



# WAJIR COUNTY

## Hazard Atlas





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# List Of Abbreviations And Acronyms

<b>AIDS</b>	Acquired Immune Deficiency Syndrome
<b>ASAL</b>	Arid and Semi-Arid Lands
<b>CCPP</b>	Contagious Caprine Pleuropneumonia
<b>CHIRPS</b>	Climate Hazards Group InfraRed Precipitation with Station data
<b>CDC</b>	Centers for Disease Control and Prevention
<b>CLN</b>	Corn Lethal Necrosis
<b>CMV</b>	Cucumber Mosaic Cucumovirus
<b>CoP</b>	Conference of Parties
<b>DCM</b>	Drought Cycle Management
<b>ECF</b>	East Coast Fever
<b>FAO</b>	Food and Agriculture Organization of the United Nations
<b>FAW</b>	Fall Army Worms
<b>FEWSNET</b>	Famine Early Warning Systems Network
<b>FMD</b>	Foot and Mouth Disease
<b>GHG</b>	Green House Gases
<b>HIV</b>	Human Immunodeficiency Virus
<b>GoK</b>	Government of Kenya
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>ITNs</b>	Insecticide-Treated Bed Nets
<b>KNBS</b>	Kenya National Bureau of Statistics
<b>LSD</b>	Lumpy Skin Disease
<b>MDMV</b>	Maize Dwarf Mosaic Virus
<b>MCMoV</b>	Maize Chlorotic Mottle Virus
<b>MERS</b>	Middle East Respiratory Syndrome
<b>MLND</b>	Maize Lethal Necrosis Disease
<b>NDMA</b>	National Drought Management Authority
<b>OECD</b>	Organization for Economic Co-operation and Development
<b>OIE</b>	World Health Organization for Animal Health
<b>PPR</b>	Peste des Petits Ruminants
<b>RCMRD</b>	Regional Centre for Mapping of Resources for Development
<b>SCMV</b>	Sugarcane Mosaic Virus
<b>TSC</b>	Teachers Service Commission
<b>UNDP</b>	United Nations Development Programme
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>UNDRR</b>	United Nations Office for Disaster Risk Reduction
<b>URTI</b>	Upper Respiratory Tract Infection

<b>USGS</b>	United States Geological Survey
<b>UTI</b>	Urinary Tract Infection
<b>VCI</b>	Vegetation Condition Index
<b>WSMV</b>	Wheat Streak Mosaic Virus
<b>WCG</b>	Wajir County Government
<b>WHO</b>	World Health Organization

# Acknowledgement

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Finally, the County Government thanks the Regional Centre for Mapping of Resources for Development and appreciates the professional role they played in the production of this document.

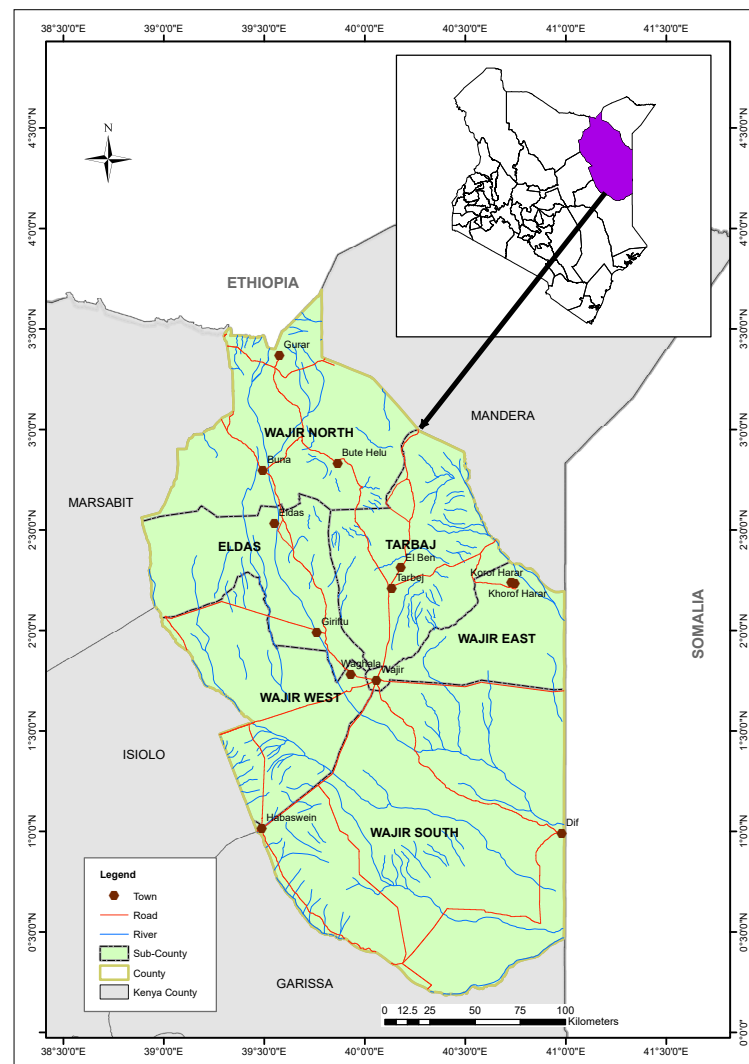
# Chapter 1: Context And Background To The Hazard Atlas Map

## 1.1 County Background

**W**ajir County is located in the North-Eastern part of Kenya. The County lies between latitudes 30° 60'N and 00° 20'N and Longitudes 39° 00'E and 41° 00'E and covers an area of 56,685.9 Km<sup>2</sup>. (Wajir CIDP, 2018). It borders Marsabit to the North West, Isiolo to the South West, Mandera to the West, Somalia to the East and Garissa to the South. The County has a population of 781, 263, with 415, 374 males, 365,840 females and 49 Intersex (KNBS, 2019). Wajir town is the County's capital. Othertowns include Buna, Eldas, Bute, Helu, Elben, Waghala and Khorof Harar. The County is divided into 6 sub-counties namely Wajir East, Wajir West, Wajir North, Wajir South, Eldas and Tarbaj. The 6 sub-counties are further sub-divided into 30 wards. Wajir West has 4 wards (Arbajahan, Hadado/Athiboho, Adamasajide and Ganyure/Wagalla), Tarbaj has 4 wards (Elben, Sarman, Tarbaj and Wargadud), Wajir East has 4 wards (Wagberi, Township, Barwago and Khorof Harar), Eldas has 4 wards (Eldas, Della, Lakoley South/Basir and Elnur), Wajir South has 7 wards (Benane, Burder, Dadajabula, Habaswein, Lagbogol South, Ibrahim Ure and Diff) and Wajir North has 7 wards (Gurar, Bute, Korondille, Malkagufu, Batalu, Danaba and Godoma (WCG). The County is generally flat with an average altitude of 244m (Wajir CIDP, 2018). Wajir County falls in the ecological zones V-VI. Zone V receives rainfall between 300-600mm annually while zone VI receives an annual rainfall of 200-400mm (Wajir CIDP, 2018).

## 1.2 Hazard Profile in Wajir County

Wajir County falls in the semi-arid region in the North-Eastern part of Kenya. The already delicate environment makes the county prone to hazards and disasters. It is paramount to address hazards promptly, failure to which they advance to disasters. Disasters threaten food security through disruption of the nomadic lifestyle, cropping and overall ecosystem procedures. Compromised food security contributes to reduced nutrition and increased disease incidences. Hazards are complex as a primary hazard can generate a secondary hazard. For example, floods which is a primary hazard leads to subsequent hazards such as conflicts, human and livestock diseases. Proper mechanisms on how to handle these hazards before they graduate to disasters should be identified and put in place. Great strides have been made at the global, regional and national levels with the formulation of policies and frameworks that are useful for disaster management. For instance, the Sendai Framework 2015-2030 which is closely linked to the 2030 Agenda for Sustainable Development, has clear targets and priorities that should help with the fight against disasters. There is a need to streamline global and national policies on disaster risk reduction at the county level. County governments have a duty to draft policies that address



their unique hazard and disaster challenges. Wajir County has enacted a disaster management bill. Wajir County's Disaster Management Bill (2014) acts as a guide on the prevention, mitigation, preparedness, response and recovery from emergencies and disasters. These duties are to be undertaken by the Disaster Management Committee with the Directorate of Disaster Management acting as the overseer. Issues of funding are also addressed in the bill. The efforts at the county level have to be streamlined to the community at the level to bring each member of the county on board. The creation of awareness of the risks posed by hazards is very crucial.

Based on the assessments done by RCMRD through this hazard atlas development program, the main hazards found to impact the county and that would therefore be discussed in this atlas are: Droughts, floods, conflicts (human and human-wildlife), environmental degradation, human diseases, livestock diseases, crop diseases and pests. The atlas goes further to assess vulnerabilities posed to the communities in Wajir county based on the existing risks and access to basic infrastructures like education, water and health. It is important to note that the thematic information specific to each hazard and as specified in this atlas was derived from desktop studies on existing literature carried out in the county coupled with intensive evidence-based field surveys and stakeholder engagements through organised participatory mapping, community consultative and validation forums at the county.





**Plates 1.1 and 1.2:** Participants of Stakeholders' participatory mapping workshop and community consultative forum in Wajir County (Source: RCMRD)

### 1.2.1 Drought

Wajir county's climate and environmental conditions make it susceptible to drought episodes. This county has a generally hot and dry climate with minimal rainfall received during the year. Drought is a slow onset hazard that can have devastating impacts on the entire ecosystem. Shortage or lack of adequate precipitation affects pasture, availability of food due to crop failure, reduced quantity of drinking water and leads to ethnic rivalry also humans-wildlife conflict. Unsustainable land uses, increasing human population and conversion of land for arable farming coupled with poor communication infrastructure and lack of (or poorly implemented) traditional coping mechanisms are also major catalysts of droughts in the county. It is evident that climate change exacerbates drought in the county, therefore, integration of climate change adaptation and disaster risk management strategies is important.

### 1.2.2 Floods

Wajir county's flat landscape makes it prone to flooding. Flooding in the county is a result of heavy rainfall. Floods in the county are mainly flash floods. Flooding in the County causes damage to infrastructure with roads being rendered impassable thus affecting the supply of essential commodities such as food. Learning in schools

is disrupted, forced migrations, destruction of property and death of livestock are other impacts of flooding. Clearance of vegetation cover in the County for charcoal production contributes to degradation and desertification. Other factors like climate variability and climate change are attributed to increasingly erratic rainfall that leads to flooding. Early warning system and proper communication channels aid in averting the adverse impacts of floods.

### 1.2.3 Conflicts

Conflicts disrupt the livelihoods of people. Various conflict types are common in Wajir county. Clan-based disputes and extremism are believed to be prone in the County. Competition for natural resources like water and pasture fuels conflicts. Human-Wildlife conflicts are rampant in several sub-counties in Wajir. Snake bites and hyena attacks have caused human and livestock deaths. Conflicts have negative impacts on the socio-economic well-being of any community. Some of these include infliction of injury to humans and livestock; disruption of learning due to closure of schools, displacement of people and increased medical expenditure and among others. Community-based peace building approaches are key for early warning, response and post-conflict management. Initiatives like the establishment of the Wajir Peace and Development Committee (WPDC) in 1994 have borne fruits in the fight against conflicts in Wajir (Karienyé&Warfa, 2020).

### 1.2.4 Environmental Degradation

Wajir county falls in the arid and semi-arid region of Kenya. Arid and Semi-Arid Lands are fragile and prone to environmental degradation. Minimal vegetation cover leaves the ground bare and exposed to extreme anthropogenic and climatic events. Environmental degradation is the deterioration of the environment. Factors that contribute to environmental degradation in Wajir county include soil erosion, overgrazing, invasive species, clearing of vegetation for charcoal production and disposal of both solid and liquid waste. Climate change and variability and increased human population also exacerbate environmental degradation by putting pressure on the limited resources. Environmental degradation impacts the availability of pasture, water and contributes to increased flooding. Mechanisms aimed at reducing environmental degradation should be put in place in the County.

### 1.2.5 Human Diseases

Good health is mandatory for meaningful development to take place in any region in the world. Human diseases incapacitate people. Disease outbreaks can graduate into a disaster if not controlled on time. Pastoralist communities face great challenges when it comes to accessing quality health care. Some of these constraints include uneven distribution of health facilities, long travel distance to the health facilities and few medical personnel. The most prevalent human diseases in the county are Cholera, Measles, Kala-azar, Rift Valley Fever (RVF), Malnutrition, and

emerging diseases such as the 2019 corona virus (COVID-19) pandemic together with conditions such as diabetes, hypertension, obesity and cancer.

### 1.2.6 Livestock Diseases

Livestock rearing is the backbone of the economy of Wajir county. Inhabitants of the County are pastoralists. Livestock disease outbreak can affect the socio-wellbeing of the entire community. Livestock reared in the county include cattle, donkeys, sheep, goats and camel. Livestock diseases, drought and minimal resources affect the livestock sector. Common livestock diseases in Wajir county include Foot and Mouth Disease (FMD), peste des petits (PPR), contagious caprine pleuropneumonia (CCPP), Rift Valley Fever (RVF), sheep and goat pox, Trypanosomiasis, Middle East Respiratory Syndrome (MERS), Anthrax and Lumpy Skin Disease (LSD). Most of these diseases are highly contagious and cause immense losses (through death and decreased productivity) when they attack animals.

### 1.2.7 Crop Diseases and pests

Crop production is rarely practised in Wajir county. Agriculture is practised in depressions and along drainage lines where there is more moisture due to seasonal flooding (Wajir CIDP, 2018). The poor environmental and climatic conditions hinder agricultural activities. The main crops grown for subsistence include sorghum, drought-tolerant maize, beans, melons, cowpeas, green grams and horticultural crops like mangoes, citrus, kales, spinach, tomatoes, sweet and hot peppers (Wajir CIDP, 2018). Challenges faced by farmers in the region are crop disease and pest incidence, erratic rainfall and high temperatures. Crop diseases and pests in the county include Head smut, black leg (for Irish potatoes only) and black rot (for cabbages), while the pests that attack crops are such as; aphids, mealybug, desert locust, *quelea quelea* and stalk borers.

## 1.3 Need for Hazard Mapping and Atlas Development

Disasters are increasingly becoming a common phenomenon globally and in many regions of Kenya. This may be attributed to changes in the ecosystem driven by many factors such as increased population growth that puts pressure on many resources and climate change among others. Disasters that occur on large scale may have a serious impact on society and the economy, resulting in a significant national loss. Preventing the adverse impacts of disasters is one of the most important priorities of governments. Although it is difficult to avoid the impacts of hazards and related disasters, it is essential to understand their characteristics and how we can reduce their impacts by strengthening our ability to deal with their effects. Understanding hazards and related disasters and vulnerabilities start by answering such questions as:

- What hazards are likely to occur?
- Where do they occur?
- How significant are they in scale?

- When are related hazards likely to happen?
- And what elements are most at risk?

The purpose of hazard maps is to provide a set of information in a form of a visual presentation concerning hazards and related disasters prevailing in a given geographic area. This visualization is for subsequent use in systematically addressing underlying risk factors and taking necessary measures to reduce potential adverse impacts on their geographic location so that disaster prevention activities and measures could be undertaken. Depending on the details they provide, hazard maps therefore would be an important tool for enhancing early warning, preparedness, contingency planning and implementing relief, early recovery, and rehabilitation interventions. As importantly, hazard maps could be used for planning and implementation of preventive measures including building resilience and adaptive capacity.



# Chapter 2 : Climate Profile

## 2.1 Introduction

Kenya has a complex tropical climate that varies significantly between its coastal, interior and highland regions and from season to season, year to year, and decade to decade (Parry, et al, 2012, Gok, 2012 & GoK, 2013). The climate is hot and humid at the coast, temperate inland and very dry in the north and northeast parts of the country. The two main rainy seasons are the long rainy season (March-May) and the short rainy season (October-December). The other months of the year are cool and warm dry seasons. However, this may slightly vary from one region to another. Favourable rainfall is key for the sustainability of different livelihoods in the Country. Farmers rely on the rains for crop production while the livestock rearing communities depend on rains for the availability of pasture and fodder. Analysis of rains from 1981 to 2019 by RCMRD shows that there has been a gradual increase in the amount of rain received during the short rains in Wajir but a decline in the amount of rain during the long rains period. Generally, the rain has become erratic and insufficient to support a harvest or even livestock rearing. It has been acknowledged that climate variability and change is rampant in Kenya and the effects can be felt. Action to respond to climate variability and change is necessary to ensure that development opportunities are realized through people-centred growth while encouraging a green economy and resource efficiency for the long-term sustainable development of the country (GoK, 2012). This chapter has been designed to bring out Temperature and Rainfall trends and seasonal changes in Wajir County over the last thirty-eight years.

## 2.2 General Climate

Wajir county falls in the arid and semi-arid region of the county which is very fragile and experiences hot and dry conditions. The County falls in ecological zones V-VI, with zone V receiving slightly higher rainfall than zone VI (Wajir CIDP, 2018).

### 2.2.1 Rainfall

Just like most counties in Kenya, Wajir experiences largely a bimodal rainfall pattern with the long rain season occurring between March and May and the short rainy season between October and December (Wajir CIDP, 2018). The wettest month is April while the hottest months are February and March (Wajir CIDP, 2018).

Rainfall analysis indicates that there has been a slight increase in the total annual average rains from the year 1981 to 2019. However, the amount of rainfall received is unpredictable. Figure 2.1 below shows the total annual rainfall for Wajir County from 1981 to 2019.

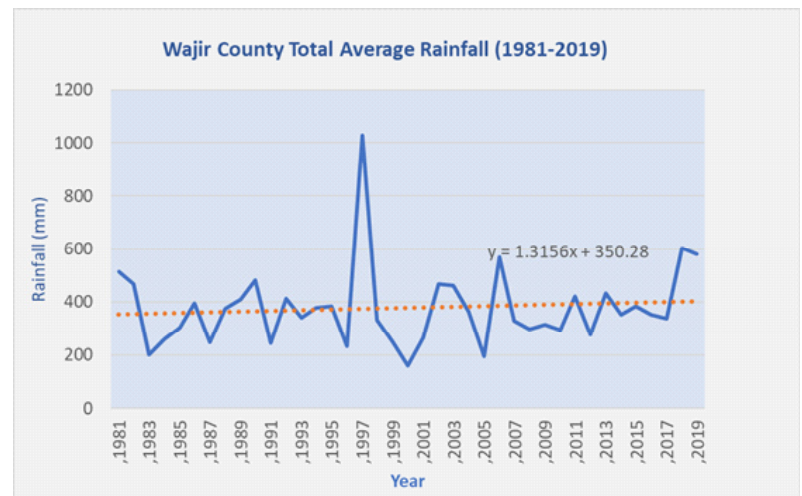


Figure 2.1: Wajir County Total Annual Rainfall (1981-2019) (Source: CHIRPS/GeoCLIM/RCMRD)

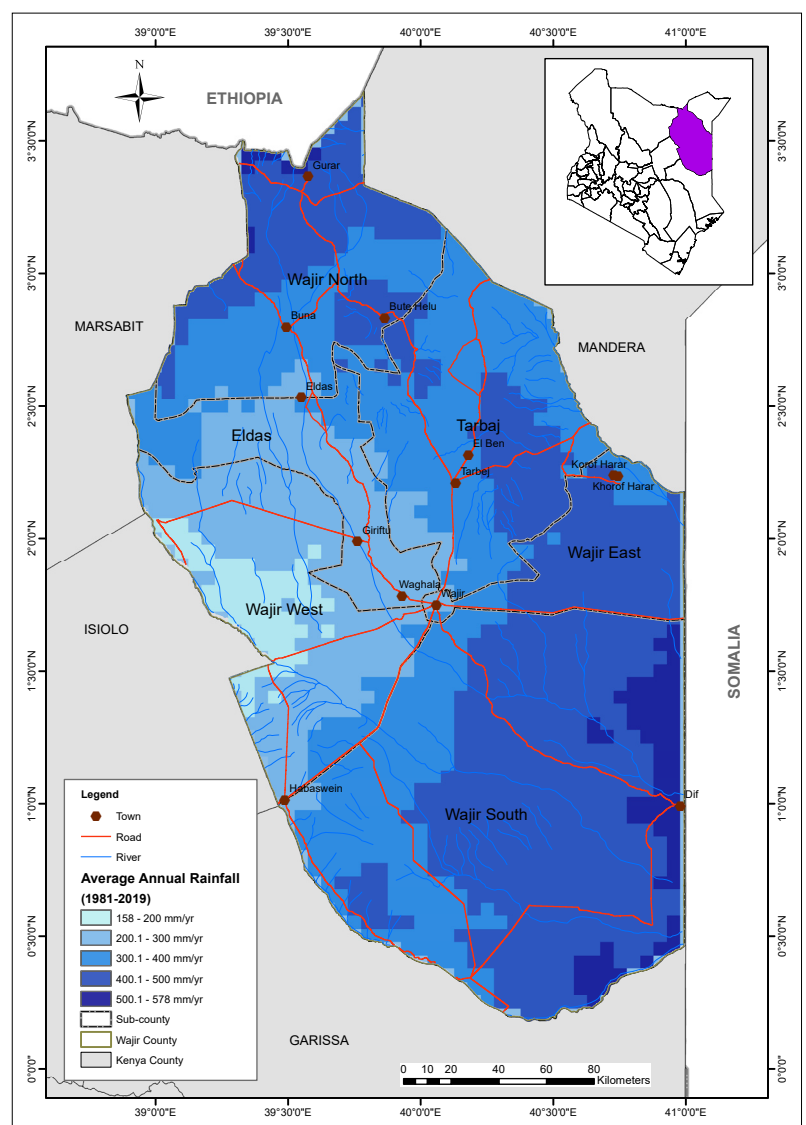
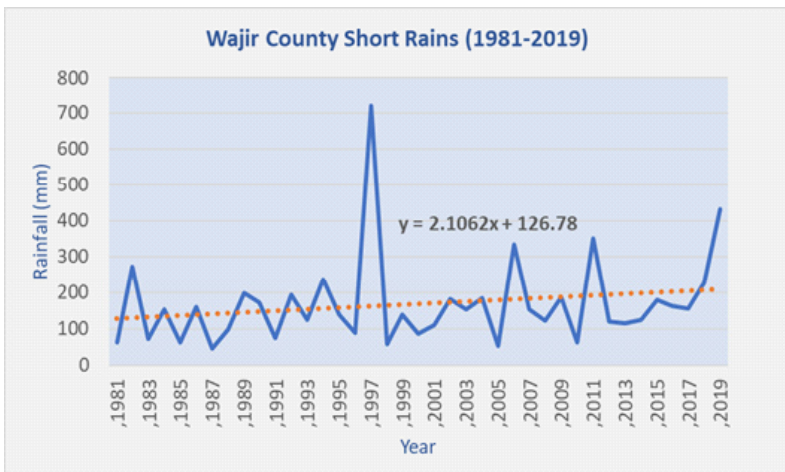
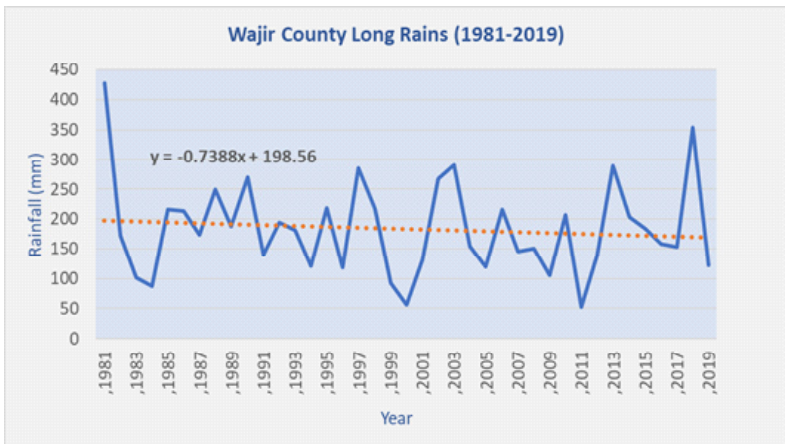


Figure 2.2: Wajir County Average Annual Rainfall (1981-2019) (Source: CHIRPS/GeoCLIM/RCMRD)

Further analyses by RCMRD (Figures 2.3 and 2.4) indicate that both the short and long rains seasons are erratic. The amount of rainfall varies from year to year. Short rains have registered an increase while long rains have decreased from 1981 to 2019. The amount of rains received during the 1997/1998 El-Niño was much more compared to the other years.



