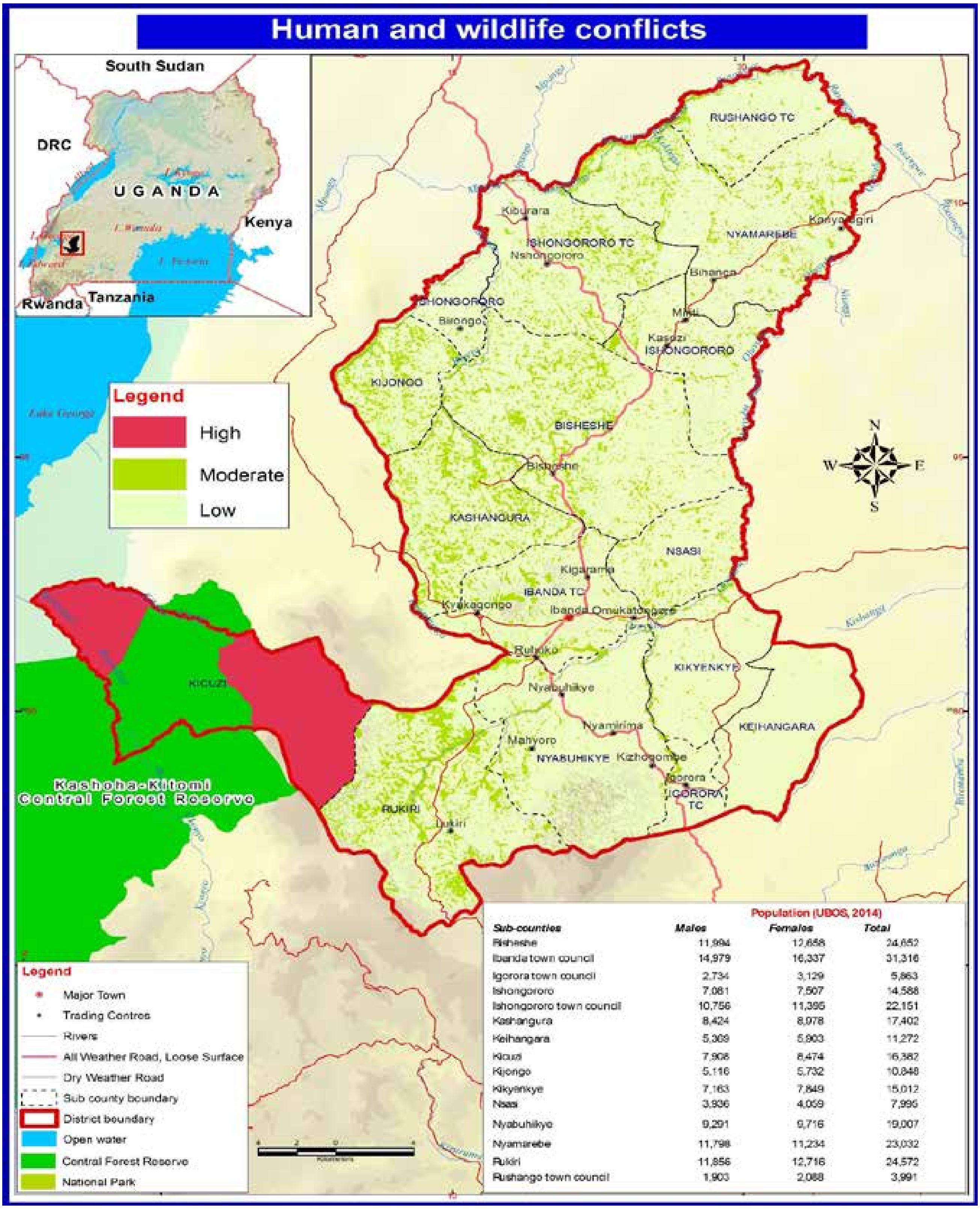

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Figure 15: Hotspots for human and wildlife conflicts

2.5.5 Deforestation

Increasing human population has increased pressure on existing forest reserves due to increased demand for construction materials (poles and timber), fuels (charcoal) and cultivation land. Deforestation is rampant on the hillslopes especially in Rukiri Sub County (Nyarubira National Community Forest) (Figure 16). The impact has been loss of forest cover, climate change and reduced firewood availability.