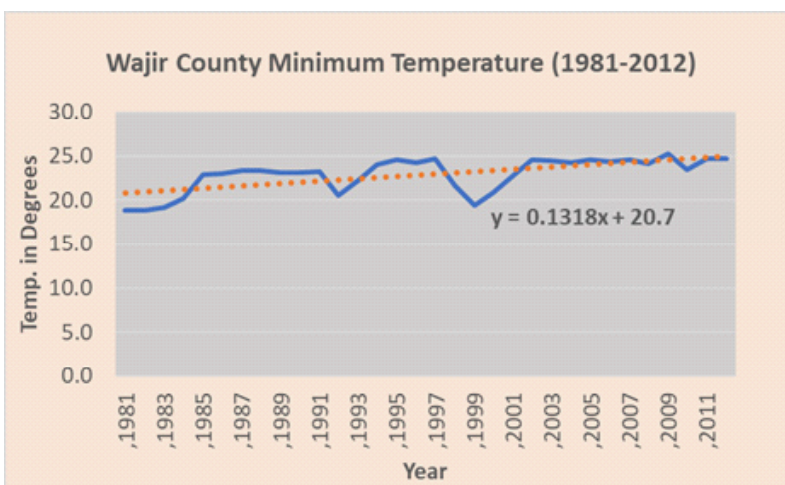
**Figure 2.3:** Wajir County Short Rains Seasonal Trend (1981-2019)  
(Source: CHIRPS/GeoCLIM/RCMRD)



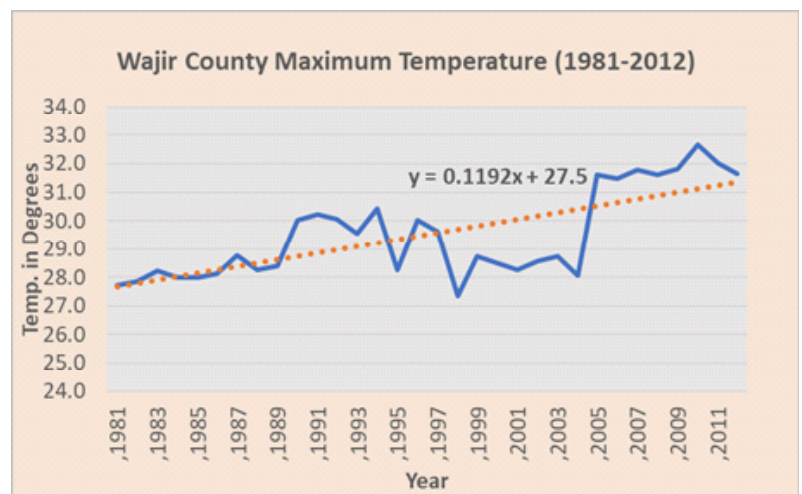
**Figure 2.4:** Wajir County Long Rains Seasonal Trend (1981-2019)  
(Source: CHIRPS/GeoCLIM/RCMRD)

### 2.2.2 Temperature

Wajir County's average annual temperature range is 27.90C (Wajir CIDP, 2018). The warmest months are February and March while the coolest months are June, July, August and September (Wajir CIDP, 2018). Figures 2.5 and 2.6 below show the trend of Wajir County's minimum and maximum temperatures from 1981-2012.



**Figure 2.5:** Wajir County Minimum Temperature (1981-2012)  
(Source: FEWSNET/GeoCLIM/RCMRD)



**Figure 2.6:** Wajir county Maximum Temperature (1981-2012)  
(Source: FEWSNET/GeoCLIM/RCMRD)

Figures 2.5 and 2.6 indicate that there was a slight increase in temperatures from 1981 to 2012. Extreme climatic events manifested as extremely high temperatures and high rainfall amounts in a short period, contribute to drought and flash floods in the County (Wajir CIDP, 2018). Temperature increase in the county may be attributed to the clearing of vegetation in the County for charcoal production. Another major factor that contributes to warmer temperatures is the retention of heat by greenhouse gases such as methane, carbon dioxide and nitrous oxide. Most of the warming is believed to have been caused by anthropogenic increases in greenhouse gases. The temperature rise has caused several changes in the environment and will continue to do so if not controlled. Warmer temperatures affect the amount of water available for use, pasture availability, nutrition and health. Lack of adequate clean water for drinking and other uses caused deterioration in health due to the spread of water-borne diseases and survival of disease vectors.

### 2.3 Climate Change

United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable periods. Evidence of climate change in Kenya includes irregular, intense and unpredictable rainfall (GoK, 2010). Temperature increase in Kenya is an indicator of climate variability as well. The National Climate Response Strategy points out that since the early 1960s, both minimum (night time) and maximum (daytime) temperatures have been on an increasing (warming) trend. The minimum temperature has risen generally by 0.7 – 2.0 oC and the maximum by 0.2 – 1.3oC, depending on the season and the region. In areas near large water bodies, the maximum temperatures have risen much like in other areas but the minimum temperatures have either not changed or become slightly lower. Figures 2.1, 2.2, 2.3 and 2.4 above show variability such as erratic rains despite the increasing rains during the short and long rains seasons. Temperatures in Wajir county have been increasing too in the last thirty-two years.

Bureaucracy, limited and high cost of climate data by meteorological institutions poses a challenge to researchers and other individuals interested in climate analysis. Climate variability and change affects the quality of life as the environment is no longer able to sustain the various livelihoods. Some of the impacts of climate variability and climate change in the County include:

- Increased frequency and intensity of droughts.
- Increased flash floods that damage infrastructure and causes the death of small livestock especially goats
- An outbreak of human and livestock diseases
- Reduced volume of surface and ground water due to erratic rainfall.
- Human conflicts and human-wildlife conflicts as locals compete for resources such as water and pasture for livestock.
- Migrations have increased as people search for pasture and alternative livelihoods.
- Loss of biodiversity
- Infrastructure damage due to increased rains that result in floods

Climate change is a global issue and a lot needs to be done to address the challenges that it does pose. There have been efforts at the global level with countries signing treaties such as the Kyoto protocol and participants in the United Nations Conference on Climate Change like the recent, Paris agreement (COP 21). Kenya is a party to the Kyoto protocol and has made several strides towards mitigating climate change impacts. Such progress includes the existence of the National Climate Change Response Strategy and the National Climate Change Action Plan. However, more needs to be done at the local level. There is evidence of climate change in Wajir county. Mitigation measures and adaptation strategies that have been set up by the county government of Wajir include: Environmental awareness, regular vaccination, planting drought-resistant crops, reducing stock numbers

# Chapter 3: Drought

## 3.1 Introduction

**D**rought has been a complex phenomenon and has not been addressed or understood. Drought is a temporary occurrence and is a direct consequence of a reduction in the amount of precipitation received over an extended period, usually a season or more (UNDP, 2011). Various definitions of drought have been documented; drought is a prolonged dry period in the climate cycle that is caused by the lack of rainfall and causes serious hydrological imbalance. In recent years, drought incidences have been on the rise since the first incidence was reported in the country in the year 1928. Residents attribute increased drought frequency and intensity to climatological changes such as increased temperatures and reduced rainfall.

## 3.2 Types of Drought

According to United Nations International Strategy for Disaster Reduction, the broad definition of drought is a deficiency of precipitation over an extended period, usually a season or more, which results in a water shortage for some activity, group, or environmental sectors. However, in terms of typologies, droughts are commonly classified as meteorological, agricultural, hydrological, and socio-economic (UNISDR, 2007). Further explanation of these types of drought is as indicated below:

### 3.2.1 Meteorological drought

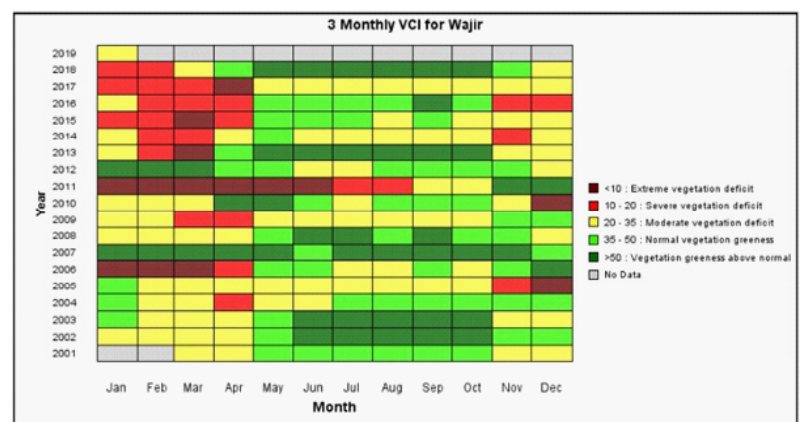
Meteorological drought depends on precipitation deficit and duration of the period with precipitation deficit. It is simply expressed in terms of a rainfall deficit in relation to some average amount and duration of the drought period. Many people relate to this type of drought as it is more evident. Erratic rainfall is attributed to meteorological drought in the county. Wajir County receives two seasonal rainfall; long and short rain seasons. Several impacts have been brought up by this drought including conflict over resources, crop failure, reduced animal productivity, poor pasture generation and poor recharge of water resources. Some of the mitigation factors include water trucking, planting drought-tolerant crops, strategic food reserves, restocking and the formation of peace committees.

### 3.2.2 Agricultural drought

Agricultural drought occurs when the soil moisture which should have been available for crops drops to levels that affect crop yields. Agricultural drought is linked to various categories of hydrological and meteorological drought focusing majorly on soil water deficits and differences between actual and potential evapotranspiration. Some of the impacts of this type of drought include food insecurity, loss of income, crop failure, and moisture stress. Food insecurity has been known to cause several negative impacts including malnutrition, anaemia and weight loss among children. Just like meteorological and hydrological

droughts, mitigation measures include irrigation, planting drought-tolerant crops, conservation agriculture, investing in strategic food reserves and an effective early warning system.

**Vegetation Condition Index (VCI)** is an effective index based on satellite observations for assessing vegetation quality and condition thereby determining the severity levels for agricultural drought. This indicator is suitable to measure the status of pasture and therefore can be used to assess grazing resources available to livestock (NDMA, 2016). The Vegetation Condition Index is based on the relative NDVI change with respect to minimum and maximum historical NDVI value (NDMA, 2016). The NDVI of a given week is compared to the minimum NDVI found in the archive (of that week: NDVImin) and the maximum NDVI found for that week (NDVImax), (NDMA, 2016).



**Figure 3.1:**Vegetation Condition Index for Wajir County 2001-2019 (Source: NDMA, 2019)

According to figure 3.1 above the severity and duration of drought has been increasing since 2010 with 2011 being the year which drought was most severe since the turn of the millennium with the long rains which occur between March and May completely failing in that year.

### 3.2.3 Hydrological drought

Hydrological drought occurs after a long period of precipitation deficit. It is characterized by the effects of periods of rain shortfall on the surface and sub-surface water supply. Groundwater drought is outlined by lower-than-average annual recharge for more than one year. Groundwater levels are good indicators in an aquifer area. Major impacts of this type of drought in the county included drying of water sources, conflicts, diseases, reduced productivity and animal deaths. Mitigation measures include water harvesting and storage, and water trucking. Several projects have been run up in Wajir to aid in the provision of clean water to the residents.



**Plate 3. 1:** Dried water pan due to drought (source:RCMRD)

### 3.2.4 Socio-economic drought

Socio-economic drought refers to conditions where the available water that is in supply cannot satisfy the environmental and human needs. Socio-economic drought is a direct result of agricultural, hydrological and meteorological droughts. This type of drought cuts across all groups of people regardless of their economic status. This scenario limits the ability to purchase commodities and makes those who are economically disadvantaged suffer the most. This type of drought has several impacts in Wajir county including insecurity, loss of livelihood, malnutrition, the collapse of social systems and migration. Mitigation measures that can be undertaken include alternative income-generating activities, social safety nets, restocking, support to livestock health care resources and livestock insurance.

### 3.3 Drought in Wajir

Drought in Wajir county has been known to be horrible because of the bare nature of the land that is expansive where winds can blow and sweep across. The drought affects both human beings and livestock to an extent of having water conflicts at the watering points. The county continues to be affected by drought where thousands of people have had a dire need of pasture for livestock and water. The county receives drought episodes especially in June to September which has had negative impacts on education, access to water, pasture, crop farming, nutrition and livestock. The county has continued to be ravaged by drought and has affected thousands of people. The recurring situation has led to the launching of drought response interventions by the national and county governments with support from the humanitarian partners.



**Plate 3.2:** Wajir Governor flagging off relief food. (Credit: Nation Media Group)

The boreholes that are in Wajir county serve many people including pastoralist from the neighbouring counties. Drought is a common occurrence across the county. Livestock which serves as the main source of livelihood in the county are also adversely affected by drought.

### 3.4 Impacts of Drought

The impacts of drought can be categorized into social, environmental and economic. Environmental and economic impacts are more visible compared to social impacts.

#### 3.4.1 Social Impacts

Alberta Water indicates that social impacts of drought are indirect as they are a consequence of direct impacts of drought (albertawater.com). Social impacts include tension between upstream and downstream users, forced migration of people that destabilizes families, increased conflicts due to scarce resources and health issues such as anxiety, stress, increased school dropouts, closure of schools and malnutrition among the community members that rely on livestock rearing and farming. The general quality of life is affected is normally affected by droughts.

#### 3.4.2 Economic Impacts

Drought episodes cause a lot of economic losses. Some of

these losses may run into millions of Kenya shillings. Farmers face great economic losses whenever crops fail. Livestock deaths affect the pastoralists who rely on their animals for income. Low livestock offtake prices indicate that the pastoralists in Wajir County experience losses. Livestock and human deaths, human and livestock injuries and disruption of livelihoods have been the consequences/effects of drought.

### 3.4.3 Environmental Impacts

Drought affects the environment in numerous ways. Some of these environmental impacts include destruction of habitat for wildlife as people encroach into wetlands and forests, lack of adequate water for plants and animals, exacerbated land degradation due to overgrazing that removes vegetation cover leaving the soil bare and increased soil erosion as soils are easily blown away by winds and water when it rains contributing to siltation.

### 3.5 Drought Cycle Management

Drought is a natural occurrence but timely intervention by all the relevant stakeholders can reduce the vulnerability of a community to its impacts. Drought cycle management (DCM) is a model that was developed to act as a guide in planning and responding to droughts. Drought cycle management is a cyclic process that affirms that drought is a cyclic event and defines what actions to be taken at each stage of a drought (Lesukat, 2012). It aids in ensuring that practitioners improve the timeliness, appropriateness, and ultimately the effectiveness of work by inviting them to consider whether activities are appropriate given the current stage of the drought cycle (NDMA). DCM conceives drought as a cycle of warning phases; Normal, Alert, Alarm, Emergency and Recovery (NDMA).

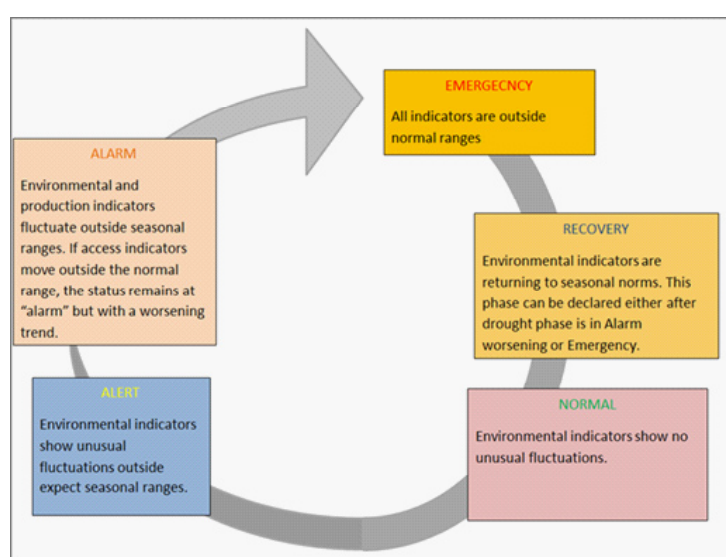


Figure 3.2: Drought Cycle Management (Source: NDMA)

Drought Management has four phases. Drought Preparedness (Readiness measures before the onset of drought), Mitigation, Relief assistance/emergency operations and Recovery or Reconstruction (measures after the drought to facilitate fast normalcy).

### 3.6 Drought Management in Wajir County

Drought management in Wajir county has been a challenge to all the involved stakeholders. There has been a focus on the development of availability of water using infrastructure development. This has been done without any effort in the involvement of the local communities. Community engagement is weak and the incorporation of locals' water priority needs has not been taken into consideration. This has led to a situation where water scarcity is a problem and resulting in conflicts over the rare commodity. Some losses and destructions are caused by the droughts depending on a combination of factors such as availability of water and pastures, the performance of previous rains, outbreak of diseases, and the level of preparedness of the county, National Government, development partners and the community at large (Wajir CIDP, 2018). Some of the measures put in place by the county government include rain water harvesting through water pans, zoning dry and wet season grazing areas, supply of relief food, and irrigated agriculture.

#### 3.6.1 Mitigation measures employed or proposed by communities, government and other stakeholders in Wajir County include:

- Purchasing of feeds from other sources should be adopted as a practised to minimize livestock deaths
- Timely relief food supply to areas that are most affected during drought episodes.
- Drilling of more strategic boreholes/shallow wells
- Cash transfer to vulnerable groups
- Improvement in the provision of healthcare
- Acceleration of livestock vaccination
- Dissemination of early warning information
- Improvement of road infrastructure
- Equitable distribution of resources
- Limiting the development of new settlement to avoid extra stress on grazing areas.
- Distribution of water points strategically with pastoral range management.
- Differentiating the domestic and livestock needs in the development of water points to avoid overgrazing.
- Increased and prompt water trucking for the affected population and livestock.



- Creation of self-help groups and support
- Extensive Disaster Risk Reduction training to communities in the areas.

### 3.6.2 Other Mitigation Measures

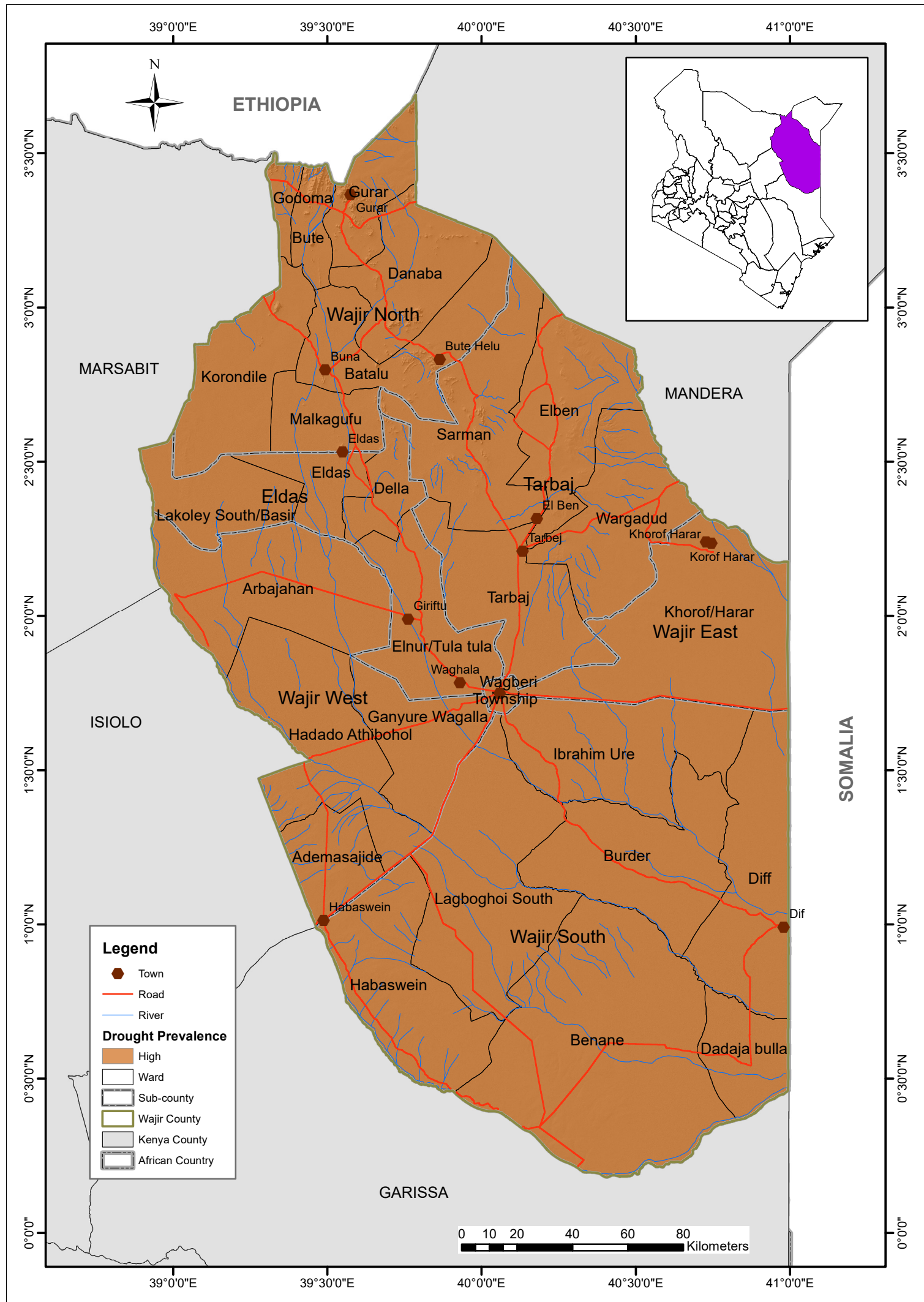
- School feeding programmes.
- Nutrition support to the severely malnourished.
- Hunger safety net programme emergency \ upscaling.
- Recover water holding capacity of soils through tree planting and practising soil conservation methods.
- Sensitization on the use of renewable and alternative sources of energy to reduce the use

- of charcoal.
- Sensitization of water users' associations for inclusive management of water points.
- Diversification of rural livelihoods through social protection, cash-transfer programs or improving access to markets and rural services: Access to markets could help create alternative non-farm employment that could reduce the impacts of droughts;
- Livestock insurance and;
- Managing livestock production within the landscape: relocation of herds, nomadic migration, use of special reserve areas.