Plate 2: Deforestation in Nyarubira National Community Forest, Rukiri Sub County

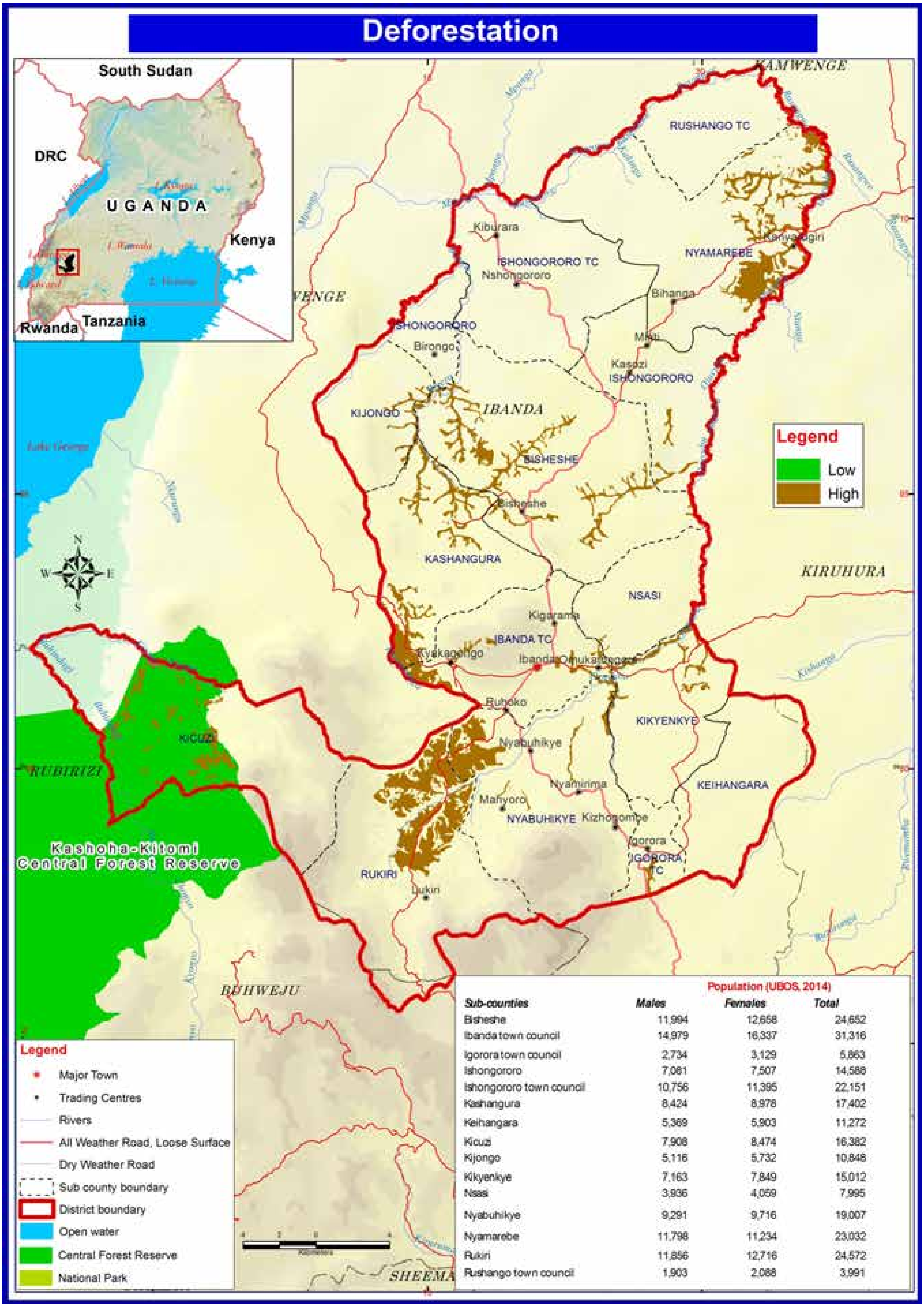

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Figure 16: Hotspots for deforestation in Ibanda district

2.5.6 Policy and political risks

Environmental stewardship by the community is a function of the existing policy and political frameworks; thus if not well implemented policy and political frameworks do present risks especially emanating from conflict of interest. A number of policy and political risks according to key informants and focus Group Discussion include: a) weak enforcement of conservation management and environmental protection policies; and b) weak penalties to offenders e.g. penalties on illegal timber dealers. FGDs revealed that political risks are severe in the election and bye-election periods throughout the district though more common in Ishongororo Sub county. The political risks are fuelled by tribalism and nepotism as well as religious affiliations. These have resulted into household migration (especially marginalised households), death as a result of unhealthy conflicts and violence, and depletion of land cover, poor yields, and food price fluctuations.

2.5.7 Invasive species

Participants identified *Lantana camara* and *Pasperum Spp,* congress weed as some of the most common invasive species present in parts of Ishongororo, Rushonga, Kijingo, Bisheshe and Ibanda Town Council (Figure 17). Some of these species are toxic and have led to livestock (cattle) deaths.

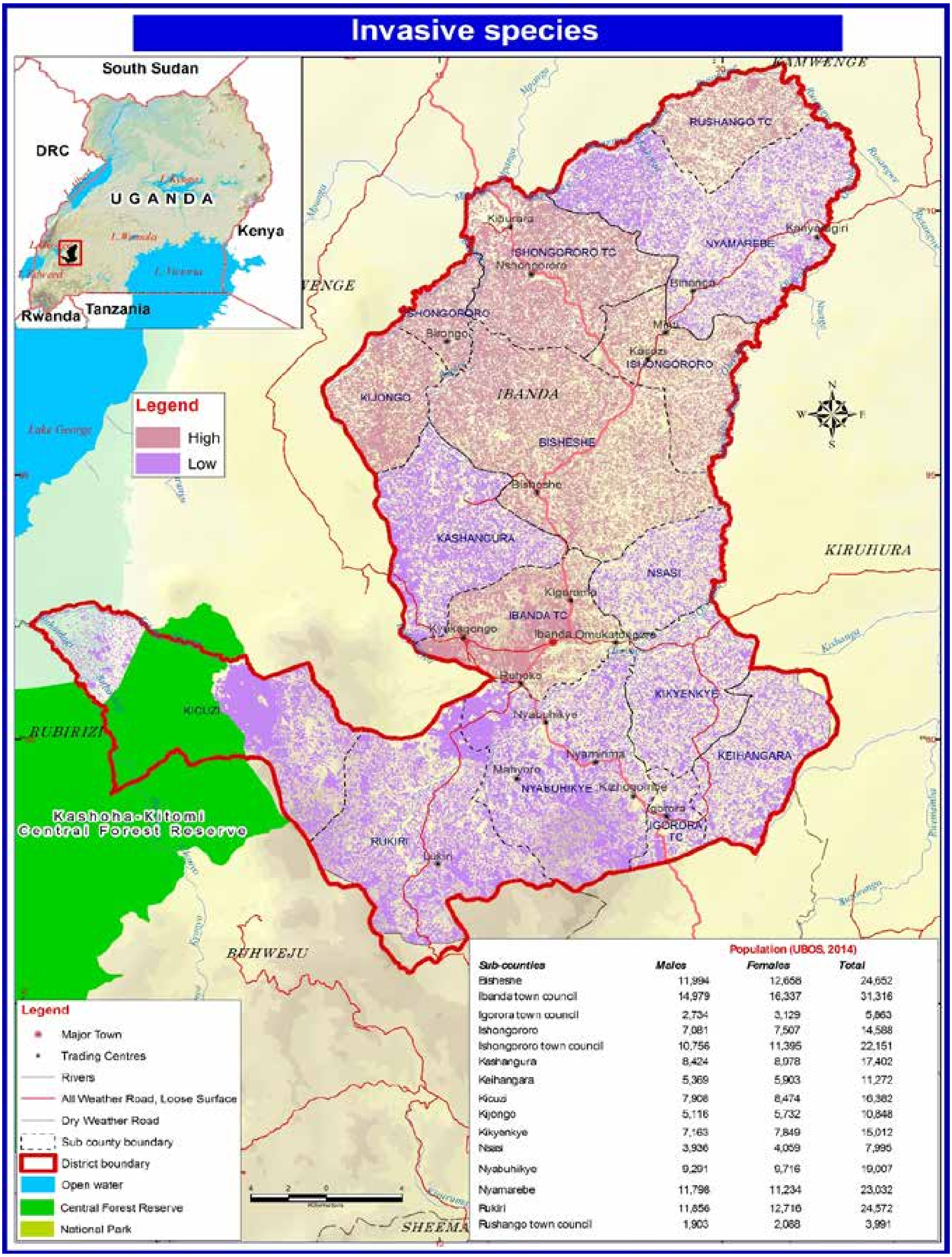

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Figure 17: Hotspots for invasive plant species in Ibanda district

Other minor hazards

2.5.8 Mass movement

Mass movements have been induced by artisanal gold mining activities especially in Kicuzi Sub County leading to reduced land aesthetic value and siltation of River Nsangi.

2.5.9 Volcanicity

The presence of a crater lake in Kijongo sub-county presents a risk of a possible volcanic eruption even if there are no signs of volcanic activity.

2.5.10 Mild earth quakes

According to key informants and FGDs, mild earth quakes are regular in Ibanda district almost on a monthly basis. At the moment, they are non-damaging but do present signs for potential high magnitude earth quakes in the near future.

2.6 Risk Coping strategies

According to key informants and FGDs, the following strategies (Table 3) have been employed by communities to cope with risks they experience.