**Table 3.1:** Sub-County seasonal drought vulnerability (2016-2021) (Source: NDMA-Wajir County)

Sub-County Seasonal Drought Vulnerability (2016-2021)			
Year	Long Rain Assessment	Short Rain Assessment	Vulnerability
2016	Wajir South Eldas Wajir West	Wajir South Wajir West Wajir North	Very high
	Wajir East Tarbaj Wajir North	Wajir East Tarbaj Eldas	High
2017	Wajir South Wajir West Eldas	Wajir South Wajir West Tarbaj	Very high
	Wajir East Tarbaj Wajir North	Eldas Wajir North Wajir East	High
2018	Wajir West Wajir South Eldas	Wajir South Wajir West Eldas	Very high
	Wajir East Tarbaj Wajir North	Wajir East Tarbaj Wajir North	High
2019	Wajir West Eldas Wajir South	Wajir North Wajir West Eldas	Very high
	Wajir East Tarbaj Wajir North	Tarbaj Wajir East Wajir South	High
2020	Wajir North Wajir West Eldas	Wajir West Eldas Tarbaj	Very high
	Tarbaj Wajir East Wajir South	Wajir East Wajir South Wajir North	High
2021	Wajir west Eldas Wajir South	-	Very high
	Tarbaj Wajir East Wajir North	-	High

### Map 3.1: Drought Prevalence in Sub-Counties

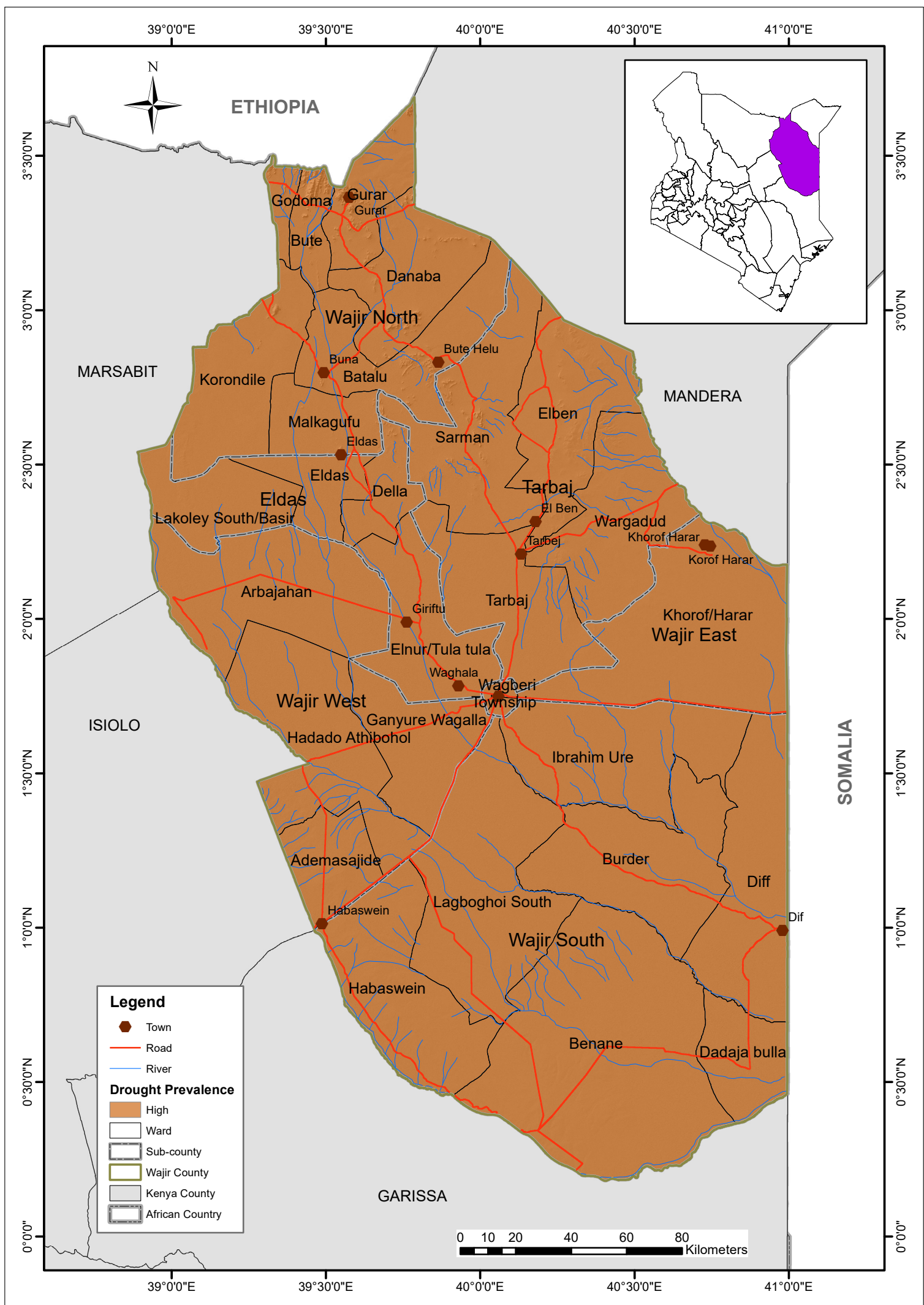


**Data sources:** RCMRD (Drought Assessment by County Sector teams)  
**Administrative Boundaries:** (OCHA ROSEA)

**Spatial reference:** : Geographic WGS 84

This map shows sub-county drought prevalence. This map was developed after county stakeholders' participatory mapping workshop in Wajir County. Drought prevalence is High in all sub-counties.

## Map 3.2: Drought Prevalence in Wards

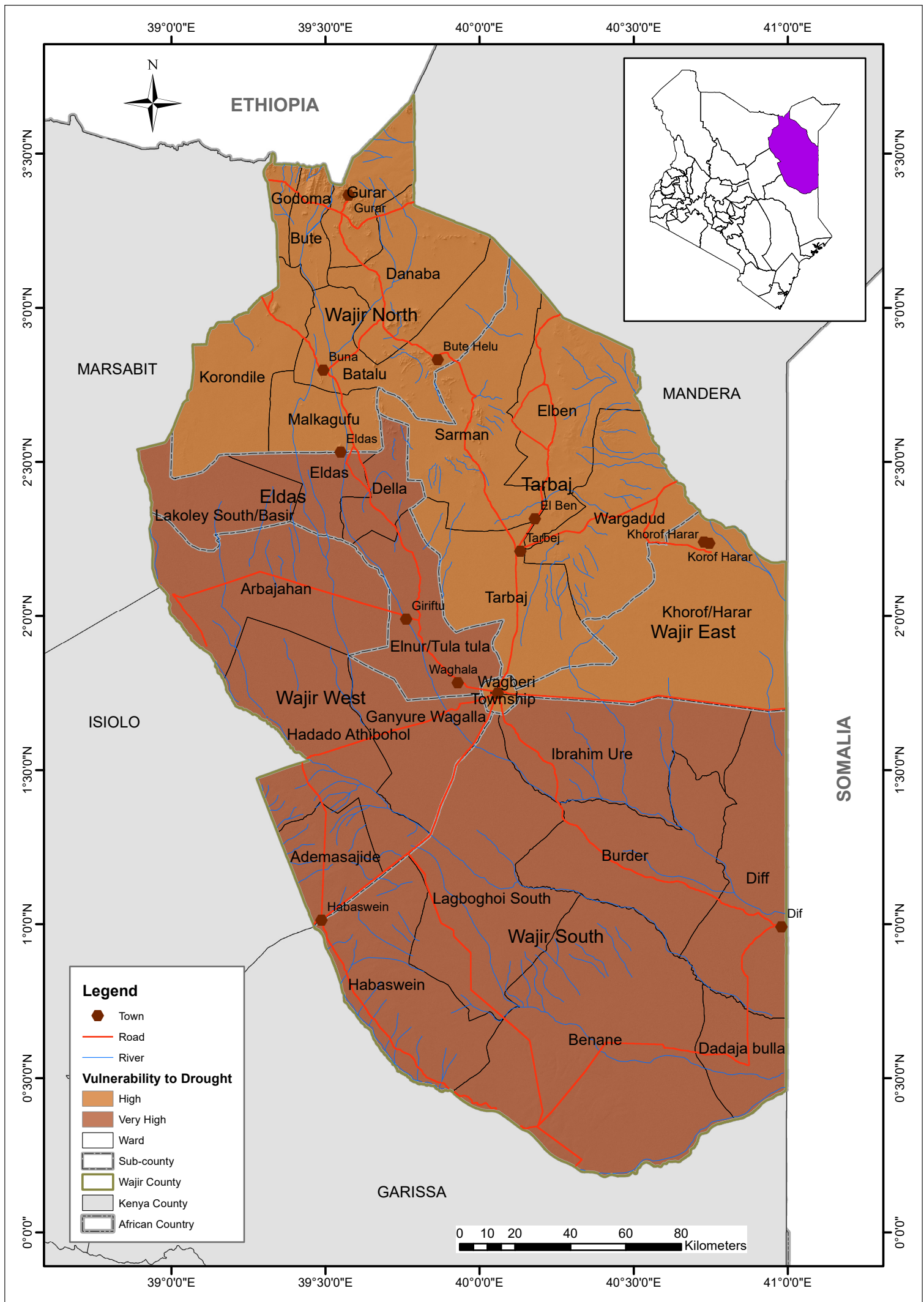


Data sources: RCMRD (Drought Assessment by County Sector teams)  
 Administrative Boundaries: (OCHA ROSEA)

Spatial reference: Geographic, WGS 84

This map shows ward drought prevalence. This map was developed after county stakeholders' participatory mapping workshop in Wajir County. Drought prevalence is High in all wards.

# Map 3.3: Vulnerability to Drought in Sub-counties



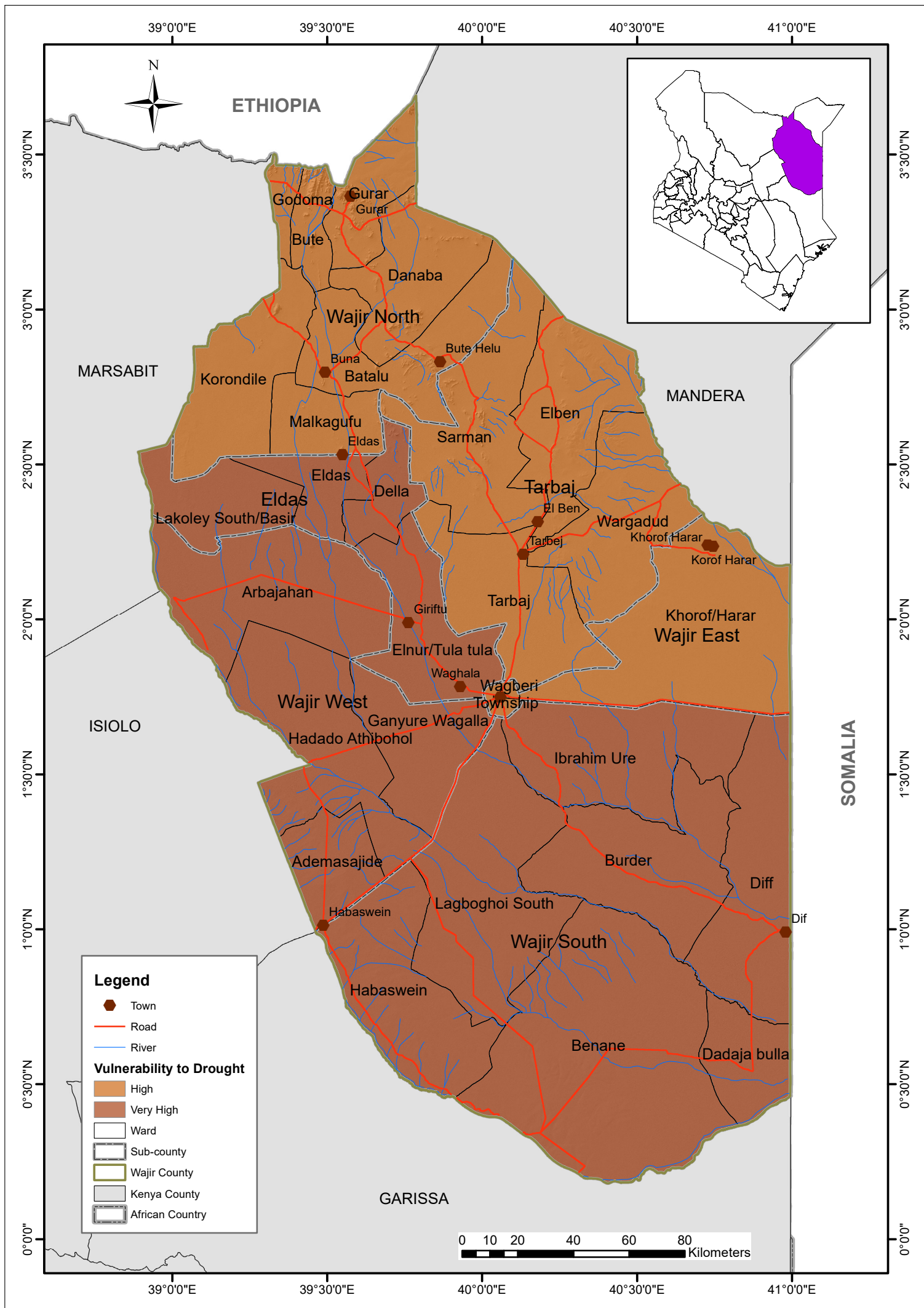
Data sources: UNEP DEWA-GRID

Administrative Boundaries: (OCHA ROSEA)

Spatial reference: Geographic, WGS 84

This map shows sub-county vulnerability to drought. This map was developed after county stakeholders' participatory mapping workshop in Wajir County. Vulnerability to drought is Very high in Wajir South, Wajir West and Eldas. High in Wajir East, Tarbaj and Wajir North.

# Map 3.4: Vulnerability to Drought in Wards



Data sources: UNEP DEWA-GRID

Spatial reference: Geographic, WGS 84

Administrative Boundaries: (OCHA ROSEA)

This map shows ward vulnerability to drought. This map was developed after county stakeholders' participatory mapping workshop in Wajir County. Vulnerability is very high in Hadado/Athibohol, Elnur, Lakoley South/Bair, Benane, Burder, Ibrahim Ure, Eldas, Della, Dadajabula, Habaswein, Lagboghoi South, Diif, Arbajahan, Adamasajide and Ganyure/Wagalla. High in Malkagufu, Batalu, Godoma, Khorof Harar, Elben, Sarman, Tarbaj, Wargadud, Bute, Korondile, Gurar, Danaba, Wagberi, Township and Barwaqo.

# Chapter 4: Conflicts

## 4.1 Introduction

Natural resource conflicts are disagreements and disputes over access to, and control and use of, natural resources. These conflicts often emerge because people have different uses for resources such as minerals, forests, water, pastures and land, or want to manage them in different ways. Disagreements also arise when these interests and needs are incompatible, or when the priorities of some user groups are not considered in policies, programs and projects. Natural resource conflicts are becoming prominent in many pastoral communities in Kenya due to land-use changes, increased human population and increased urbanization. Natural disasters like drought, floods and land degradation either as a result of anthropogenic activities or climate change all fuel resource conflicts in one way or another. Wajir County is prone to conflicts as it falls in the arid and semi-arid area in Kenya. This means that the environment is fragile and greatly affected by hazards like drought that have been affecting the greater horn of Africa in recent years. In 2010/2011 Kenya experienced a major drought which was closely followed by another one in 2017. It is believed that the lack of adequate pasture as a consequence of these droughts force the pastoralist community to migrate to the neighbouring Counties resulting in conflicts. Conflict resolution in the County requires proper planning and consultation of all stakeholders to come up with measures that will mitigate the effects of conflicts or end them completely. Some of the sub-counties that are prone to conflicts in the County include Wajir east, Wajir West, Tarbaj, Eldas, Wajir south and Wajir north.

## 4.2 Types of Conflicts

### 4.2.1 Inter/intra-clan disputes

The inter/intra-clan conflicts in Wajir County are mostly hinged upon the land and the resources that it harbours with relation to land boundaries. Land conflict involves conflicting claims to rights in land by two or more parties (Bruce and Boudreaux, 2013). Land Conflicts in Wajir are attributed to political influences, constituency boundaries, Mushrooming of new settlements, unequal sharing of county resources and competition over water and pasture.

This type of conflict was reported to be most prevalent in Wajir North, Eldas, Wajir West, Wajir South and Wajir East with their respective wards namely Malkagufu, Lakole-Basir, Korondile, Elben, Sarman, Wargadud, Khorof Harar, Habaswein and Banane wards. Hotspots mentioned were such as; Batalu- Buna, Batalu – Ajawa, BojiGaras, GarabBisiq, Habaswein-Ademasajida, Masalale- Masalale, boji yare, fadhiweyn, Aqal Aar, Lakole North- Lakole South,

Basir North- Basir South, Kutulo- Kutulo, Leheley(next to Kutulo), El Rhamu- Khorof Harar, Burmayo- Burmayo, Gunana – Gulani and Wajir Bor East/South.

Some interventions highlighted to be employed in the mitigation of this conflict are such as the beefing up of security in the hotspot areas, proper boundary demarcation, use of early-warning desks while strengthening the inter/ intra clan peace structures.

### 4.2.2 Inter/Intra County boundary Conflicts

Cross-border conflicts take place between two or more communities that share a common border. In Wajir County, this type of conflict is reported to be common along the communities along border areas of Mandera and Wajir counties. These conflicts have been reported to occur in Wajir North, Eldas, Wajir West, Wajir South, Wajir East and Tarbaj Sub-Counties. Wajir and Isiolo/Marsabit county conflict is resource based and not boundary related Wajir and Garissa boundary conflicts along Aqal Aar and Fadhiweyn areas is a boundary related. At the intra-county level there is the issue of Wajir North/Eldas at Lakoley, Masalale and Basir, Wajir West/Eldas at Baqala area, Wajir West/Wajir South at Ademasajida, Wajir East/South at Wajir Bor, Tarbaj/ North at Gunana.

An instance of such a skirmish is one that left 30 people dead, 9 injured and displacement of 12,140 households since 13th May 2014. The clashes have directly affected roughly 10 locations in Tarbaj Sub-County; BojiGaras, Mansa, Ogoralle, Ber Janai, Dunto, Burmayo, Basanechaa, Leheley, Gunana and Belowle in Wajir North (Kenya Red cross). The wards in the aforementioned Sub-Counties that were highlighted as areas where the conflicts occur are such as Sarman ward, Wargadud ward, Elben ward, Tarbaj ward, Khorof Harar ward, Malkagufu ward, Korondile ward, Habaswein ward, Adhemasajida ward and Arbajahan ward. In addition to that, the hotspots highlighted were Batalu-Buna, Batalu – Ajawa, BojiGaras, GarabBisiq, Habaswein-Ademasajida, Masalale- Masalale, boji yare, fadhiweyn, Aqal Aar, Lakole North- Lakole South, Basir North- Basir South, Kutulo- Kutulo, Leheley, El Rhamu- Khorof Harar, Burmayo- Burmayo, Gunana – Gulani and Fadhiweyn & Aqal Aar.

These conflicts increase greatly during the dry spells with pastoralists from neighbouring counties driving their livestock into Wajir and vice versa depending on the areas with pasture at the time of the dry periods, in search of pasture and water. Most of these communities are believed to have possession of firearms thereby leading to the death of humans and livestock, and injuries, (loss of lives and livelihoods, displacements, injuries).

However, political influence and competition and disputes on boundaries were also highlighted as causes that instigate this type of conflict. As a consequence, proper demarcation of boundaries and use of early-warning desks while strengthening the inter/intra clan peace structures are seen as some of the measures that may be used to mitigate this conflict.



**Plate 4.4:** Call for peace as two communities along Wajir-Marsabit border clash (Credits: Wajir County Government; Department of Special Programmes)

#### 4.2.3 Resource-Based Conflicts (Water, Pasture and Livestock)

Resource-based conflicts are attributed to competition for scarce resources such as water, pasture and livestock due to drought effects. Other factors that contribute to such conflicts include overstocking, climate variability and change, environmental degradation, poor rangeland management, political incitement and youth disenfranchisement. Impacts of these conflicts are loss of life, destruction of property, loss of livelihood, slow development and anarchy. Mitigation measures include customizing legislation to address the local needs, enforcing law and order, effective political representation and enact existing laws, enforcement of community policing and engaging the youth in constructive activities.

#### 4.2.4 Gender-Based Violence (GBV)

Gender-based Violence refers to harmful acts directed at an individual based on their gender. This includes sexual, physical, mental and economic harm inflicted in public or in private and mostly affects women. The United Nations High Commissioner for Refugees (UNHCR) estimate that one in three women experience this form of violence in their lifetime. This form of conflict has the potential of increasing in frequency during the displacement of people and in times of crisis. The impacts of this conflict are life-long and are devastating with a high potential to cause psychological trauma and death. In Wajir County, this conflict affects all the Sub-Counties and all wards in the areas.

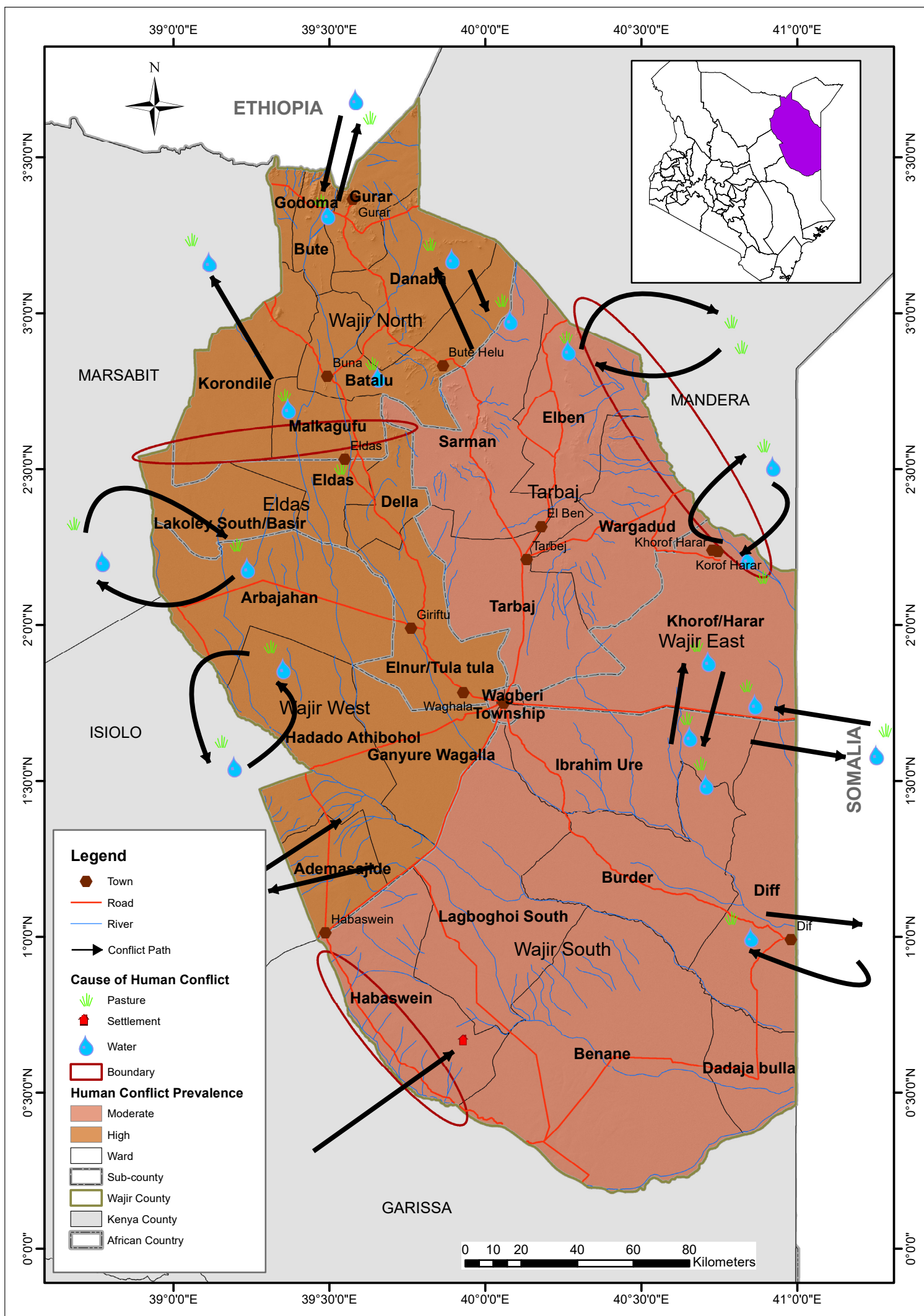
This conflict should be mitigated through the use of counselling modes that allow peaceful resolutions of

family issues and at a county and national level through the legislation of stricter anti-GBV laws Establishing a recovery centre, DNA screening lab social welfare and legal services.

#### 4.2.5 Violent extremism

Violent extremism pursues its social or political goal through violent intimidation of people residing in a given location and the radicalization of youth into extreme beliefs. Essentially terror attacks are intended to place overbearing pressure on the government to give political or social concessions. The ripple effect of the intimidation often extends beyond the area targeted by the violence. Some scholars (Kruger, 2007) argue that even though terrorist attacks focus on a small area of a country's stock of capital, the aftermath normally has outward expanding political and economic consequences. Al-Shabaab has long posed a significant terrorist threat in areas along Kenya's porous border with Somalia.

# Map 4.1: Human Conflict Prevalence in Sub-Counties



Data sources: RCMRD (Human-Human Conflict Assessment by County Sector teams)

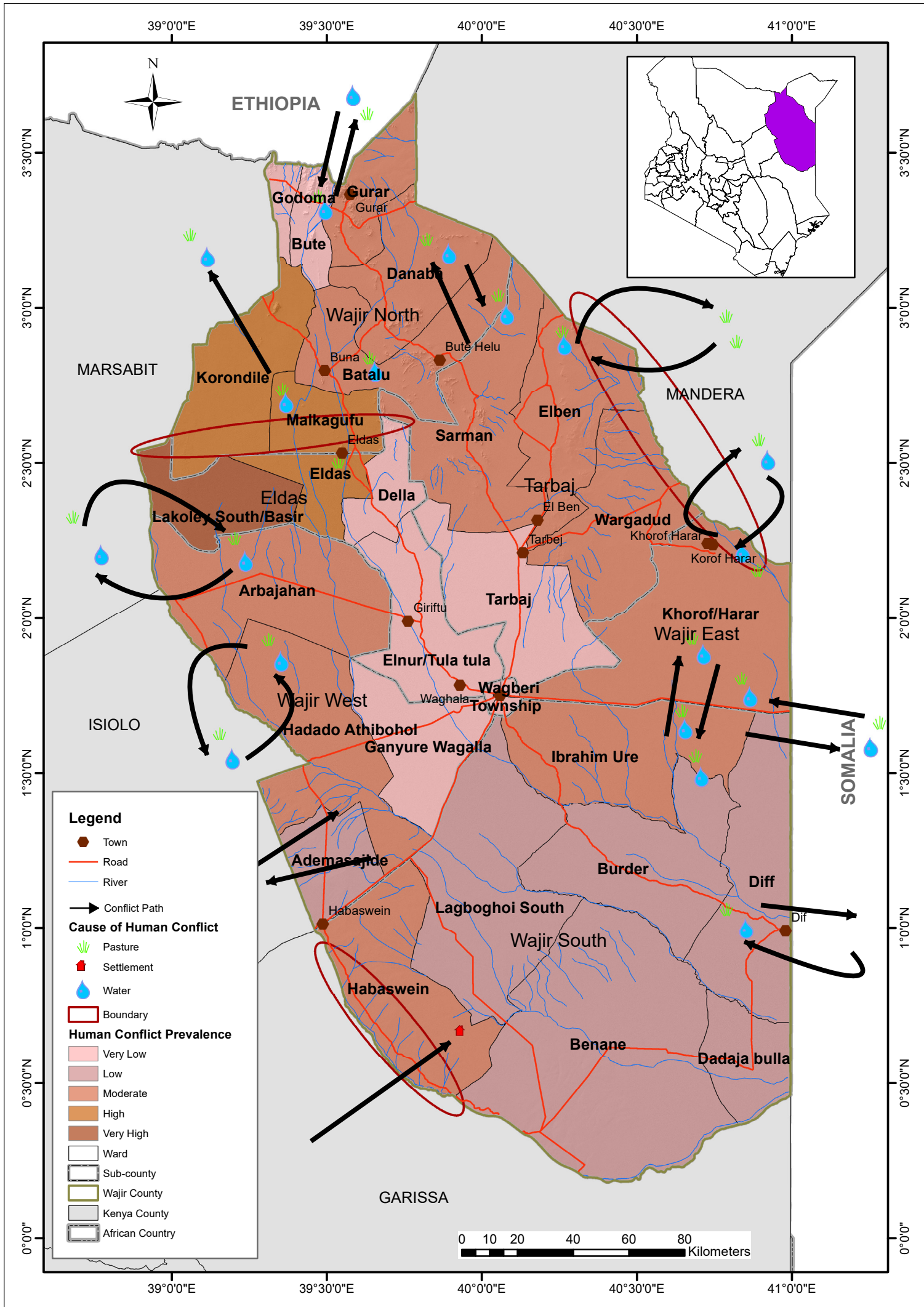
Spatial reference: Geographic, WGS 84

Administrative Boundaries: (OCHA ROSEA)

This map depicts Human-Human conflict incidence. The map was informed through county stakeholders' participatory mapping workshop in Wajir County. Human conflict incidences are high in Wajir West, Eldas and Wajir North Sub-Counties and Moderate in Wajir South, Wajir East and Tarbaj Sub-Counties.



# Map 4.2: Human conflict Prevalence in wards



Data sources: RCMRD (Human-Human Conflict Assessment by County Sector teams)

Spatial reference: Geographic, WGS 84

Administrative Boundaries: (OCHA ROSEA)

This map depicts Human-Human conflict incidence. The map was informed through county stakeholders' participatory mapping workshop in Wajir County. Human conflict incidences are Very High in Lakoley South/Basir Ward; High in Korondile and Malkagufu Wards; Moderate in Habaswein, Hadado/Athibohol, Arbajahan, Gurar, Danaba, Batalu, Saman, Elben, Wargadud, Khorof/Harar and Ibrahim Ure Wards; Low in Ademasajide, Lagboghoh South, Banane, Dadaja Bulla, Diff, Bur-Der; and Very Low in Elnur/Tula tula, Dela, Wagberi Township and Tarbaj Wards.

#### 4.2.6 Human-Wildlife Conflict



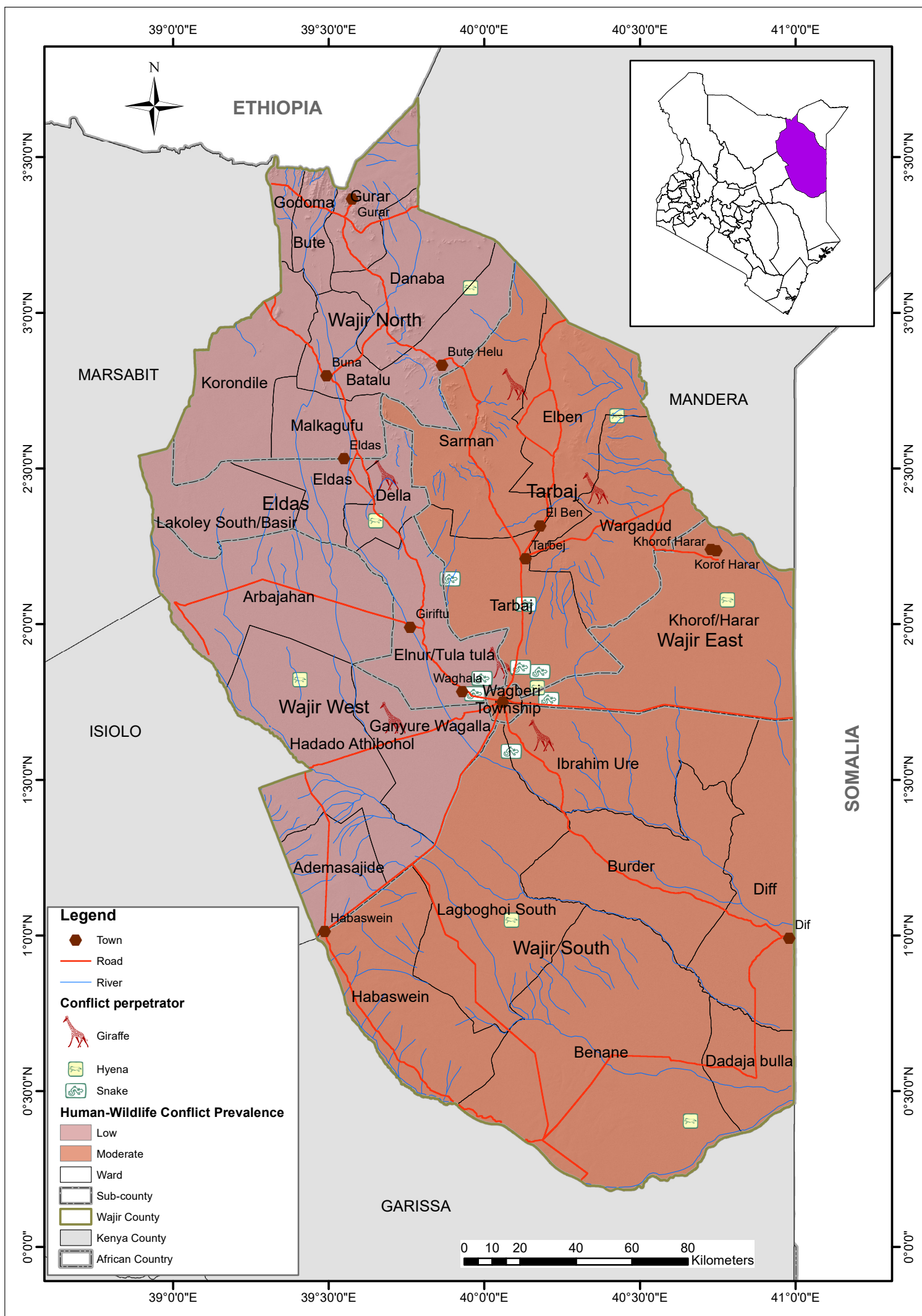
**Plate 4.1:** Wildlife in Wajir County. (Source: RCMRD)

This type of conflict occurs when wild animals interact with human beings in a manner that results in loss of life, injuries, destruction of property and habitat. FAO (2009) indicates that human population growth, an extension of transport routes, increased human settlement, blockage of wildlife migratory corridors, expansion of agricultural, habitat degradation and industrial activities and competition for available natural resources have increased these conflicts. Typical human-wildlife conflict in the county involves infrastructure damage, killing of livestock and poultry by leopards, hyenas and lions, loss of human lives and injuries. This leads to retaliation by the locals at times resulting in the death of wildlife. Major impacts of human-wildlife conflicts include increased crop damage, loss of livelihoods, increased loss of human life leading to higher compensation bills, loss of properties, an increased vulnerability which slows development. The County government of Wajir highlights measures that have been put in place to curb human-wildlife conflicts as electric fencing, translocation of elephants and transfer of tourism proceeds to local communities (Wajir CIDP, 2018). However, more needs to be done to make these efforts effective. It was reported that all the sub-counties Wajir North, Eldas, Wajir West, Wajir South and Wajir East are affected by this conflict with all their respective wards with the exception of those in Wajir town.



**Plate 4.2:** Killed giraffe in Wajir (Source: The Nation)

# Map 4.3: Human-wildlife conflict prevalence in Sub-Counties



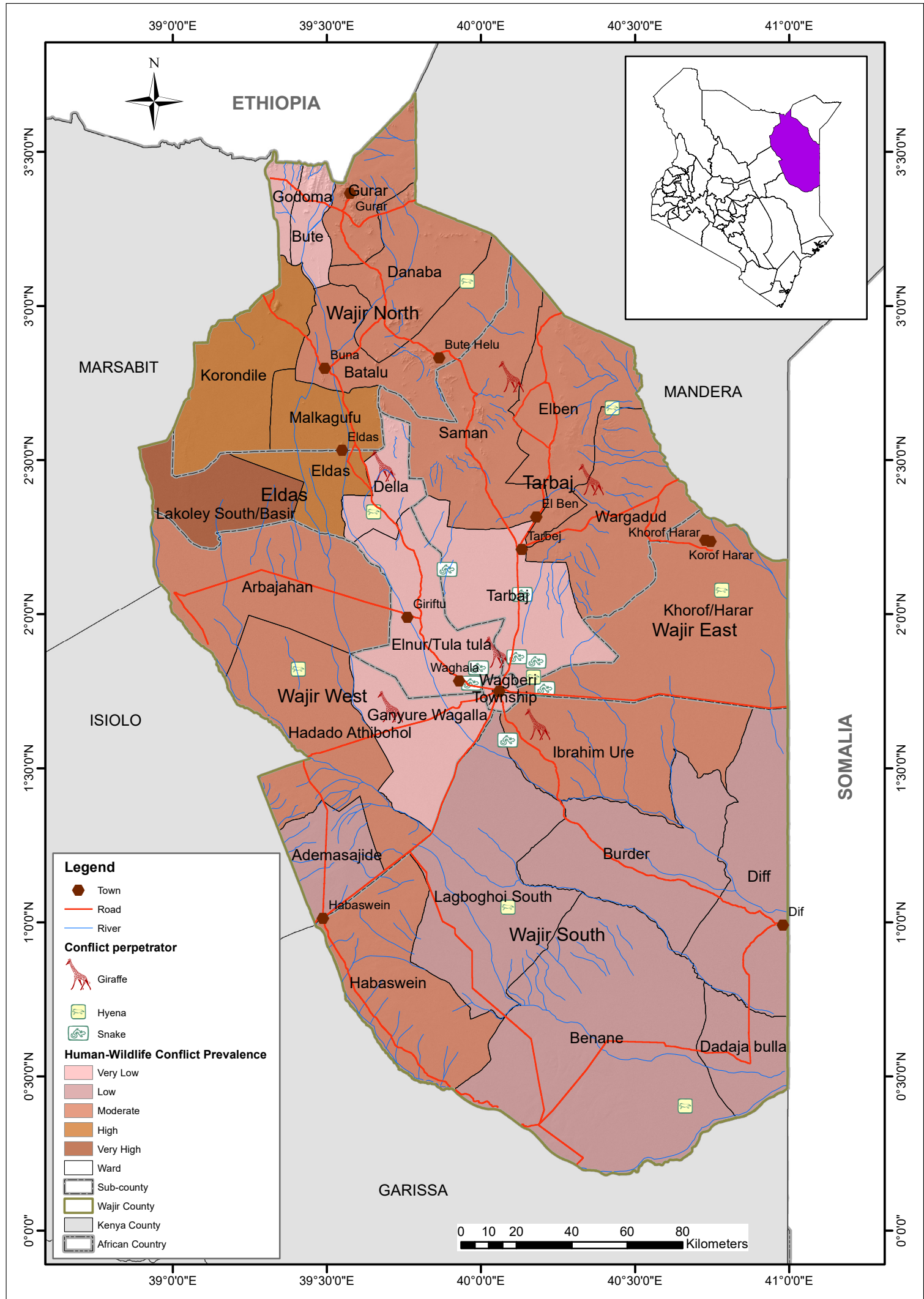
Data sources: RCMRD (Human-Wildlife Conflict Assessment by County Sector teams)

Spatial reference: Geographic, WGS 84

Administrative Boundaries: (OCHA ROSEA)

This map depicts Human-Wildlife conflict incidence. The map was informed through county stakeholders' participatory mapping workshop in Wajir County. Human-Wildlife conflict incidences are Moderate in Wajir South, Wajir East and Tarbaj Sub-Counties; and Low in Wajir West, Eldas and Wajir North Wards Sub-Counties. The wild animals highlighted were Giraffes, Hyenas and Snakes.

# Map 4.4: Human-wildlife conflict prevalence in Wards



**Data sources:** RCMRD (Human-Wildlife Conflict Assessment by County Sector teams)

**Spatial reference:** Geographic, WGS 84

**Administrative Boundaries:** (OCHA ROSEA)

This map depicts Human-Wildlife conflict incidence. The map was informed through county stakeholders' participatory mapping workshop in Wajir County. Human-Wildlife conflict incidences are Very High in Lakoley South/Basir Ward; High in Korondile and Malkagufu Wards; Moderate in Habaswein, Hadado/Athibohol, Arbajahan, Gurar, Danaba, Batalu, Saman, Elben, Wargadud, Khorof/Harar and Ibrahim Ure Wards; and Low Ademasajide, Lagboghol South, Banane, Bur-Der, Dadaja bulla and Diff wards; and Very Low in Ganyure, Wagberi Township, Wagalla, Elnur/Tula tula, Della, Godoma, Bute and Tarbaj Wards

## 4.3 Causes of Conflicts

### 4.3.1 Boundary disputes

Boundary issues and conflicts resulting from this are motivated by resources that are scarce and the demand for these resources that are brought about by the increase in population. These factors are the most prevalent contributing factors towards the occurrence of cross-boundary conflicts and intra-boundary conflicts.

### 4.3.2 Proliferation of Arms

Some of the communities in Wajir County possess firearms leading to escalation of conflicts. The government states that there are illegal firearms in Wajir county. Some of the locals claim that they require firearms to defend themselves from other communities that attack them. Violent conflicts lead to injuries and wanton destruction of property.

### 4.3.3 Politics

Politics play an important role in any democratic society. However, at times politics lead to tension or disputes among the locals due to differing opinions. Some politicians take advantage of the existing situations and peoples' vulnerability to instigate conflicts. Most of the locals are incited by politicians to look for water and pasture elsewhere during the highly heated campaigns. Supremacy related to ethnicity and political representation are some of the issues that politicians dwell on to cause wrangles among the communities. Some of the mitigation measures are mediation, peace meetings, fair representation and civic education.

### 4.4.4 Expansionism

During electioneering period clans frustrate other clans and label them as expansionists in order to block them from registering as voters.

### 4.3.5 Competition Over Scarce Natural Resources

Clan conflicts are a common phenomenon in Wajir County. Conflicts over grazing land and water points are a major source of clan animosity. In Wajir County, some changes in climatic conditions such as erratic rainfall, diminished pasture lands and depleted water supply in catchment areas have been significant contributors to conflicts. This increases competition over the resources among the people during the dry spell and it creates tensions that have led to conflicts over resources.

### 4.3.6 Radicalization

Radicalization is a process of developing extremist beliefs, emotions, and behaviors (Trip et al, 2019). Radicalization has been attributed to some of the conflicts in the Northern

parts of Kenya. Young people are lured to join groups that unleash terror on innocent individuals for reasons that are not clear to the target communities.

### 4.3.7 Social cultural deterioration

Culture and traditions for most communities have been eroded over the years. In many traditional communities there existed norms that dictated their way of life. For instance, upbringing of a child was the responsibility of the society and the land was communally owned within existing structures. Communities have also abandoned the traditional conflict resolution mechanisms. The disintegration of social order has contributed to reduced social cohesion.

## 4.4 Effects of Conflicts

### 4.4.1 Food insecurity

Conflicts have disrupted community's livelihood systems by restricting access to natural resources as well as markets. There are limited opportunities for income generation whereas alternate livelihood avenues suffer from lack of support and this has led to stagnation of incomes and unemployment. The majority of the FGD reported not having enough food. This has also been attributed to them not affording food and unavailability of food in the market. The drought situation reported by NDMA was on alert stage and forecasted to worsen following a depressed poorly distributed rainfall.

### 4.4.2 Loss of lives and livelihoods

Humans, livestock and wild animals always sustain injuries during conflicts. In Wajir County injuries are always sustained when wild animals attack humans due to competition for pasture. Similarly injuries may be caused when people fight over limited resources in the county.

Animals and humans lose lives during conflicts.

Most violent conflicts always destroy property. Loss of property leads to heavy losses to the community. Houses being burnt down causes the residents to migrate to other areas.

### 4.4.3 Displacement of People

Displacement of people from their homes is a common phenomenon with violent disputes. This occurs when one group overpowers the other conflicting party and forces them to leave their homes and farms.

### 4.4.4 Disruption of learning

Conflicts disrupt normal school programs. The schools may remain closed as they are inaccessible. Teachers and students might be forced to remain indoors so as not to get injuries. In some severe cases, schools might be burnt

down and learning materials destroyed in the process.

#### 4.4.5 Disruption of lives and livelihoods

Conflicts disrupt the day-to-day activities that makeup one's life. This includes disruption of the attainment of a person's livelihood through working, students dropping out of school due to the disruption of the education and societal systems and institutions such as health facilities. Displacement of people from the areas in which they reside to other areas also brings about instability in one's life.

#### 4.5 Interventions

1. Pastoralists face increased challenges due to increased droughts, disease outbreaks, land degradation and conflicts as a result of competition for limited resources. The promotion of alternative livelihoods will aid pastoralists in diversifying their sources of income and break overreliance on livestock. Some alternative sources of livelihood include beekeeping for honey and aloe Vera farming in fertile areas with a supply of water, agro-pastoral and agri-business can be practised.

2. The Wajir County Government should also put in place measures in the enactment of their Rangeland Management Act that will be a measure to see the fair and equitable distribution of resources as an attempt in the mitigation of Resource-based conflict, especially among pastoralists.

3. Community sensitization on the importance of wildlife in the community and the community's role in the conservation and protection of wildlife. KWS should also be more effective in their compensations modes when wildlife bring destruction to human lives and livelihoods while having strong surveillance modes that assist in mitigating conflicts between humans and wildlife.

4. Formation of joint grazing/water user committees that will see the fair and equitable use of the resources in the community and mitigate the conflicts that result from competition for resources.

5. Strengthening of the inter/intra County as well Cross-border Peace structures to foster peace within and between communities and clans throughout the entire County with emphasis on areas with those who reside along boundaries and dispute-prone areas.

6. The County government should come up with a land policy that acts as a guideline for land management in the County. Unsustainable land uses need to be avoided and

sub-division of land into small parcels regulated with a minimum land unit.

7. Formulation of county peace policy and bill.

8. Deradicalization/alternative narrative

9. Wajir county CVE Action Plan (WCAP)- its being implemented

# Chapter 5: Environmental Degradation

## 5.1 Introduction

**E**nvironmental degradation is the process by which the natural environment is compromised making it reduce its biological diversity and the health of the environment (GEMET, 2020). The Organization for Economic Co-operation and Development (OECD) defines environmental degradation as the deterioration of the quality of the environment caused by a concentration of pollutants with other activities such as natural disasters and improper land use. Anthropogenic activities cause environmental degradation which makes it difficult for the development of meaningful activities. The effects of environmental degradation are felt in the ability of the ecosystem to provide necessary services to man. For example, deforestation will lead to reduced rainfall, flooding, and even soil erosion which affects the normal ways of living for the people. Different areas experience degradation magnitude depending on the nature of the landscape in that lowlands and the highlands are prone to wind and water erosion. The extents of degradation can be large or small as well depending on the nature of the landscape. Wajir county is in the semi-arid region of Kenya. This means that it is prone to environmental degradation that is caused by unfavourable climatic conditions such as floods and drought and climate change at large. The nature of the ground in most of Wajir County is bare and the soils can be easily blown away by wind and as well washed by floods. Human activities have contributed largely to environmental degradation where anthropogenic factors such as overgrazing, poor land husbandry, excessive forest conversion, and destruction of natural vegetation have been seen to be practised by the people in Wajir County (LADA, 2018).

## 5.2 Causes of Environmental Degradation

### 5.2.1 Deforestation

When forest cover is removed through encroachment, the surface is left bare making it vulnerable to wind and water erosion making it lose its productivity. Deforestation in Wajir County is caused by illegal logging, charcoal burning and increased settlements. The Wajir Climate Risk Profile report indicates that 1.99% of the woodland coverage in the county has been encroached causing several effects such as reduced rainfall and soil erosion. Deforestation has been experienced in the county because most people graze domestic animals in the county. This form of degradation is evident in Wajir North, Wajir East, Wajir West, Eldas, Tarbaj and Wajir South Sub-Counties with Khorof Harar, Ibrahim Urey, Wagalla,

Elnur, Wargadud and Tarbaj Wards mentioned as being affected. Furthermore, Arbaqeyraso, Lafaley, Gunana, Boji yare, Wamadera, Sukela, Kulaaley and Ibrahim Urey areas were mentioned as the hotspots where this form of degradation occurs.