Table 3: Risk coping strategies in Ibanda District

No	Risks	Coping strategies
1	Land conflicts	- Migration - Seek for court and land office redress - Community policing
2	Uncontrolled bush fires	- Sensitisation of people on the negative effects of fires - Development of the Bush Burning Law
3	Human wildlife conflicts	- Encourage bee keeping (apiary) and red pepper cultivation as repellents - Revenue sharing Policy - Fencing off the park - Recruiting vermin guards by Uganda Wildlife Authority - Digging trenches to bar elephants
4	Deforestation	- Pine and eucalyptus plantations - Distribution of free tree seedlings - Subsidising tree nurseries
5	Land degradation and soil erosion	- Community awareness campaigns - Live fencing - Opening up of trenches - Promoting proper agricultural practices
7	Policy and political risks	- Migration - Attitude change - Conflict mediation
9	Invasive species	- Burning - Roughing (uprooting) - Spraying using herbicides
10	Climate risks and shocks	- Tree planting - Sensitisation on early warning systems
11	Livestock thefts	- Kraal fencing - Animal tagging - Prosecution of offenders
12	Land collapsing	- Community sensitisation - Tree planting on hilltops - People yet to be relocated

2.7 Vulnerability profiles

Vulnerability depends on low capacity to anticipate, cope with and/or recover from a disaster and is unequally distributed in a society. The vulnerability profiles of Ibanda district were assessed based on exposure, susceptibility and adaptive capacity at community (village), parish, sub-county and district levels highlighting their sensitivity to a certain risk or phenomena. Indeed, vulnerability was divided into biophysical (or natural including environmental and physical components) and social (including social and economic components) vulnerability. Whereas the biophysical vulnerability is dependent upon the characteristics of the natural system itself, the socio-economic vulnerability is affected by economic resources, power relationships, institutions or cultural aspects of a social system. Differences in socio-economic vulnerability can often be linked to differences in socio-economic status, where a low status generally means that you are more vulnerable.