### 5.2.2 Overgrazing and overstocking

Overgrazing can be defined as the practice of grazing too many livestock for a long period on a land unable to recover its vegetation, or of grazing ruminants on land not suitable for grazing as a result of certain physical parameters such as slope. This is the exceeding of a land's carrying capacity. Pastoralists cover a larger area in Wajir County and grazing has been the main activity. As well, wildlife is available in the county making overgrazing a problem. Depletion of soil cover has been experienced exposing it to forces such as wind and water erosion. The loss of fertile soil that supports vegetation growth as well leads to desertification. Most people as well in the county have large heard of livestock which increases overgrazing in the county. The Sub-Counties affected by this degradation are such as Wajir West, Wajir South and Eldas Sub-Counties with Hadado, Basir, Arbajahan and Habaswein Wards mentioned as being affected. Furthermore, Boji areas from Basir to Meri were emphasized as being the hotspots.

### 5.2.3 Pollution

Pollution is the introduction of harmful materials (pollutants) into the environment. These pollutants may be as a result of natural earth forming processes such as vulcanicity which leads to the extrusion of volcanic ash into the air or through anthropogenic activities such as the discharge of raw waste water from domestic and industrial uses into open water features such as rivers (water pollution), burning of fossil fuels (air pollution), or the improper disposal of plastic waste on land (land pollution).

In Wajir County, it is approximated that 98.4 per cent of households depend on wood fuel which is majorly firewood and charcoal for cooking while an estimated 31.5 per cent use kerosene for lighting (KIHBS, 2015). Due to this fact, pollution is a problem which means that it increases the instances of land degradation in the county. Furthermore, the inadequate sanitation facilities in the County especially with regards to pastoralists leave water sources vulnerable to be contaminated by human and animal waste in the event of torrential rainfall or flooding.

This type of degradation is present mostly in Wajir East Sub-County and more particularly in Ibrahimurey, Wagalla, Elnur, Habaswein, Tarbaj, Eldas wards, Barwaqo township and Waberi wards. The wards in Wajir town especially, tend to have a prevalence of all three forms of pollution due to their high density of population as compared to other parts of Wajir.

#### 5.2.4 Poor waste disposal (Unregulated dumping)

This is the uncontrolled disposal of mostly plastic waste and other pollutants that are non-biodegradable or take a long period before they naturally breakdown and decompose. As a consequence of this action of dumping, the land is left unaesthetically pleasing as it is littered and degraded extensively. Furthermore, the action results in the breeding of harmful and disease-carrying rodents such as rats and mice. Also, improper dumping of organic waste leads to air pollution from the smell of the wasted decomposing.



**Plate 5.1:** Pollution through the dumping of plastic waste. (Source: RCMRD.)

This degradation is present in Wajir East, Tarbaj and Eldas Sub-Counties with Ibrahimurey, Wagalla, Elnur and Habaswein wards.

#### 5.2.5 Municipal/Urban Fires

According to the Wajir Climate Risk Profile report, the county covers 1.99% of the total forest cover in Kenya (woodland). This means that any fires affect several phenomena including depletion of vegetation cover that prevents soil erosion from occurring. Several fires have been reported which are mainly caused by locals especially hunters in the region and as an indeliberate result of charcoal burning.

#### 5.2.6 Urbanization

Urbanization can be defined as the transformation of land into a highly populous area with accompanying support and essential infrastructures such as roads and buildings that serve the purpose of commercial, residential, industrial, educational, recreational, public purpose and public utility use systems.

When there is urbanization, the soil and land surface is left compact and bare contributing to land degradation. Most of the vegetation cover is cleared to make sure that there is room for the development of new structures and amenities such as buildings and roads. Moreover, where urbanization is rapid and not effectively planned it may have a deleterious effect on the environment and the overall visual effect of the area. This is brought about by population mushrooming and leads to urban sprawl.

#### 5.2.7 Quarrying

This is the removal of minerals from the ground which requires drilling, digging and the removal of vegetation cover. These activities leave the land derelict and will be unsuitable for use. In Wajir County, quarrying is a major activity that has had several people getting employed in the process. Many parts of the land have been left derelict which means it cannot be used for other activities which were meant for the land.

#### 5.2.8 Sand harvesting

Wajir County has considerable deposits of sand which have been used in the local building industry (Wajir CIDP, 2018). Sand harvesting together with limestone mining in the northern part of the county has vegetation cover at high risk and near extinction of trees such as the Lebi tree. Increased sand harvesting has several effects such as effects in natural river course and river velocity causing problems such as soil erosion. Interventions such as the development of sand harvesting policies should be put in place to make the situation better.



**Plate 5.2:** Degradation of land through sand harvesting. Source: RCMRD



### 5.2.9 Invasive Species(*Prosopis juliflora*)

Invasive species such as *Prosopis juliflora* have had effects in most of the tracts in Kenya's rangelands. Such species have negative impacts on the environment and livelihood systems as it takes most of the land that could have been used for livestock and wildlife grazing as well as prime crop production areas. For Wajir County, *Prosopis Juliflora* has not reached dangerous levels. With regards to this, measures should be put in place to make sure that the invasive species is controlled from spreading over to most areas.



**Plate 5.3:** *Prosopis juliflora* (Mathenge plant) in Wajir County  
**Credits:** P. K. Sirmah

This plant is highlighted to be more prevalent in Wajir West, Wajir South, Wajir East and Wajir North Sub-Counties with Hadado, Arbajahan, Habaswein and Buna wards named as the hotspots where the species is highly populous.

### 5.2.10 Bush fires

Many communities in Kenya have used fire as a tool that is essential in land management. Fires that are experienced range from bush fires, grassland fires, and forest fires. They are common in many parts because, during the dry season, most communities, especially the pastoral communities set fire on grasslands to facilitate the growth of new grass for livestock. On the same note, farmers will use fire to prepare land for cultivation before rains begin. Fire has as well been used in farmlands in breaking bushlands that are impenetrable, in control of parasites, weeds, and pests, and in keeping the wildlife away from homes.



**Plate 5.4:** Spreading bush fire in Lehely area in Wajir County  
**Credits:** Ahmed Salat Ali

Bush fires in Wajir are common because of the activities that the rural community participate in such as charcoal burning and honey hunting. Bush fires such as the one experienced in Bute Godha hills in Ethiopia was caused by honey hunters in Eel Khalu which is in the side of Wajir County. The bush fires cause the destruction of property and even the death of livestock. Major losses of the vegetation are as well experienced meaning that pasture that could have been used for grazing gets limited and in turn affecting livestock.

Bush fires have been experienced in Wajir west and have accelerated aggressively to the areas of Boji-Yarey, and Lehely. They have caused injuries with hundreds of people being evacuated from their homes. This hazard has been difficult to curb due to the strong winds that are experienced in most parts of the county and the parched terrain. In addition to Wajir West, Wajir South, Wajir East, Eldas and Tarbaj Sub-Counties are also highlighted to be facing this challenge with specificity highlighted on Lagboghol, Wagalla and Tarbaj wards and emphasis on Sukela, Boji yare, Arbaqeyranso, Dashekh, Elyunis, Della, along Tarbaj-Griftu road, Dela, Barmesh, Hadado and Salalmaa as the hotspots.

### 5.2.11 Desert Locusts

The outbreak of desert locusts in most parts of Eastern Africa has threatened livelihoods, the environment, food security, and economic development. It has been recorded as one of the highest invasions for more than 70 years (Kimathi, 2020). Wajir County is one of the counties that have been affected by the locusts' invasion. Desert locusts breed extensively in the semi-arid areas where Wajir county falls. The ideal breeding sites for locusts are characterized by vegetation close by, warmth, and sandy soil that has salt and moisture. The breeding rate is high with the female locusts laying eggs between 4 to 6 cm deep in the soil



**Plate 5.5:** Locusts on trees in Gurar, Wajir North **Credits:** Bruhan Makong, NMG

The desert locusts swarm into the country from the northeastern part of Somalia and Ethiopia. The desert locusts have thrived following periods of heavy rainfall that trigger vegetation blooms in arid areas such as Wajir County. Wajir county residents have counted losses especially on existing crops and pasturelands where the pastoral communities were dependent on the survival of livestock. The locusts have been estimated to move an average of 150 kilometres in a day and in turn, the livelihoods of rural residents have been devastated in that the locusts only eat and breed.

The government has put some efforts into curbing the spread of the desert locusts recently by the application of aerial spraying in the county. The measure taken was a relief to the residents who had adopted desperate measures to repel the pests which have threatened food security in the region. Wajir south was the most affected part by the invasion with a big colony settling around the Wajir-Garissa border and invaded through Diff, which is an area that is between Kenya and Somalia border. The colonies of the swarm of locusts also migrated to several parts of the county including Ashabito ward. The spraying has helped much in curbing the spread of the desert

locusts further to the other areas in the county.

## 5.3 Effects of Environmental Degradation

### 5.3.1 Increased Flooding

Environmental degradation makes the soil bare which in turn increases surface runoff. Compaction of the ground leads to it being less capable of absorbing water which will lead to flooding easily.

### 5.3.2 Soil erosion

Soils from exposed agricultural fields always find their way into water bodies leading to eutrophication. As time goes by the sedimentation clogs the waterways. This loss of soil leads to a decrease in soil fertility which as a result leads to a decrease in agricultural production and yield thereby leading to food insecurity.

### 5.3.3 Reduction in Pasture productivity

Arid and Semi-Arid Lands (ASALs) are fragile. Any slight loss in vegetation cover leads to a reduction in animal pasture which means that livestock will be affected in the areas. There is a chance of the livestock starving leading to death and hence affecting the livelihoods of the people.

### 5.3.4 Water Shortages

Environmental degradation due to deforestation or any other reasons such as fire reduces tree cover. A reduced tree cover means that there are chances of minimal rainfall hence the occurrence of drought. When there is a reduction of rainfall, water bodies as well dry up making the survival of humans, animals and plants a problem. Rainfall is an important aspect of food production and the availability of water. Deforestation leads to inadequate rainfall meaning there will be reduced availability of water and reduced food production. Degraded land increases the frequency of food shortages and drought.

### 5.3.5 Loss of habitat

Destruction of ground cover will lead to loss of habitat. As a consequence, microorganisms that live in the soil will be exposed making them die or even become extinct. This means that their importance in the ecosystem will not be utilized fully.

### 5.3.6 Competition for dwindling resources/Human-wildlife conflict

Environmental degradation causes pasture loss, food insecurity, and water shortage. These resources become limited in the ecosystem making competition for the resources high between man and animals. Competition for the minimal resources will eventually lead to human-wildlife conflict and human conflicts which in other cases leads to death.

### 5.3.7 Loss of Soil productivity

Land degradation leads to soil erosion where the topsoil is removed hence depletion of nutrients. Vegetation cover helps in the prevention of wind and water erosion and also helps in the addition of nutrients to the soil through decomposition. The clearance of vegetation cover leads to erosion which in turn affects soil production.



**Plate 5. 6:** Land dereliction in Wajir county **credits:** WASH project

### 5.3.8 Climate change and desertification

The loss of vegetation, soil cover and resultant erosion of fertile soil leaves destabilizes important ecological cycles such as the hydrological and carbon cycle that increase the temperature from the increase of Greenhouse gases (GHG) and reduced rainfall. A combination of these factors leads to the phenomenon known as desertification.

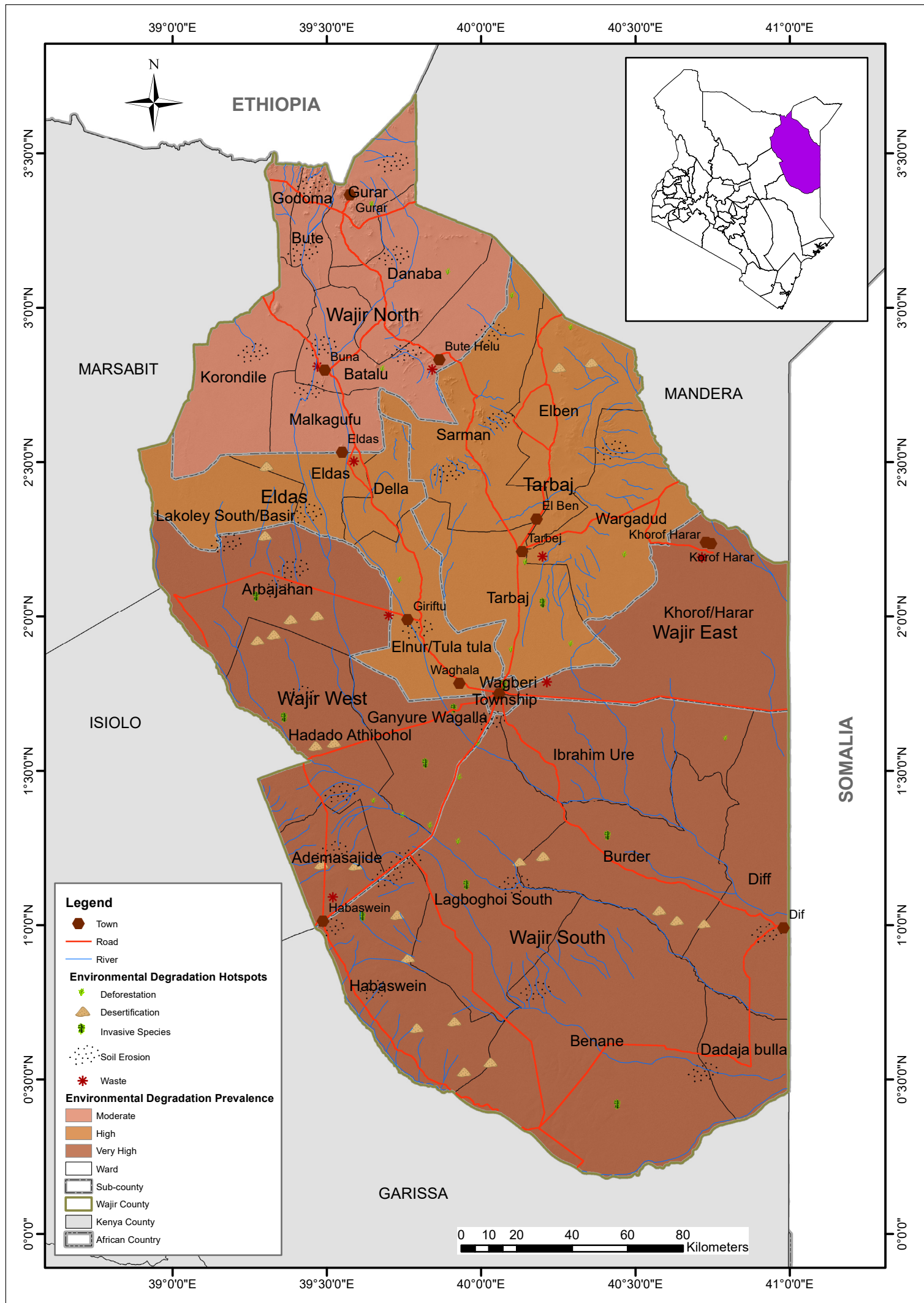
## 5.4 Interventions

1. Afforestation and reforestation practices to be implemented to attempt recovery of vegetation cover and soil conservation as well. This will mitigate and attempt to reverse soil erosion and climate change and halt the process of desertification when the trees are conserved to maturity.
2. Destocking of large herds of cattle especially in areas where there is limited vegetation available to support the herds.
3. Enforcement of policy and legal interventions that support environmental conservation measures and rangeland policies. Emphasis should be made to regulate the charcoal burning practice especially due to the pollution and deforestation that come about from this activity.
4. Construction of gabions to prevent the loss of soil through gully erosions. The gabions should especially be constructed as rill erosion starts to manifest itself along the rills to prevent the worsening of the rills into gulleys and subsequently the increased loss of soil.

5. Diversification of livelihoods away from activities that harm the environment such as charcoal burning

6. Government and private sector investment in waste recycling to mitigate the pollution especially that of water and land through dumping of plastic waste.

# Map 5.1: Environmental Degradation Prevalence in Sub-Counties



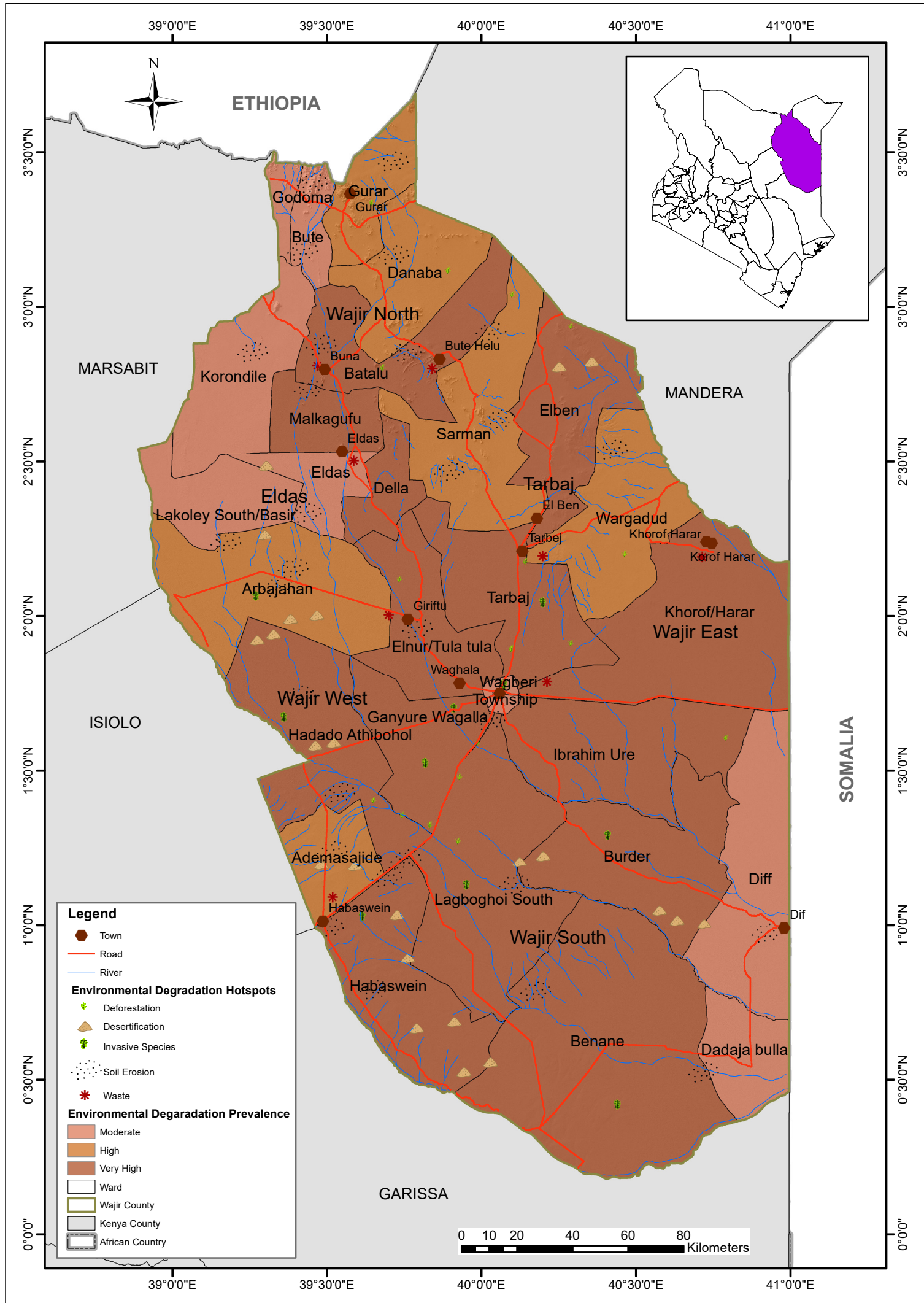
Data sources: : RCMRD (Environmental Degradation Assessment by County Sector teams)

Spatial reference: Geographic, WGS 84

Administrative Boundaries: (OCHA ROSEA)

This map shows Environmental Degradation occurrence in Sub-Counties. The map was generated as a result of being informed by the county stakeholders' participatory mapping workshop in Wajir County. Factors highlighted to cause Environmental Degradation are Desertification, Invasive species, Improper waste disposal and Soil Erosion. Degradation was said to be Very High in Wajir South, Wajir West and Wajir East; High in Eldas and Tarbaj; and Moderate in Wajir North.

# Map 5.2: Environmental Degradation Prevalence in Wards



Data sources: RCMRD (Environmental Degradation Assessment by County Sector teams)

Spatial reference: Geographic, WGS 84

Administrative Boundaries: (OCHA ROSEA)

This map shows Environmental Degradation occurrence in Wards. The map was generated as a result of being informed by the county stakeholders' participatory mapping workshop in Wajir County. Degradation was said to be Very High Banane, Habaswein, Lagboghoh South, Bur-Der, Ibrahim Ure, Khorof/Harar, Tarbaj, Elnur/Tula tula, Wagalla, Ganyure, Hadado/Athibohol, Elben, Della, Malkagufu and Batalu Wards; High in Ademasajide, Arbajahan, Wargadud, Saman, Danaba, and Gurar Wards; and Moderate in Lakoley South/Basir, Korondile, Godoma, Wagberri Township and Bute Wards.

# Chapter 6: Human, Livestock And Crop Diseases And Pests

## 6.1 Introduction

**A** disease is a particular abnormal, pathological condition that affects part or all of an organism (Dor-land's Medical Dictionary). Common human diseases in the County include pneumonia, diarrhoeal diseases, HIV/AIDS, upper respiratory tract infection (URTI), Joint pains (rheumatism and arthritis), ear infection, Urinary Tract Infections (UTI), eye infection, acute malnutrition, hypertension and typhoid. Livestock diseases that are prevalent in the County are foot and mouth, Lumpy skin disease, east coast fever, abortion, contagious bovine pleuropneumonia, coccidiosis, pullorum and Newcastle disease. Occurring crop diseases and pests include maize lethal necrosis disease (MLND), bacterial wilt, smut, fall armyworms, red spider mites and weevils.

The sub-sectors in the health sector include Medical Services, Public Health and Sanitation. Poor health services in Wajir County are attributed to inadequate health workers; high disease incidences of preventable diseases such as malaria, diarrhoea, and HIV/AIDS; inadequate medicines due to the poor supply chain for medicines and inadequate health facilities and services due to skewed budget allocation.

## 6.2 Human Diseases

### 6.2.1 Upper Respiratory Tract Infections (URTIs)

Upper respiratory tract infections are some of the most common illnesses that affect the nose, paranasal sinuses, pharynx, larynx, trachea, and bronchi. URTIs are caused by several families of viruses; including the rhinovirus, coronavirus, parainfluenza, respiratory syncytial virus (RSV), adenovirus, human metapneumovirus, influenza, enterovirus and Boca virus (SA Fam Pract, 2006.) Types of URTIs include rhinitis, pharyngitis/tonsillitis and laryngitis also known as a common cold. Common and rare symptoms include vomiting, sneezing, itchy and watery eye, nasal discharge, cough, shortness of breath, nasal congestion, body aches, foul breath, nasal breathing, reduced ability to smell, fever, scratchy or sore throat, painful swallowing, nausea, fever, sinus pain, runny nose, diarrhoea, headache and malaise. Some of the URTIs are contagious. Control involves covering the nose while sneezing or coughing, avoiding congested areas and proper handwashing ([www.medicinenet.com](http://www.medicinenet.com) & [www.clevelandclinicmeded.com](http://www.clevelandclinicmeded.com)). This disease was highlighted as affecting all sub-counties and all their corresponding wards and villages.

### 6.2.3 Diarrhoea (Shuban/shubanbiyood;Kuendesha)

Diarrhoea is an increase in the frequency of bowel movements, an increase in the looseness of stool or both. It is caused by increased secretion of fluid into the intestine, reduced absorption of fluid from the intestine or rapid passage of stool through the intestine. Symptoms associated with diarrhoea include abdominal pain, especially cramping. Other symptoms depend on the cause of the diarrhoea. Wajir is predominantly semi-arid and experiences persistent water shortage. Households in Wajir walk long distances to fetch water for domestic and economic uses. Diarrhoea is primarily caused by the faecal-oral transmission of pathogens (infectious agents) from the environment to the victim (Shier et al., 1996; Arif and Ibrahim, 1998). That is, pathogens in human or animal faeces are inadvertently ingested. This can occur through several mechanisms. First, "unimproved" water sources, such as open wells, rivers, and streams, may become contaminated by dirty buckets and hands, or by seepage of faecal matter. Second, where sanitation facilities are lacking, faeces are not adequately separated from the human environment, and children may come into contact with faecal matter directly, or through flies that carry pathogens from faeces to food or children's hands and faces. Finally, inadequate hygiene contaminates hands and food through a lack of hand-washing after defecation and before eating and meal preparation. All of these mechanisms of transmission are preventable through basic water and sanitation infrastructure most notably piped water and latrines, and through basic hygiene. This disease was highlighted as affecting all sub-counties and all their corresponding wards and villages.

### 6.2.4 Cholera (Dauun; Kipindupindu)

Cholera, as defined by WHO, (2021) is an acute diarrheal infection caused by the ingestion of food or water contaminated by the *Vibrio cholerae* bacterium. Globally, it is estimated that there are 1.3 to 4.0 million each year with about 21,000 to 143,000 deaths worldwide. The disease is transmitted through the ingestion of contaminated food or water that has cholera bacteria. The symptoms that an infected person can manifest from the infection of this disease are profuse water diarrhoea – sometimes described as rice-water stools, vomiting, thirst, leg cramps and restlessness or irritability. These also lead to clinical symptoms of rapid heart rate, loss of skin elasticity, dry mucous membranes and low blood pressure.

Prevention of this disease hinges on proper hygiene, especially when handling food and proper sanitation practices. In addition to that vaccination is also a mode of prevention of the disease. It was highlighted that cholera affected Wajir East, Tarbaj, Wajir South and Wajir West sub-counties with specificity to Township, Wagberi, Barwaqo, Tarbaj, Sarman, Habaswein, Arbajahan and Ademasajida wards and Township, Hodhan, Barwaqo, Makoror, Wagberi, Halane, Tarbaj, Dambas, Sarman, Mathalibah, Habaswein, Arbajahan, Kanchara and Gotade villages.

### 6.2.5 Typhoid (Homa ya matumbo)

Typhoid is a bacterial infection caused by the bacteria *Salmonella typhi*. It is acquired by taking contaminated water or food infected with faecal matter. Major symptoms include high fever, diarrhoea, vomiting, weakness, rash, stomach pains, headache, constipation and loss of appetite. Severe cases may lead to complications or death. Treatment is by administering antibiotics. Prevention is through access to safe water and adequate sanitation, health education, appropriate hygiene among food handlers, and typhoid vaccination are all effective strategies for prevention and control of typhoid (WHO).

### 6.2.6 Measles (Jidaca; Surua)

Measles (Rubeola) is a highly contagious, serious disease that is caused by a virus (WHO, 2019). It is a respiratory illness that is characterized by a red, blotchy rash. It is also known as 10-day measles or red measles. The virus lives in the mucus in the nose and throat and spreads from one child to another through contact with fluid from the nose and throat and also spread by the aerosolization of saliva of an infected child through coughing and sneezing (Stanford Children's Health, 2021). In 2018, WHO reckons more than 140,000 people died from measles with the majority being children under 5 years of age. On the same note, 2020 saw a measles outbreak in 15 African countries including Kenya as highlighted by the CDC (2020).

There is no specific antiviral treatment that exists for the measles virus. The medical treatment that is offered is with regards to supportive care that seeks to alleviate the symptoms that the virus is characteristic of. This includes good nutrition, adequate fluid intake and treatment of dehydration. The persons at risk are unvaccinated young children, unvaccinated pregnant women and any non-immune person; that is those who have not been vaccinated or were vaccinated but did not develop immunity.

As shown, vaccination against the disease, especially for children under 5 years is the most efficient mode of

prevention of this disease. WHO recommends the use of the vaccine terming it as safe, effective and inexpensive. It may also be viewed as convenient since the vaccine is incorporated with rubella and/or mumps vaccine.

Measles was highlighted as being prevalent in Wajir West, Wajir South, Tarbaj, Wajir North and Wajir East sub-counties. Moreover, wards in these sub-counties, the wards that are affected are Handaki East, Wagalla/Ganyure, Arbajahan, Diif, Elben, Tarbaj and Godoma and the villages are Ganyure, Griftu, Diif, Mansa, BojiGaras, Haragal, Lafaley and Watiti. Wajir county was among the 22 high risk counties for measles. The county participated the MR2 campaign and had a coverage of 91%.

### 6.2.7 Rift Valley Fever - RVF(Sandig)

RVF is a viral zoonosis that primarily affects animals. However, it also has the capability of infecting humans with the infection being severe in both human and animal infection. Its transmissibility in humans is a result of direct or indirect contact with the blood or organs of infected animals. This can occur by handling infected tissue when slaughtering or butchering or while assisting animal births, conducting veterinary procedures, or from the disposal of carcasses or foetuses. As a result of this, specific occupational groups such as herders, slaughterhouse workers and veterinarians are therefore exposed more to possibilities of being infected. In addition to that, there is also a possibility of infection when one ingests the unpasteurized or uncooked milk of infected animals. A person can also be infected by being bitten by infected mosquitoes. However, there has been no evidence of human-to-human infection of RVF (WHO, 2018).

The disease is characterized by fever, weakness, back pain and dizziness with those infected recovering within two days to one week from when the symptoms manifest themselves. There are however those (8%-10%) who develop much more severe symptoms. RVF was highlighted to be prevalent in Eldas and Wajir East. The 2018 RVF outbreak the two Sub-Counties with 86 cases in Eldas and 2 cases in Wajir East.

### 6.2.8 HIV and AIDS(Ukimwi)

HIV and AIDS have led to high dependency at a household level, increased cost for treatment of opportunistic infections and a high number of orphans. HIV prevalence rate is at 0.1% in Wajir county with 6 treatment centers that offer services to HIV patients. The productive population is declining to lead to the inadequacy of the much-required skilled labour force. The agriculture and rural development

sector are being threatened by the death of the most active group leading to a decrease in production and also through misdirection of the meagre resources by the rural population to measures aimed at reducing the pandemic. Household with people living with HIV and AIDS spend a large proportion of their expenditure on health care thus reducing savings and investments. HIV and AIDS also increase the pressure on the already overstretched health services. In addition to diverting productive time to caring for the sick particularly for women, HIV and AIDS contribute to an increase in school dropout rates and/or irregular school attendance as affected children look after ailing parents thus lowering education quality. All these ultimately negatively affect the social and economic development of the county.

### **6.2.9 Cancer(Kansar; Saratani)**

Cancer is the name given to a collection of related diseases. In all types of cancer, some of the body's cells begin to divide without stopping and spread into surrounding tissues. Cancer can start almost anywhere in the human body, which is made up of trillions of cells. Cancer is said to be a genetic disease however exposure to other environmental factors such as chemicals in tobacco smoke and radiation can lead to the disease. There are a hundred types of cancer. Challenges such as late detection, lack of equipment in the hospitals and financial constraints may lead to death or increased suffering. Screening should be done regularly to detect abnormal changes in the cells (National Cancer Institute, 2016). The available higher level facilities in Wajir County has capacity to screen for cancer. However diagnostic service are not available at the referral hospital. Patients or samples are referred to Garissa and/or Nairobi.

### **6.2.10 Malnutrition (Nafaqadarro; Utapiamlo)**

Malnutrition refers to deficiencies, excesses, or imbalances in a person's intake of energy and/or nutrients (WHO). Various forms of malnutrition include wasting, stunting, underweight, and deficiencies in vitamins and minerals (WHO). Symptoms in children include failure to grow at the expected rate, both in terms of weight and height, changes in behaviour, such as being unusually irritable, sluggish or anxious, changes in hair and skin colour (NHSInform). Wajir County's Global Acute Malnutrition (GAM) is at 17.9% while severe Acute Malnutrition (SAM) is at 2.2%. The prevalence of underweight and stunting was 14.5% and 10% respectively. (Wajir County SMART survey report-July 2021). This disease was highlighted as affecting all sub-counties and all their corresponding wards and villages.

Health and nutrition are very closely linked. There is spike of malnutrition during drought. Morbidity remains a key driver to malnutrition in the county. URTI, Diarrhoea and pneumonia are the top 3 causes of malnutrition and poor dietary diversity infection cycle. Diseases contribute to undernutrition due to poor uptake of vital nutrients. Undernutrition makes the individual more susceptible to diseases. The cause of undernutrition is multifaceted which include inadequate dietary intake and/or diseases, inadequate sanitation and poor hygiene practices, economic, social and political but not limited to environmental factors. In conclusion, undernutrition unlike other diseases can occur anytime of the year regardless of whether there is drought or not.

### **6.2.11 Kala-azar (Visceral leishmaniasis)**

World Health Organization (WHO) describe kala-azar as fatal if left untreated in over 95% of the cases. The disease is characterised by irregular bouts of fever, weight loss, enlargement of the spleen and liver, and anaemia. The disease is spread through the transmission and infection of Leishmania parasites that are propagated through the bites of infected female phlebotomine sandflies that feed on blood to produce eggs. The prevention and control of this disease require an assortment of intervention and strategies such as early diagnosis and effective prompt treatment and the control of the disease-carrying vector (WHO, 2020). Kala-azar was highlighted to be affecting Wajir East, Wajir West, Wajir South, Eldas and Wajir North sub-counties with specificity to khrof harar ward (Gumarey area), Arbajahan, Hadado/Athibohol, Basir/Lakolle, Eldas, Dela, Habaswein and Korondille wards and Arbajahan, Griftu, Adanawale, Baji, Athibohol, Basir, Eldas, Abdiwaqo, Dilmanyale, Uthole, Bulla and Korondile villages.

### **6.2.12 Skin Diseases**

Skin diseases in Wajir County are attributed to poor sanitation, contaminated and inadequate water, poverty, poor nutrition, drought, malaria and intestinal parasitic infections. Common skin diseases include rashes, hives, eczema, acne and moles. Signs of skin diseases are itchiness, swelling, redness, rash, flaky, scaly skin, blisters, oozing, bumps or growths. Treatment is by use of ointments, creams, sprays, gels, and other treatments applied directly to the skin. In some cases, doctors may prescribe oral or injectable medicines (www.health.com).

### **6.2.13 Diabetes (Cudurkasokorta/Sokorow;Kisukari)**

Diabetes is a chronic disease that occurs either when the body becomes resistant to the insulin produced hence cannot use it effectively or when the pancreas does not



produce enough insulin. Insulin is a hormone produced by the pancreas that regulates blood sugar. As a consequence, one who has high unregulated blood sugar over time ends up having serious damage to multiple body systems especially nerves and blood vessels. Due to this, diabetes may result in blindness, kidney failure, heart attacks, stroke and lower limb amputation (WHO, 2020). The prevalence of this disease is rising more rapidly in low- and middle-income countries than in high-income countries. Incidence of diabetes has been on the rise for the last 5 years. High numbers of new cases have been recorded since the establishment of NCD clinic in Wajir county referral hospital. Prevention measures have been put in place through awareness on diabetes control and management.

#### 6.2.14 Hypertension (Shinikizo la damu)

Hypertension, also known as high or raised blood pressure, is a condition in which the blood vessels have persistently raised pressure. The World Health Organization reckons that the risk factors include unhealthy diets such as excessive salt consumption, a diet high in saturated fat and trans fats, low intake of fruits and vegetables. In addition to that, physical inactivity, consumption of tobacco and alcohol, and being overweight or obese. It is estimated that 1.13 billion people worldwide have hypertension with the most about two-thirds living in low- and middle-income countries.

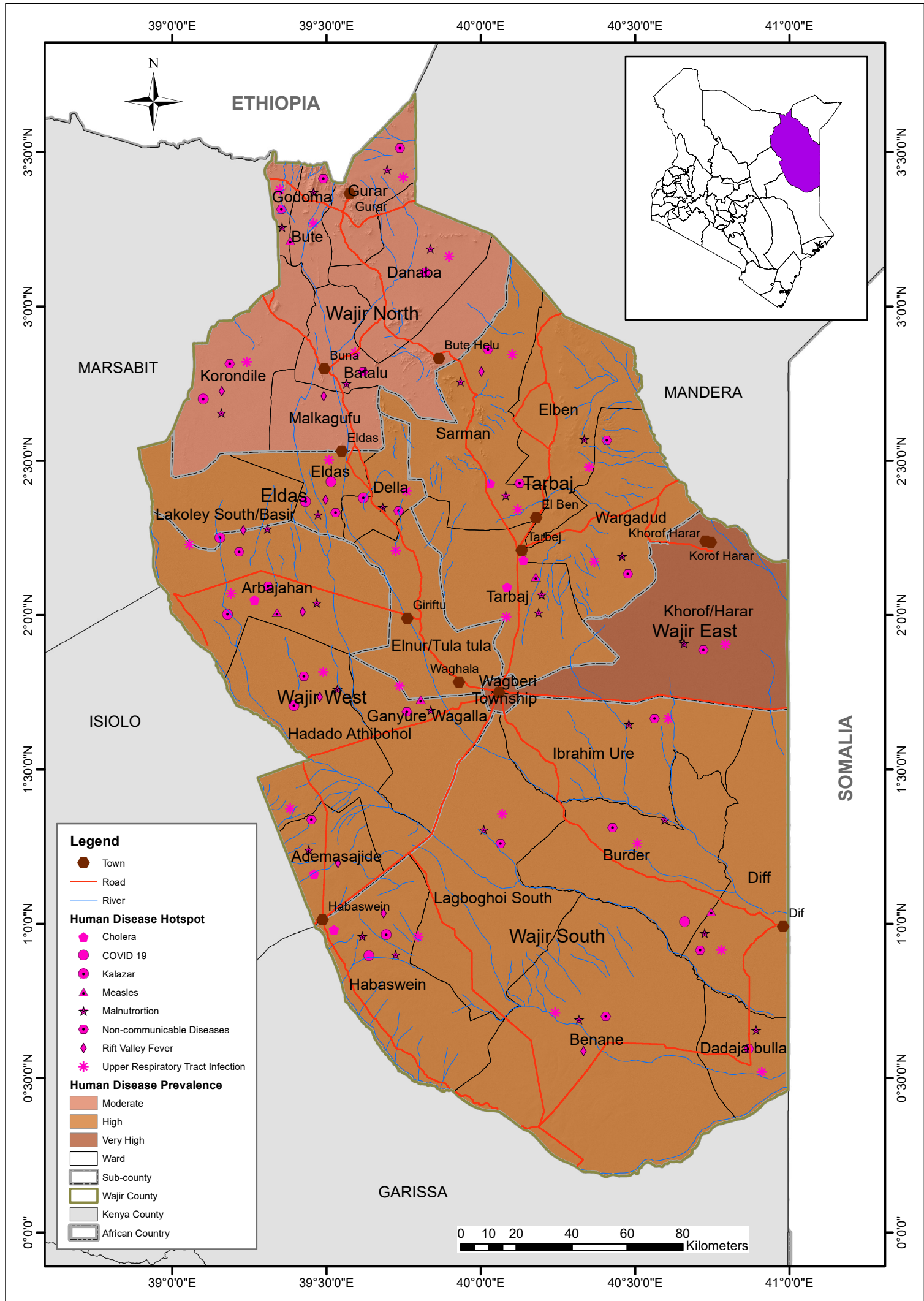
Furthermore, in most instances, hypertension is referred to as a silent killer since most people with the condition do not know they are suffering from it. However, when symptoms do occur, they include early morning headaches, nosebleeds, irregular heart rhythms, vision changes and buzzing in the ears. In severe cases, the disease can cause fatigue, nausea, vomiting, confusion, anxiety, chest pain and muscle tremors (WHO, 2019).

#### 6.2.15 COVID-19 (Corona Virus Disease 2019)

Corona Virus Disease 2019 is a communicable respiratory disease caused by a new strain of coronavirus that causes illness in humans. COVID-19 affects different people in different ways. Most infected people will develop mild to moderate illness and recover without hospitalization. The most common symptoms include fever, dry cough and tiredness. Less common symptoms include aches and pains, sore throat, diarrhoea, headache, loss of smell or taste and a rash on the skin. COVID 19 spreads from person to person through infected air droplets that are projected during sneezing or coughing. It can also be infected when humans have contact with hands or surfaces that contain the virus and touch their eyes, nose, or mouth with the

contaminated hands. COVID-19 was first reported in China, but it has now spread throughout the world. Several cases of infected people have been confirmed since the day the Covid-19 pandemic was spotted in Kenya. On May 1st 2020, 15 people were among the confirmed cases in Wajir Town. Wajir county now has so far recorded 287 positive cases, with fatalities of 22 and CFR of 7.6%. The affected were 222 male and 65 female across the 6 sub counties of which 83 % are from Wajir East. The male are on the lead in morbidity and mortality.

# Map 6.1: Human diseases prevalence in Sub-Counties



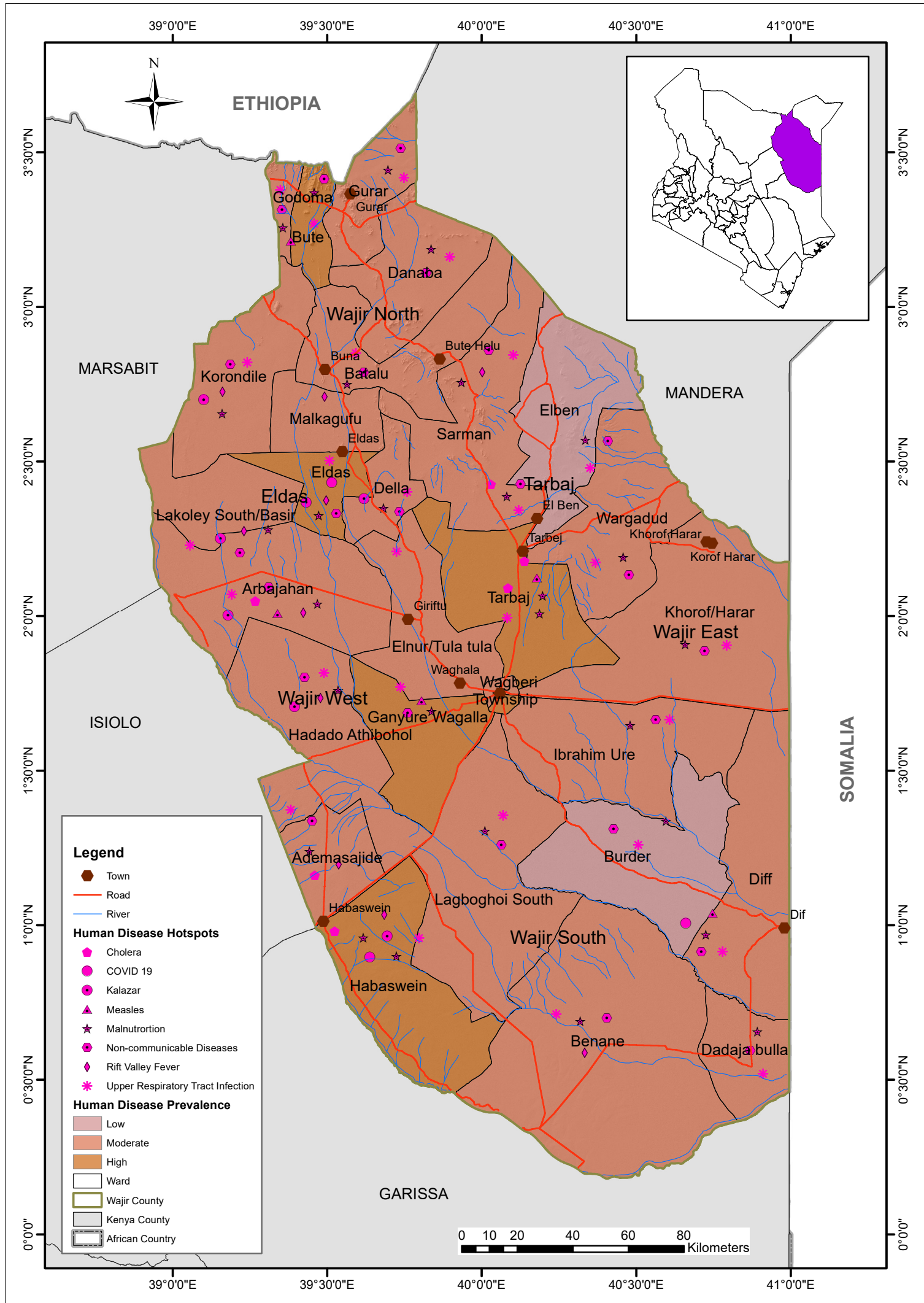
Data sources: RCMRD (Human Diseases Assessment by County Sector teams)s

Spatial reference: Geographic, WGS 84

Administrative Boundaries: (OCHA ROSEA)

This map shows Flood occurrence in Sub-Counties. The map was generated as a result of being informed by the county stakeholders' participatory mapping workshop in Elgeyo-Marakwet County. Flooding was said to be High in Marakwet East, Moderate in Keiyo South, Low in Keiyo North and Very Low in Marakwet West.

# Map 6.2: Human diseases prevalence in Wards



**Data sources:** RCMRD (Human Diseases Assessment by County Sector teams)  
**Administrative Boundaries:** (OCHA ROSEA)

**Spatial reference:** Geographic, WGS 84

This map depicts the human diseases incidence in Wards. The map was developed as a product of stakeholders' participatory mapping workshop in Wajir County. Human Diseases incidence is High in Habaswein, Ganyure, Wagalla, Wagberi Township and Bute Wards; Moderate in Banane, Lagboghol South, Ibrahim Ure, Dadaja Bulla, Diff, Ademasajide, Hadado/Athibohol, Arbajahan, Elnur/Tula tula, Lakoley South/ Basir, Korondile, Malkagufu, Della, Batalu, Danaba, Gurar, Godoma, Saman, Wargadud and Khorof/Harar Wards; and Low in Elben Ward.

### 6.3 Impacts of Human Diseases

- Reduced human productivity
- Lowers economic growth
- Reduced body immunity
- Low enrolment in schools
- Lack of involvement in development projects
- The increased cost of treatment
- Increased poverty level
- Food insecurity
- Acute Malnutrition: This is caused by diseases and inadequate food intake and other underlying causes  
Poor sanitation, contaminated and inadequate water and poor child care practices
- Overwhelmed health systems as a result of the outbreaks. This can be in regards to health personnel, Pharmaceuticals/ non-Pharmaceuticals supplies, nutrition supplies and ambulatory services.
- Increases mortality rates

### 6.4 Interventions

- Health Education on water treatment and handwashing at the community level.
- Dissemination of key messages through local media on hazard and preventive measures
- Integrated outreaches and mass screening for undernutrition at the community level especially the hard-to-reach areas
- Procurement and provision of water purification materials
- Health nutrition education promotion at all levels
- Prepositioning of Nutrition, pharm and non-pharm supplies at county and sub-county central stores  
Increase food security
- Timely treatment is critical to prevent mortalities
- Strengthen the laboratories for ease of detection of waterborne & vector-borne diseases
- Timely disposal & management of solid waste
- Outsourcing of ambulatory services
- Training of emergency response teams
- Prepositioning of Insecticide-treated bed nets (ITNs) in case of floods
- Provision of water treatment supplies
- Adequate personnel and health equipment
- Plan to work with various sectors in addressing the needs of the vulnerable groups before, during and after a crisis.