Four broad vulnerability areas were participatory identified in the district, these being social, economic, environmental and physical components of vulnerability. In each of these vulnerability components, participants characterised the exposure agents, including hazards, elements at risk and their spatial dimension. They also characterised the susceptibility of the district including identification of the potential impacts, the spatial disposition and the coping mechanisms. Participants also identified the resilience dimension at different spatial scales (Table 4)

Table 5 (vulnerability profile) shows the relation between hazard intensity (probability) and degree of damage (magnitude of impacts) depicted in the form of hazard intensity classes, and for each class the corresponding degree of damage (severity of impact) is given. It reveals that climatological and meteorological hazards in form of drought predispose the community to high vulnerability state. The occurrence of hailstorms, pests and diseases and lightening, also create a moderate vulnerability profile in the community (Table 5).

Table 4: Components of vulnerability in Ibanda District

<table>
<tr><td rowspan="2">Vulnerability components</td><td>Exposure</td><td colspan="2">-</td><td>Susceptibility</td><td colspan="2">-</td><td>Resilience</td></tr>
<tr><td>Hazards</td><td>Elements at risk</td><td>Geographical Scale</td><td>Potential impacts</td><td>Geographical Scale</td><td>Coping strategies</td><td>Geographical Scale</td></tr>
<tr><td rowspan="6">Social component</td><td>Landslides</td><td>- Human and livestock populations close to hill slopes
- Crops on hill slopes
- Infrastructure including houses and roads close to hill slopes
- Community cohesion
- Family disintegration</td><td>Village</td><td>- Loss of lives
- Stunted growth of crops
- Destruction of infrastructure including homes, schools and hospitals
- Decline of water quality</td><td>Village</td><td>- Migration
- Sensitisation</td><td>Village</td></tr>
<tr><td>Wild fires</td><td>- Human and livestock populations
- Crops
- Infrastructure including houses</td><td>Village</td><td>- Loss of lives
- Complete crop failure
- Stunted growth of crops
- Soil erosion</td><td>Village</td><td>- Sensitisation
- Enforcement of bush fire bye-law</td><td>Village</td></tr>
<tr><td>Strong winds</td><td>- Human and livestock populations
- Crops
- Infrastructure including houses, schools</td><td>Village</td><td>- Loss of lives
- Crop logging
- Destruction of infrastructure including homes, schools and hospitals
- Loss of property
- Accumulation of litter from blown off roof and tree tops</td><td>village</td><td>- Migration
- Sensitisation
- Tree planting</td><td>Village</td></tr>
<tr><td>Pests and diseases</td><td>- Human and livestock populations
- Crops
- Infrastructure including houses</td><td>District</td><td>- Loss of livestock
- Reduced livestock productivity
- Complete crop failure
- Stunted growth of crops
- Increased incidences of communicable diseases between animals and humans</td><td>District</td><td>- Vaccination
- Use of mosquito nets
- Culling off affected crops and animals
- Quarantine</td><td>District</td></tr>
<tr><td>Hailstorms</td><td>- Human and livestock populations
- Crops
- Infrastructure including houses</td><td>Parish</td><td>- Loss of lives
- Complete crop failure
- Stunted growth of crops</td><td>Parish</td><td></td><td>Parish</td></tr>
<tr><td>Lightening</td><td>- Human and livestock populations
- Crops
- Natural vegetation
- Infrastructure including houses</td><td>Village</td><td>- Loss of lives
- Unplanned expenditures to reinstate damaged infrastructure</td><td>Village</td><td>- Install lightening conductors
- Keep in doors during heavy rain events</td><td>Village</td></tr>
</table>