### 6.5 Livestock Diseases

Livestock production is the main economic activity in the rangeland where local breeds of both cattle and small ruminants mainly goats are kept in large numbers with very few crosses of improved breeds. Though livestock population are high, production has remained low due to low-quality breeds compounded with poor husbandry and

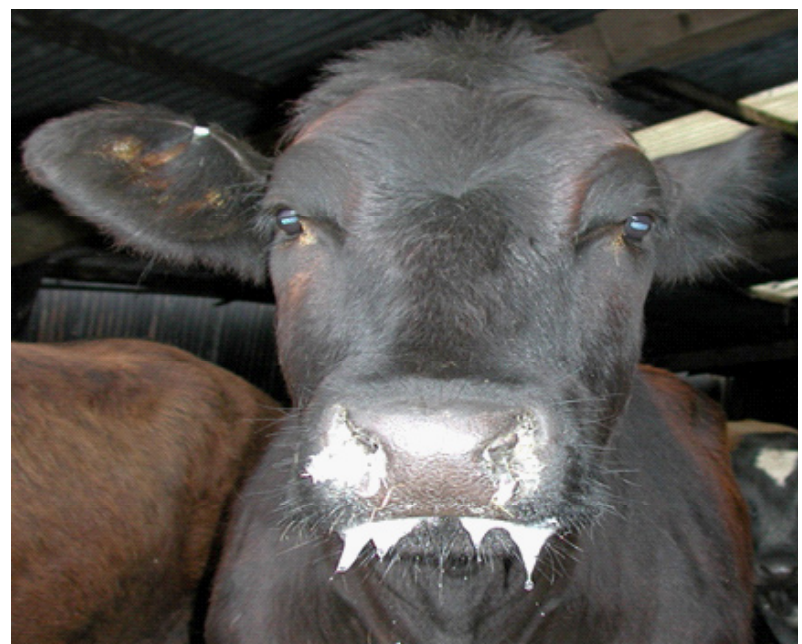
high incidences of pests and diseases. Livestock diseases compromise animal welfare, reduce productivity, and can infect humans. Livestock diseases in Wajir County include foot and mouth, lumpy skin disease, contagious bovine pleuropneumonia, east coast fever, coccidiosis and Newcastle disease

#### 6.5.1 Foot and Mouth Disease – FMD (Habeab)

Foot-and-mouth disease (FMD) is a highly contagious acute viral infection of cloven-hoofed animals including domesticated ruminants and pigs and more than 70 wildlife species and is one of the most important economic diseases of livestock (Coetzer et al., 1994, Broonsvoort et al., 2004). The disease is characterized by fever, loss of appetite, salivation and vesicular eruptions in the mucosa of the mouth, skin of the interdigital spaces and coronary bands of the feet and teats. It is also characterized by high morbidity and low mortality (Coetzer et al.,1994).

The disease spreads rapidly by the movement of infected animals or mechanically on fomites such as clothing, shoes, vehicles, and veterinary instruments. The reasons for the rapid of spread to fully susceptible populations is due to the highly infectious nature of the virus, the production of high titre in respiratory secretions and the large volumes of droplets and aerosols of the virus shed by infected animals. The stability of virus in such droplets, the rapid replication cycle with very high virus yields and the short incubation period begins (Sellers, 1971).

FMD is prevalent in Wajir North, Eldas, Wajir West and Wajir South Sub-Counties with hotspots in all the wards in Wajir North, Eldas, and Basir/Lakolle, together with Arbajahan, Hadado/Athibohol, Diif, Dadajabulla administrative wards. All villages in these wards were highlighted as hotspots by the stakeholders.



**Plate 6.3:** Cow that exhibits signs of foot and mouth disease (Source: <https://www.farmbizafrica.com/10-smart-farms/3372-farmers-use-salt-and-ash-to-tackle-deadly-foot-and-mouth>)

### 6.5.2 Trypanosomiasis/Nagana (Sura/dukan)

Trypanosomiasis is a disease caused by parasites in the *Trypanosoma* genus that affects both domestic and wild animals. It also affects humans and is referred to as sleeping sickness. However, in domestic animals where it is referred to as Nagana, WHO (2020), describe it as being a major obstacle to the economic development of the affected rural areas.

The symptoms that the disease manifests in cattle are such as; cattle becoming thinner, the hair having a rough and upstanding appearance, tight skin over the ribs and pelvis, discharge from the eye, younger animals have their tail bush falling off. Mitigation measures of this hinges upon the vector control of tsetse flies that carry the parasites.

This disease is most prevalent in Wajir West, Wajir South, Eldas, Wajir East and Wajir North Sub-Counties with hotspots in Arbajahan, Hadado/Athibohol, Ademasajida, All wards in Wajir South and Eldas, Khorofharar, Korondille and Batalu administrative wards. All villages in these wards were highlighted as hotspots by stakeholders.

### 6.5.3 Contagious Bovine Pleuropneumonia (CBPP)

Contagious Bovine Pleuropneumonia is a highly infectious disease of the cows caused by *Mycoplasma mycoides*. CBPP is spread mainly by inhalation of droplets from infected coughing animals, especially if they are in the acute phase of the disease. Symptoms include inappetent animal with moderate fever, followed by coughing, thoracic pain and increased respiratory rate. As pneumonia progresses, there is laboured respiration and dyspnoea, and animals prefer to stand with elbows abducted to decrease thoracic pain and increase chest capacity (World Organization for Animal Health, 2018). Treatment is by the use of antibiotics. Quarantine of afflicted animals can be used to control the spread.

### 6.5.4 Lumpy Skin Disease – LSD (Kuskus)

Lumpy skin disease is a viral disease of cattle that is spread by biting insects. Less commonly, the virus may be spread by direct contact to the skin lesions, saliva, nasal discharge, milk, or semen of infected animals. The virus, which is closely related to the poxviruses of sheep and goats and causes nodular skin lesions on the animal's body. The most apparent sign is multiple nodules on the body, including the muzzle, nostrils, head, neck, back, legs, scrotum, perineum, udder, eyelids, nasal and oral mucosa and tail. Other signs include fever, loss of appetite, discharge from the eyes and nose; drop in milk production and weight loss (CFSPH, 2018). Treatment involves the use of strong antibiotic therapy. Prevention includes control of vector (mosquitoes and other biting flies) and quarantine of infected animal.

LSD is prevalent in Wajir South Sub-County with hotspots highlighted as all wards in Wajir South together with Hadado/Athibohol ward and all the villages in these wards affected.



**Plate 6.4:** Cow suffering from lumpy skin disease (Source: [www.tieraerzteverlag.at](http://www.tieraerzteverlag.at))

### 6.5.5 Middle East Respiratory Syndrome (MERS)

OIE (2019), define MERS as a viral respiratory infection of both humans and dromedary camels caused by a virus called Middle East Respiratory Syndrome Coronavirus (MERS-CoV). The disease was first reported in 2012 in Saudi Arabia. Dromedary camels have been said to be the natural hosts and zoonotic source of the infection when it is transmitted to humans.

However, there is limited evidence that has depicted the possibility of infection of domestic animals with MERS after being in contact with infected dromedary camels. The symptoms exhibited by infected animals are such as the secretion of mucus from the nose, respiratory challenges that make breathing difficult, fever and lack of appetite.

Due to the brief history of the disease, little is known about the disease with few studies carried out to learn about its epidemiology. As a consequence, there is limited information on the ways to prevent or treat the disease.

MERS was highlighted as prevalent across all sub-counties in Wajir with hotspots in all the wards and all the villages in these sub-counties.

### 6.5.6 Anthrax

Anthrax is a serious zoonotic disease just like MERS and Trypanosomiasis. However, this disease is caused by the spore-forming bacteria *Bacillus anthracis*. The disease has high mortality primarily in domestic and wild herbivores as well as most mammals and bird species. Its spores have been observed to be highly resistant and can survive in the environment for decades making its control and eradication difficult while occurring across all the continents.

The disease manifests in four forms; peracute, acute, subacute and rarely chronic form. In the acute form, the animals exhibit high fever, muscle tremors and difficulty in breathing shortly before the animal collapses and dies. Whereas, in the subacute form animals may experience fever, depression, inappetence, weakness and prostration.

Prevention and control of the disease are mainly through antibiotic therapy. In addition to that, proper disposal of dead animal is also critical. The premises of the infected animal should also be quarantined until all susceptible animals are vaccinated and all carcasses properly disposed of preferably by incineration or deep burial.

Wajir West, Eldas and Wajir North sub-counties were highlighted as the areas in which anthrax is most prevalent; whereas Buna, Basir, Korondille, Arbajahan, Hadado, Laghbogol wards were said to be the hotspots with all the corresponding villages in these wards affected.

#### 6.5.7 Contagious Caprine Pleuropneumonia (CCPP)

Contagious Caprine Pleuropneumonia (CCPP) is a highly contagious infectious disease of goats caused by the *Mycoplasma mycoides* Capri and *Mycoplasma F38* bacteria. CCPP causes inflammation of the lungs and accumulation of fluid in the chest cavity. Damaged lung tissue can harden and adhere to the chest wall, which interferes with effective respiration and causes the goat to die from lack of oxygen. Mortality rates can reach 100%. The disease is spread through the inhalation of airborne droplets from coughing/sneezing animals. Direct goat-to-goat contact is necessary for the disease to spread. Symptoms include fever, weakness, lethargy, coughing, difficulty in breathing, frothy nasal discharge, stringy saliva, anorexia (poor appetite) and exercise intolerance (FAO, 2016). CCPP can be treated by the use of antibiotics. Vaccinations and quarantine of infected animals can be used to control the disease.

CCPP was highlighted as having been prevalent across all sub-counties in Wajir and their corresponding wards and villages.

#### 6.5.8 Rift Valley Fever - RVF (Khumata rift valley)

The World Organization for Animal Health – OIE, (2021) state that RVF is an acute arthropod-borne disease that can cause severe disease in domestic animals such as camels, cattle, goats and sheep as well as wild animals such as buffalo.

Pepin et al, (2010) further add that the disease is primarily transmitted by mosquitoes and causes potentially severe disease in both humans and animals. In addition to that, the symptoms of the disease vary depending on the species of the animal affected, age, and whether the animal is pregnant. OIE, explain that young ones of sheep and goats are the most susceptible with mortality rates of 70 – 100%. The characteristic of the disease to be non-specific with its symptoms make it extremely difficult to diagnose. The occurrence of numerous abortions in animals together with the presence of the disease in humans is characteristic. Pregnant sheep and cattle affected by the disease will

almost always abort about 80 – 100%.

Eldas, Wajir West, Wajir North and Wajir South sub-counties were highlighted as the prevalent areas of the disease with Korondille, Batalu, Malkagufu, Basir/Lakolle, Eldas, Arbakahan, Hadado/Athibohol, Ademasajida and Habaswein wards affected and Ingirirm Buna, Fulo, Malkagufu, Basir, Aresawaji, Bananey, Arbajahan, Qara, Lankot, Qarseqoftu, Athibohol/Hadado, Lolkuta, Wara, LMD, Ademasajida, Habaswein, Uthole, Dilmanyale and Abakore villages highlighted as hotspots.

#### 6.5.9 Sheep and Goat Pox (Furuq)

Sheep pox and goat pox are serious and often fatal viral diseases that are characterized by widespread skin eruption, fever, ocular and nasal discharge with pox lesions that appear on the skin and the respiratory and gastrointestinal mucosa (Gibbs, 2021). Both diseases are confined to parts of South-eastern Europe, Africa and Asia.

Mitigation measures for the diseases include local control which entails the reduction of movement of the infected or suspected infected animals into areas where they may spread the disease. Preventative measures such as the vaccination of the animals against the disease are also highly effective.

All sub-counties with all their corresponding wards and villages were highlighted to be areas where this disease is prevalent in the County.

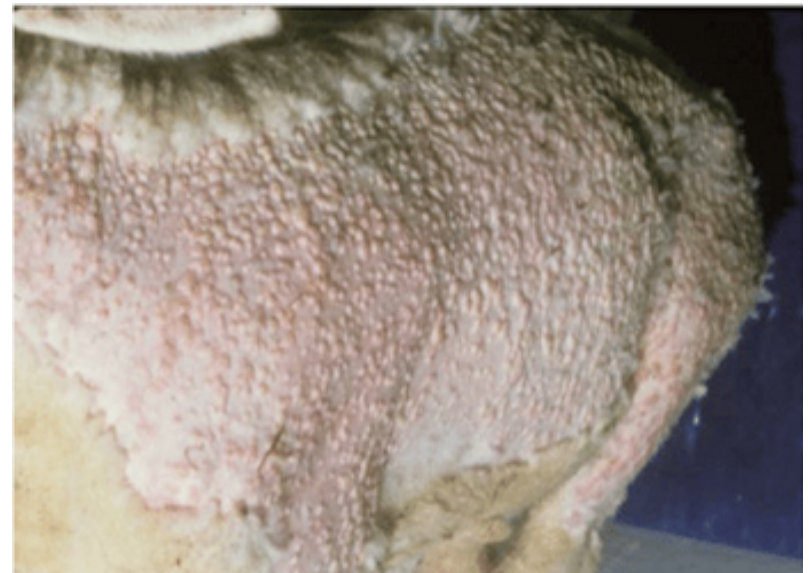


Plate 6.6: Sheep showing signs of sheep pox infection.

Source: researchgate.net

#### 6.5.10 Peste des Petits Ruminants – PPR (Diifdera)

PPR, also known as sheep and goat plague is a highly contagious animal disease that affects domestic and wild small ruminants. It is caused by the PPR virus – PPRV (*Morbillivirus paramixoviridae*). The virus may infect up to 90% of a herd while mortality will result in about 70% of the animals in the herd. The disease is present in West Africa, Part of Central Africa (Gabon, CAR) and East Africa.

Balamurugan et al, (2013), states that the symptoms of the disease manifest in fever, conjunctivitis, oculo-nasal discharges, necrotizing and erosive stomatitis, diarrhoea and bronchopneumonia. The infected animal may either recover from the disease or succumb.

PPR is an OIE-reportable disease worldwide. There is no specific treatment for the disease but treatment for bacterial and parasitic complications decreases the mortality in the affected flocks or herds. A vaccine for the disease is available and gives the animal natural disease for over 1 year. All sub-counties with all their corresponding wards and villages were highlighted to be areas where this disease is prevalent in the County.

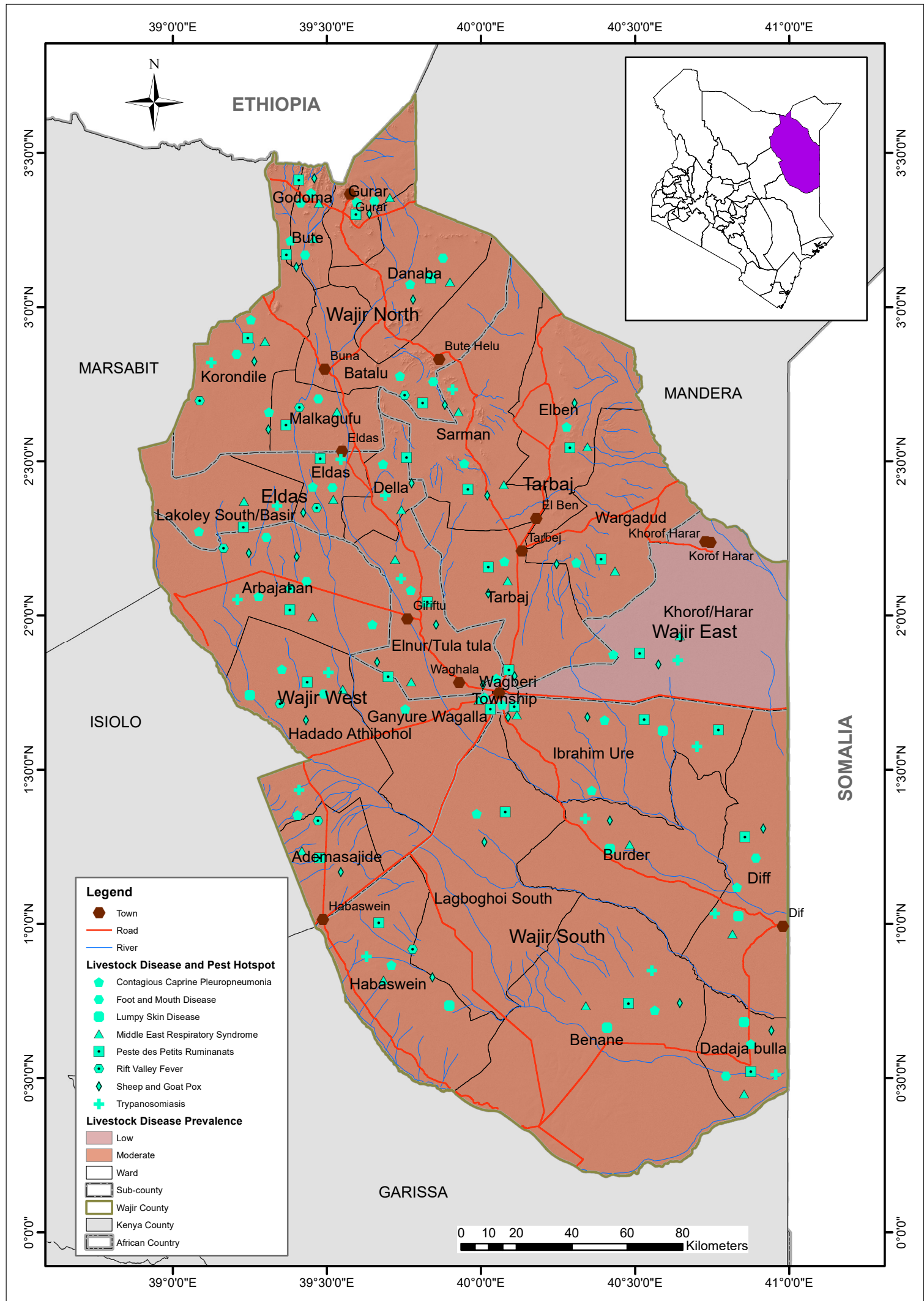
### **6.6 Impacts of Livestock Diseases**

- Loss/ Reduction of income
- Loss/decline of household assets
- Loss of livelihood

### **6.7 Interventions/Control**

- Provision of Veterinary expertise and conducting regular disease surveillances and community awareness programs regularly
- Livestock vaccination
- Vector control –Dips
- Livestock trainings and Veterinary extension services to all livestock keeping communities
- Deworming
- Breed improvement programs
- Quarantine
- Disease Surveillance

# Map 6.3: Livestock diseases prevalence in Sub-Counties



Data sources: RCMRD (Livestock Diseases Assessment by County Sector teams)

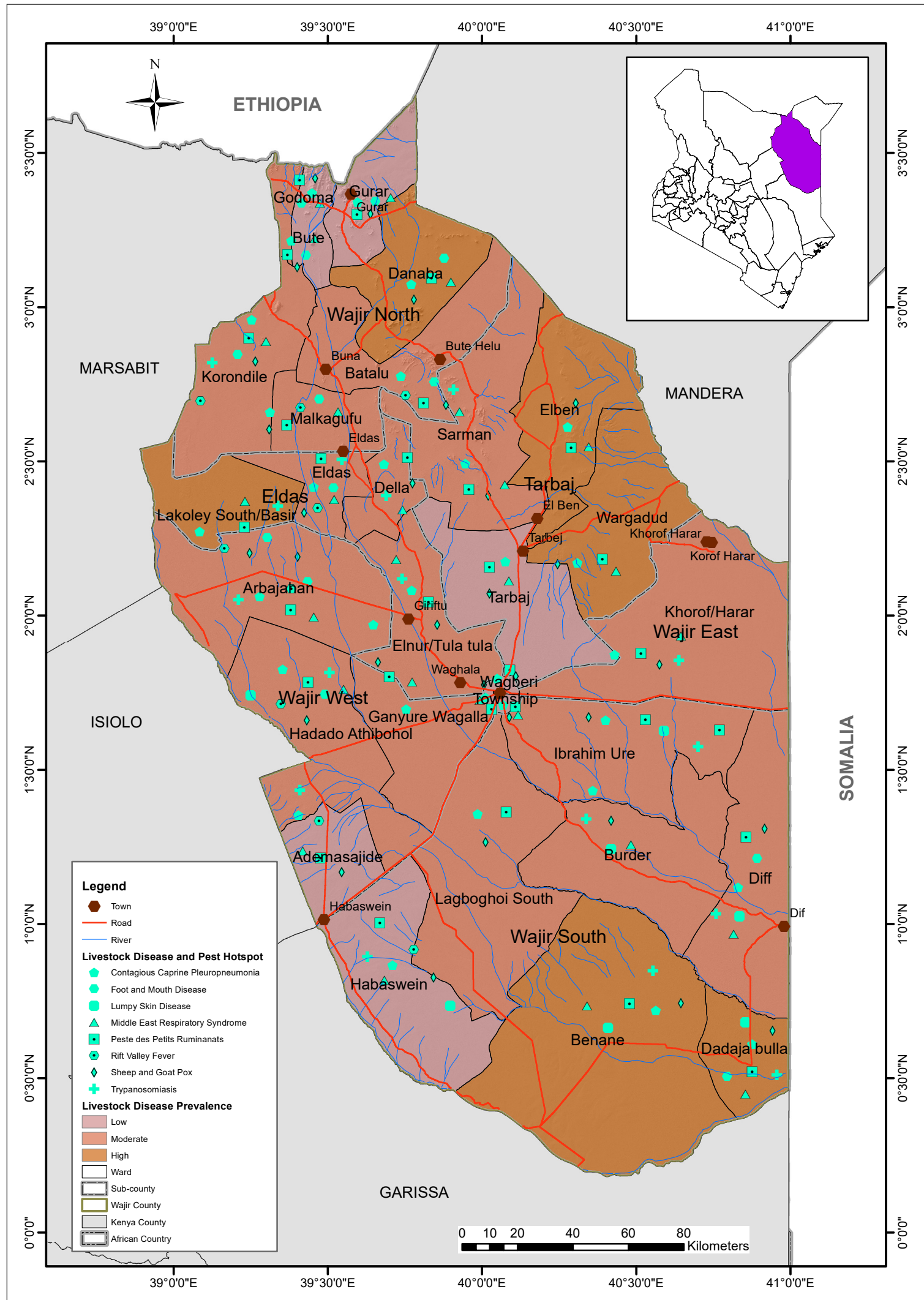
Spatial reference: Geographic, WGS 84

Administrative Boundaries: (OCHA ROSEA)

This map depicts the Livestock diseases incidence. The map was developed as a product of stakeholders' participatory mapping workshop in Wajir County. Livestock Diseases incidences are Moderate in Wajir South, Wajir West, Eldas, Tarbaj and Wajir North; and Low in Wajir East Sub-County.



# Map 6.4: Livestock diseases prevalence in Wards



Data sources: RCMRD (Livestock Diseases Assessment by County Sector teams)

Spatial reference: Geographic, WGS 84

Administrative Boundaries: (OCHA ROSEA)

This map depicts the Livestock diseases incidence in Wards. The map was developed as a product of stakeholders' participatory mapping workshop in Wajir County. Livestock Diseases incidences are High in Banane, Dadaja bulla, Lakoley South/Basir, Danaba, Elben and Wargadud Wards; Moderate in Diff, Bur-Der, Ibrahim Ure, Khorof/Harar, Hadado/Athibohol, Ganyure, Wagalla, Elnur/ Tula tula, Arbajahan, Eldas, Della, Korondile, Batalu, Godoma, Saman and Lagboghol South Wards; and Low in Habaswein, Ademasajide, Tarbaj, Wagberi Township, Bute and Gurar Wards.

## 6.8 Crop Diseases and Pests

The main crops grown in Wajir County include sorghum, maize, millet, beans, cowpeas and green grams. There is the promotion of resistant varieties of crops. Horticultural crops available include; kales, spinach, tomatoes, sweet and hot pepper. These activities in Wajir are however undertaken on a small scale because there is no commercial farmer registered so far. Watermelons have however been flooding the area, therefore, indicating a huge potential in this sector. (Wajir CIDP, 2015). Maize Common crop diseases and pests are maize lethal necrosis disease (MLND), bacterial wilt, smut, fall armyworms, red spider mites and weevils.