Economic component	Landslides	- Human and livestock populations - Crops - Natural vegetation - Infrastructure including houses, schools, hospitals and roads	Village	- Complete crop failure - Destruction of infrastructure including homes, schools and hospitals - Loss of income - Unplanned expenditures due to evacuations	Village	- Migration - Sensitisation	Village
	Wild fires	- Human and livestock populations - Crops - Natural vegetation - Infrastructure including houses, schools, hospitals and roads	Village	- Destruction of infrastructure including homes - Loss of income and government revenue - Increased expenditure to purchase food and other necessities	Village	- Sensitisation	Village
	Strong winds	- Human and livestock populations - Crops - Infrastructure including houses	Parish	- Loss of income - Loss of government revenue - Unplanned expenditures	Parish	- Migration - Sensitisation	Parish
	Pests and diseases	- Human and livestock populations - Crops - Infrastructure including houses	District	- Loss of income - Loss of government revenue	District	- Vaccination - Use of mosquito nets - Culling off affected crops and animals - Quarantine	District
	Hail storms	- Human and livestock populations - Crops - Infrastructure including houses	Village	- Loss of income - Loss of government revenue	Village		Village
	lightening	- Human and livestock populations - Crops - Natural vegetation - Infrastructure including houses	Village	- Loss of income - Loss of government revenue - Retaliation of the institutional sectors	Village	- Install lightening conductors - Keep in doors during heavy rain events	Village

Environmental component	Landslides	- Human and livestock populations close to hill slopes - Crops close to hill slopes - Natural vegetation close to close slopes - Infrastructure including houses, schools, hospitals and roads close to hill slopes	Village	- Loss of vegetation cover including trees - Loss of fertile soils - Siltation of rivers (lowering water levels) - Increased outbreaks of waterborne diseases due to reduced water quality	Village	- Migration - Sensitisation - Tree planting	Village
	Wild fires	- Human and livestock populations - Crops - Natural vegetation - Infrastructure including houses, schools, hospitals and roads	Village	- Loss of vegetation cover including trees - Increased emission of greenhouse gases accelerating climatic changes	Village	- Migration - Sensitisation - Fires lines - Enforcement of bush burning bye-laws - Prosecution of arsonists	Village
	Strong winds	- Human and livestock populations - Crops - Infrastructure including houses	Parish	- Loss of vegetation cover including trees	Parish	- Migration - Sensitisation - Tree planting as wind breaks	Parish
	Pests and diseases	- Human and livestock populations - Crops	Sub county	- Loss of crops - Increased expenditures on pesticides and drugs	Sub county	- Vaccination - Use of mosquito nets - Culling off affected crops and animals - Quarantine	Sub county
	Hailstorms	- Human and livestock populations - Crops	Village	- Loss of vegetation cover including trees - Loss of leaves	Village	- Food storage	Village
	lightening	- Human and livestock populations - Crops - Natural vegetation - Infrastructure including houses	Village	- Loss of vegetation cover including trees	Village	- Install lightening conductors - Keep in doors during heavy rain events - Encouraging population to avoid moving on barefoot during rain events	Village

Physical components	Landslides	- Human and livestock populations close to hill slopes - Crops close to hill slopes - Natural vegetation close to close slopes - Infrastructure including houses, schools, hospitals and roads close to hill slopes	Village	- Loss of vegetation cover including trees - Loss of human lives - Loss animal lives	Village	- Migration - Sensitisation	Village
	Wild fires	- Human and livestock populations - Crops	Village	- Loss of vegetation cover including trees - Loss of crops	Village	- Sensitisation	Village
	Strong winds	- Human and livestock populations - Crops - Infrastructure including houses, schools and hospitals	Parish	- Loss of vegetation cover including trees - Loss of crops - Loss of properties like houses	Parish	- Migration - Sensitisation - Tree planting as wind breaks	Parish
	Pests and diseases	- Human and livestock populations - Crops	Sub county	- Loss of crops - Loss of animal lives	Sub county	- Vaccination - Use of mosquito nets - Culling off affected crops and animals - Quarantine	Sub county
	Hailstorms	- Human and livestock populations - Crops	Sub county	- Loss of crops	Sub county		Sub county
	Lightening	- Human and livestock populations - Crops - Natural vegetation - Infrastructure including houses	Village	- Loss of crops - Loss of human and livestock lives - Loss of properties like houses	Village	- Install lightening conductors - Keep in doors during heavy rain events	Village

Table 5: Vulnerability profile for Ibanda District

	PROBABILITY	SEVERITY OF IMPACTS	RELATIVE RISK	VULNERABLE SUB COUNTIES
	Relative likelihood this will occur	*Overall Impact (Average)*	*Probability x Impact Severity*	
Hazards	*1 = Not occur* *2 = Doubtful* *3 = Possible* *4 = Probable* *5 = Inevitable*	*1 = Lowest* *2=moderate* *5 = Highest*	*1-10 = Low* *11-20 =Moderate* *21-25 = High*	
Floods	3	1	3	Kicuzi, Rukiri, Nyabuhikye
Droughts	5	5	25	Ishongororo TC, Nyamarebe, Kijongo, Kashangura, Nsasi, Rushango TC
Landslides	3	2	6	Kicuzi, Rukiri, Ibanda TC, Nyabuhikye
Hill slope cracks	3	1	3	Rukiri, Nyabuhikye (Bwahwa hill)
Hail storms	5	4	20	Kicuzi, Rukiri, Kikyenkye, Ibanda Tc, Nyabuhikye, Ishongororo TC, Nyamarebe, Kijongo, Kashangura, Nsasi, Rushango TC
Wild fires	3	2	6	Kicuzi, Rukiri,Kikyenkye, Ibanda Tc, Nyabuhikye, Kijongo
Lightening	3	5	15	Kicuzi, Rukiri, Kikyenkye, Ibanda Tc, Nyabuhikye, Ishongororo TC, Nyamarebe, Kijongo, Kashangura, Nsasi, Rushango TC
Pests and diseases	3	5	15	Kicuzi, Rukiri, Kikyenkye, Ibanda Tc, Nyabuhikye, Ishongororo TC, Nyamarebe, Kijongo, Kashangura, Nsasi, Rushango TC
Deforestation	3	2	6	Kicuzi
Strong winds	3	2	6	Rukiri, Kikyenkye, Nyabuhikye,Ibanda Tc, Kijongo, Nyabuhikye
Road accidents	3	2	6	Ibanda TC, Ishongororo, Kikyenkye, Nyabuhikye, Igorora T/C

Note: This table presents relative risk for hazards to which the community was able to attach probability and severity scores

Key for Relative Risk

H	High
M	Moderate
L	Low

2.8 General conclusions and programmatic recommendations

It was established that Ibanda district has over the last 35 years increasingly experienced hazards including landslides, wild fires, strong winds, pests and diseases for crops and livestock, hailstorms and lightening putting livelihoods at increased risk. The limited adaptive capacity (and or/resilience) and high sensitivity of households and communities in Ibanda district increase their vulnerability to hazard exposure necessitating urgent external support.

Hazards experienced in Ibanda district can be classified as:

i. Geomorphological or Geological hazards including landslides and hilltop cracks.
ii. Climatological or Meteorological hazards including drought, hailstorms, strong winds, lightening and hill-slope surface runoff.
iii. Ecological or Biological hazards including livestock pests and diseases, crop pests and diseases, bush fires.
iv. Technological hazards including road accidents.

However, counteracting vulnerability at community, local government and national levels should be a threefold effort hinged on:

i. Reducing the impact of the hazard where possible through mitigation, prediction, warning and preparedness.
ii. Building capacities to withstand and cope with the hazards and risks.
iii. Tackling the root causes of the vulnerability such as poverty, poor governance, discrimination, inequality and inadequate access to resources and livelihood opportunities.

Recommended policy actions targeting vulnerability reduction include:

i. Improved enforcement of policies (e.g. NDA policy) aimed at enhancing sustainable environmental health.
ii. Establishment of macro-economic mechanisms to curtail exportation of raw produce to the neighbouring countries such as Rwanda and Democratic Republic of Congo;
iii. Quickly review the animal diseases control act because of low penalties given to defaulters.
iv. Establishment of systems to motivate support of political leaders toward government initiatives and programmes aimed at disaster risk reduction.
v. Increased awareness campaigns aimed at sensitizing farmers/communities on disaster risk reduction initiatives and practices.

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Appendices

Appendix one: Focus Group Discussion tool

DATE:		X		Data collection sheet no	
District		y			
Sub-county		Z		Data collectors	
Parish		GPS accuracy			
		Units			

1. Mention the hazards experienced in your area in the last 30 years
   - ✓ 1980-1989
   - ✓ 1990-1999
   - ✓ 2000-2009
   - ✓ 2010-2015

2. Kindly rank these hazards in the order of importance/frequency of occurrence

Hazard	1980-1989			1990-1999			2000-2009			2010-2015		
	F	D	E	F	D	E	F	D	E	F	D	E
Floods												
Droughts												
Landslides												
Earth quakes/tremors												
Hail storms												
Wild fires												
Lightening												
Pests and diseases												
Deforestation												
Strong winds												
Road accidents												
Key: F=Frequency; D=Destructiveness; E=Extent												

3. Indicators of destructiveness

Hazard	Categorise by Sub-county	List indicators of destructiveness
Floods		
Droughts		
Landslides		
Earth quakes/tremors		
Hail storms		
Wild fires		
Lightening		
Pests and diseases		
Deforestation		
Strong winds		
Road accidents		
Key: F=Frequency; D=Destructiveness; E=Extent		

4. Return period

Hazard	Duration of events	Return period of hazards
Floods		
Droughts		
Landslides		
Earth quakes/tremors		
Hail storms		
Wild fires		
Lightening		
Pests and diseases		
Deforestation		
Strong winds		
Road accidents		
Key: F=Frequency; D=Destructiveness; E=Extent		

5. Together we are going to develop resource map of your district showing the following features
   - ✓ Floods
   - ✓ Drought
   - ✓ Landslides /mudslides
   - ✓ Earth quakes and tremors
   - ✓ Hailstorms
   - ✓ Wild fires
   - ✓ Lightening
   - ✓ Pests and Diseases
   - ✓ Deforestation

6. Livelihoods strategies

Household Livelihood strategy	Rank of importance

7. Copies strategies

Hazard	1980-1989	1990-1999	2000-2009	2010-2015
Floods				
Droughts				
Landslides				
Earth quakes/ tremors				
Hail storms				
Wild fires				
Lightening				
Pests and diseases				
Deforestation				
Strong winds				
Road accidents				

Appendix Two: Field sheet

Hazard	**X**	**Y**	**Z**	**Observations (soil type, extent, water depth, effect/damage)**
Floods				
Droughts				
Landslides				
Earth quakes/tremors				
Hail storms				
Wild fires				
Lightening				
Pests and diseases				
Deforestation				
Land conflicts				
Climate risks and shocks				
Uncontrolled bush fires				
Environmental risks (land degradation and soil erosion status)				
Policy and political risks				
Human and wildlife conflicts				
Biological risks (pests, Diseases and contamination)				
Labour and health risks (illness, death and injuries)				

Indicator analysis for each hazard (floods, drought, diseases etc)

Indicators: Vulnerability needs to be reflected through indicators. An indicator, or set of indicators, can be defined as an inherent characteristic which quantitatively estimates the condition of a system; they usually focus on small, manageable, tangible and telling pieces of a system that can give people a sense of the bigger picture.

Vulnerability	Exposure	-	Susceptibility		-	Resilience
	Exposure	Geographical scale	Susceptibility	Geographical scale	Resilience	Geographical scale
Social component						
Economic component						
Environmental component						
Physical components (eg flood duration, slope,						

Geographical scale: D=district; S=Subcounty; P=parish; V=village

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