### 6.8.1 Maize Lethal Necrosis Disease (MLND)

According to FAO's Food Security and Nutrition Working Group, Maize lethal necrosis disease is a result of a combination of two viruses, the Maize chlorotic mottle virus (MCMoV) and any of the cereal viruses in the Potyviridae group, like the Sugarcane mosaic virus (SCMV), Wheat streak mosaic virus (WSMV) or Maize dwarf mosaic virus (MDMV). The double infection of the two viruses gives rise to what is known as MLND, also referred to as Corn lethal necrosis (CLN). Mosaic virus (WSMV) or Maize dwarf mosaic virus (MDMV). The double infection of the two viruses gives rise to what is known as MLND, also referred to as Corn lethal necrosis (CLN). Symptoms of Maize Lethal Necrosis are dying leaves leading to premature plant death, Failure to tassel and sterility in male plants, Malformed or no ears and Rotting cob. Some control measures include uprooting and removing affected plants, not growing maize in consecutive seasons, opting for crop rotation or grow alternative crops, awareness of specific season and planting time to avoid spreading of the disease; and application of good agronomic practices. Chemical spraying of vector under specific circumstances.



**Plate 6.5:** Maize crop affected by Maize Lethal necrosis (Source: Farmbizafrica.com)

### 6.8.2 Bacterial wilt

Bacterial wilt is a disease caused by the bacterium *Ralstoniasolanacearum* which lives in the soil. The disease affects tomatoes, potatoes, tobacco, eggplant and bananas. Bacterial wilt causes the plant to wilt and die quickly with little warning. Bacterial wilt happens where plants have

been cut, injured or weakened by insects or simply by cultivation. The bacterium clogs up the stem, preventing water and nutrients from reaching the leaves and the plant dies. All branches wilt at about the same time. When the stem of a wilted plant is cut across, the pith has a darkened, water-soaked appearance. There is a greyish slimy ooze on pressing the stem. In later stages of the disease, decay of the pith may cause extensive hollowing of the stem. Bacterial wilt causes no spotting of the fruits. Affected roots decay, becoming dark brown to black. If the soil is moist, diseased roots become soft and slimy ([www.infonet-biovision.org](http://www.infonet-biovision.org)). Prevention is through adequate spacing between plants, crop rotation, growing resistant crops and washing hands after handling infected plants ([www.tomatodirt.com](http://www.tomatodirt.com)).



**Plate 6.8:** Bacterial wilt on tomatoes (Source: RCMRD)

### 6.8.3 Maize Smut

Maize smut is caused by the fungus *Ustilagozeae* and can appear in the stalks, leaves, tassels or ears. Symptoms are most commonly noticed when the ears produce mushroom-like tumours or galls ([www.planetnatural.com](http://www.planetnatural.com)). Galls on leaves remain small and eventually become hard and dry. Prevention is through practising crop rotation with non-cereal plants such as cassava and sweet potatoes, planting clean and disease-free maize seeds, planting at the onset of the rains for good crop establishment and ploughing deep to bury surviving spores, among others ([www.kalro.org](http://www.kalro.org)).



**Plate 6.9:** Maize cobs affected by maize smut (Source: agreport.bz)

Head smut was highlighted to be prevalent across sub-counties and their corresponding wards and villages

#### 6.8.4 Blackleg

Blackleg is a seed-borne disease caused by a bacterium (*Erwinia* spp) that affects stems and tubers through the breakdown of plant cell walls. The disease causes losses that occur in both the fields and the storage areas that are especially warm and humid. The bacteria spreads through seed tubers, other infected plants, soil and water. This means it can spread from the plant via water, soil and seed and on farming tools and machinery or people (KEPHIS, 2016).

The disease may show signs at different stages of growth in the plant. That is when the plant shoot emerges or in the later growth stages of a more mature plant. At the early stages of the disease development in mature stems, the leaves may turn yellow and wilt without the occurrence of black decay.

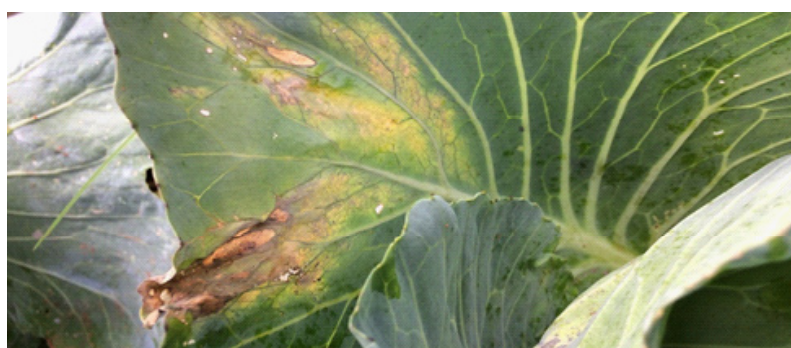


**Plate 6.13 & 6.14:** Infection of blackleg disease in the plant and tubers of potatoes. **Source:** (<https://www.apsnet.org/edcenter/disandpath/prokaryote/pdlessons/Pages/Blacklegpotato.aspx>)

Black leg affects Wajir North sub-county with Bute ward and Bute village highlighted as the hotpot for the disease.

#### 6.8.5 Black rot

Black rot is a bacterial disease caused by the bacterium (*Xanthomonas campestris* pv. *Campestris*). The disease more active and is spread more during warm and wet conditions and is capable of infecting the crop at any growth stage. The major source of the infection that causes the disease are infected seed, infected transplants and infected cruciferous weeds. Infection of the disease causes symptoms that vary on whether it is systemic or local. Systemic infection results in the seedlings turning yellow, dropping of lower leaves and the plant eventually dies. The disease is recognized through the characteristic presence of chlorotic to necrotic V-shaped lesions that extend inwards from the leaf margins as shown in Plate 6.15 above. **Source:** (<https://www.greenlife.co.ke/black-rot-of-crucifers/>). Black rot affects Wajir North sub-county with Bute ward and Bute village highlighted as the hotpot for the disease.



**Plate 6.15:** Black rot in cabbage.

**Source:** (<https://www.greenlife.co.ke/black-rot-of-crucifers/>)

#### 6.8.6 Fall armyworms

Fall armyworms are also known as *Spodoptera frugiperda* are crop pests that prefer to feed on maize but also target wheat, millet, cotton, sorghum, sugarcane, tobacco, potatoes and rice. The fall armyworm's head has a predominantly white, inverted Y-shaped suture between the eyes. Young larvae are greenish or brownish in colour and smooth-skinned. Mature larvae vary from light tan or green to nearly black. They have three yellow-white hairlines down their backs. On each side and next to the yellow lines is a wider dark stripe. The moths have a dark grey, mottled (coloured spots) on the forewings with light and dark splotches (marks), and a noticeable white spot near the end of the worm. The cause causes tattered edges and holes in leaves. Control is by the use of pesticides ([www.theorganicfarmer.org](http://www.theorganicfarmer.org)).



**Plate 6.6:** Fall armyworm lava (**source:** syngenta)



**Plate 6.7:** Maize crop affected by fall armyworm  
(Source: RCMRD)

### 6.8.7 Stalk borer

The maize stalk borer (*Busseolafusca*) also known as the African maize stalk borer and sorghum stalk borer is the most invasive insect pest of maize in Africa and more so in Kenya. It belongs to a family of moths that includes cutworms and armyworms. The larva of the stalk borer bores into the stalk/stem of the host plant and feeds within the plant. The pest has a variety of hosts that include; maize, sorghum, sugarcane, rice, finger millet and thick-stemmed grass such as Napier grass.

The larval stage is the most destructive. This is due to the larvae's mode of biting and chewing where they feed on the terminal leaf whorls that lead to the production of a characteristic pattern of small holes. As the infestation progresses, they invade the growing points causing dead hearts whereby the central leaves dry and wither. On the other hand, the much older larvae tunnel in the stem where they feed on the stem causing it to weaken and break. In addition to that, they also tunnel into maize cobs, millet inflorescence and sorghum peduncles leading to significant damages



**Plate 6.11:** Maize stalk borer in a maize plant.  
(Source: <https://www.greenlife.co.ke/stalk-borer/>)

The damage caused by the pest results in the increase in vulnerability of the affected plants to infection by other pathogens like fungi. The yield losses linked to stalk borers areas are high at about 40%. (Source: <https://www.greenlife.co.ke/stalk-borer/>). The maize stalk borer was highlighted to be prevalent across all sub-counties and subsequently all their corresponding wards and villages.

### 6.8.8 Quelea birds

The Quelea bird or red-billed quelea/dioch bird is a small brownish bird of Africa. The bird is characteristic in its occurrence in large numbers that results in extensive destruction of grain crops and through roosting, results in the breaking of branches. Despite their preference for wild grasses over those of cultivated crops, their huge numbers make them a constant threat to fields of sorghum, wheat, barley, millet and rice. Also referred to as “feathered-locust” the bird has a fast-breeding characteristic that sees flocks grow to a size of about 2 million. The bird averagely consumes about 10 grams of grain per day which is almost half of its body weight; this means that a flock of 2 million can consume as much as 20 tonnes of grain in a single day. This, FAO estimate leads to agricultural losses that exceed USD. 50 million annually (The New Humanitarian, 2009).



**Plate 6.12:** The Quelea bird. Source: (thenewhumanitarian.org)

Currently, despite the multiple modes tried in the management of the bird's population, such as the use of poisons, napalm, pathogens and electronic devices, there are no resoundingly successful modes of management or mitigation of these pests. This pest was highlighted to be prevalent across all sub-counties and subsequently all their corresponding wards and villages.

### 6.8.9 Aphids

Aphids are also known as plant louse, greenfly or ant cow are considered true bugs for their characteristic of having specialized mouths to suck the fluids (sap) from leaves and flowers. They are about the size of a pinhead with most species having a pair of tube-like projections on the abdomen. Aphids can transmit plant virus diseases and cause deformation of leaves, buds and flowers all the while stunting plant growth and producing plant galls. Due to these effects, they can be serious plant pests and are considered the most destructive pests on cultivated plants. Source: (<https://www.britannica.com/animal/aphid>)



**Plate 6.16 and 6.17:** Aphids on the leaves of plants **Source:** (<https://www.saferbrand.com/advice/insect-library/garden-insects/aphids>)

They are usually found in colonies on the underside of tender terminal growth and can attack any part of the plant that is above ground and at any stage of their growth. Despite their plump and dumpy appearance, aphids can travel long distances with the aid of low-level winds. There are about 250 aphid species that are considered serious pests that attack a wide range of plants such as; vegetables (e.g. Sukuma wiki, cabbage and tomato). Fruit trees, flower plants such as roses, legumes such as beans and green grams; and cucurbits such as watermelons. (Source: <https://www.greenlife.co.ke/aphids/>). Aphids affect Wajir East sub-county with specificity to Barwaaqo, Township and Wagberi administrative wards and all their corresponding villages as hotspots.

### 6.8.10 Mealybug

Mealybugs is soft-bodied, wingless insects that often appear as white cottony masses on the leaves stems and fruit of plants and tend to live together in clusters. They feed by inserting their long sucking mouthpart into plants to suck out the sap in their tissues. With the increase in the number of the pest, there is a significantly higher risk

of damage to the plant with the yellowing of leaves and curling as the plant weakens. As they suck the sap from plants, they excrete the excess sugars as a substance called honeydew, which facilitates the development of sooty mould. Moreover, their lethal nature is amplified by their potential to act as vectors for various plant diseases. Mealybugs attack both indoor and outdoor plants and are found in almost all parts of the world with prevalence in warmer regions. Wajir East sub-county with specificity to Barwaaqo, Township and Wagberi administrative wards and all their corresponding villages as hotspots where this pest is present.



**Plate 6.18 and 6.19:** Plant leaves affected by mealybugs **Source:** (<https://www.aos.org/orchids/orchid-pests-diseases/mealybugs.aspx>)

### 6.8.11 Desert locusts

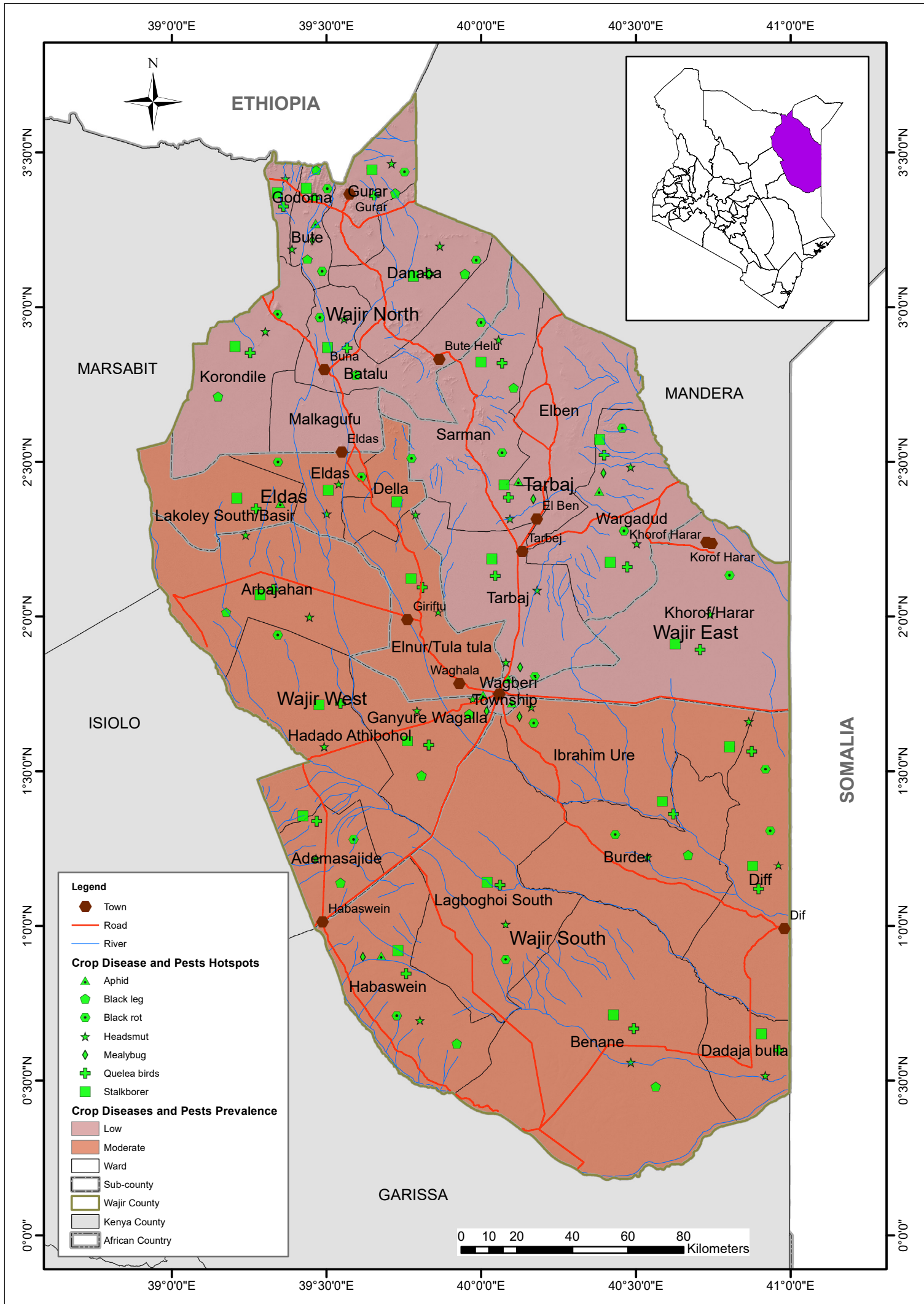
Invasion of swarms of desert locusts was an event that was majorly highlighted in 2020. Favourable weather and rainfall facilitated the breeding of the insects and the exponential growth of the swarms that were seen in the greater Horn of Africa region. In Kenya, the adversely affected regions were the Northern part of the country, Wajir County included. This invasion in early 2020 was the worst ever desert locust infestation in the region. In addition to that, there is still a risk of other infestations in the coming years.



**Plate 6.20 and 6.2:** Desert locust invasions in the Horn of Africa. **Source** (<https://www.nationalgeographic.com/science/article/locust-plague-climate-science-east-africa>)

The locusts have disastrous effects that come about due to their ability to rapidly reproduce in favourable conditions of warm weather and abundance of food. This coupled with their ability to move 150 Kilometres a day and devour their weight in food per day make them dangerous to food security and livelihoods. (Source: <https://news.un.org/en/story/2020/12/1080202>).

# Map 6.5: Crop diseases prevalence in Sub-Counties



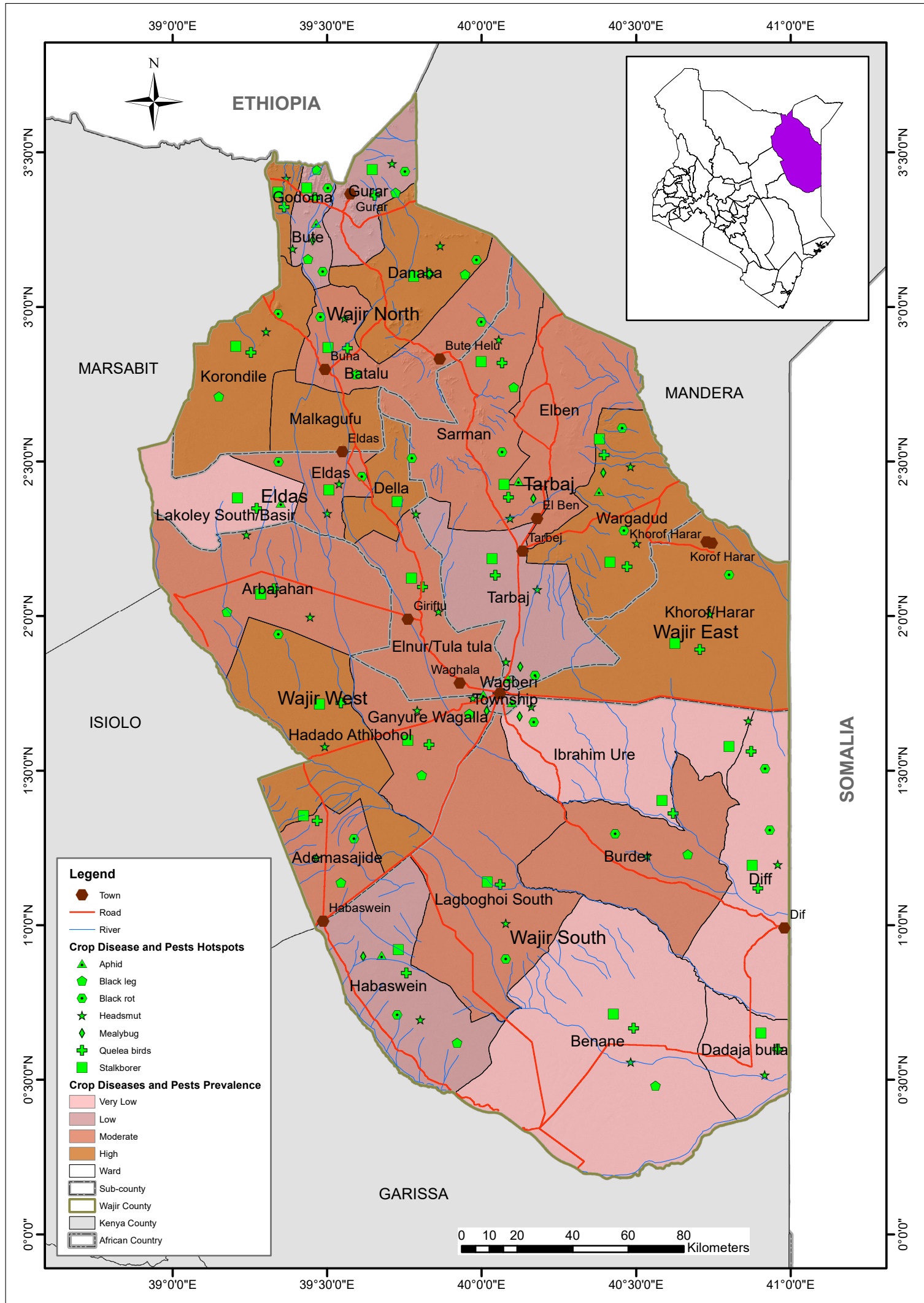
**Data sources:** RCMRD (Crop Pests and Diseases Assessment by County Sector teams)

**Spatial reference:** Geographic, WGS 84

**Administrative Boundaries:** (OCHA ROSEA)

This map depicts the Crop Pests and Diseases prevalence in sub-counties. The map was developed as a product of stakeholders' participatory mapping workshop in Wajir County. Crop Pests and Diseases incidences are Moderate in Wajir South, Wajir West and Eldas; and Low in Wajir East, Tarbaj and Wajir North Sub-Counties.

# Map 6.6: Crop diseases prevalence in Wards



**Data sources:** RCMRD (Crop Diseases and Pests Assessment by County Sector teams)

**Spatial reference:** Geographic, WGS 84

**Administrative Boundaries:** (OCHA ROSEA)

This map depicts the Crop Diseases and Pests incidence in Wards. The map was developed as a product of stakeholders' participatory mapping workshop in Wajir County. Livestock Diseases incidences are High in Hadado/Athibohol, Khorof/Harar, Della, Malkagufu, Korondile, Godoma and Danaba; Moderate in Ademasajide, Lagboghoh South, Bur-Der, Ganyure, Wagalla, Arbajahan, Eldas, Batalu, Saman and Elben Wards; Low in Habaswein, Tarbaj, Wagberi Township, Bute and Gurar Wards; and Very Low in Lakoley South/Basir, Banane, Dadaja bulla, Diff and Ibrahim Ure.



# Chapter 7: Floods

## 7.1 Introduction

Floods are one of the most common environmental hazards worldwide. This is due to the geographic location and distribution of low-lying coastal areas and river floodplains. Most people have the preference of settling in areas near waterbodies to have sufficient water supply, transport alternatives and farming. As much as it is the best choice, an increase in water that overflows on land has several effects. Flooding does occur due to natural factors such as excessive rainfall. Other causes of flooding are due to human activities that manipulate the situation of watersheds, flooding plains and drainage basins. In most cases, floods have occurred even with the normal rains due to excess surface water runoff caused by land degradation due to overstocking, deforestation, derelict land up and downstream, and bare lands. The impacts of floods on individuals and communities may be social, economic, and environmental. The impacts might be positive or negative depending on the location and the extent of flooding, the environments they affect, and the vulnerability. In recent years, several parts of Wajir County have been hard-hit by flooding affecting at least 43,000 people and destructing normal activities (UN Office for the Coordination of Humanitarian Affairs, 2019).

## 7.2 Types of Floods

Flooding can be categorized according to the way it occurs and the magnitude of damage that it causes. The two broad categories of floods are river and flash floods.

### 7.2.1 River Floods

A river flood occurs in the instance where a river bursts its course onto dry land. The bursting of the river can be articulated to heavy rainfall where excess water is channeled to the river channel. The characteristics of the landscape around the river will influence how quickly rainwater reaches the channel. The determination of the probability of river flooding depends on factors such as current river water levels, soil type, and terrain conditions.

### 7.2.2 Flash floods

Flash floods are characterized by intense high-flow velocities of running water. It occurs with little to zero warning which makes them dangerous and destructive. The nearby terrain elevation is one of the factors that cause flash floods to occur in most cases. Other factors include surface condition, drainage, rainfall intensity and the duration of rainfall. All these factors tend to have an increased rate of runoff into the water system.



**Plate 7.1 & 7.2:** Flooding in Dambas and Haragal in Tarbaj Sub-County. **Credits:** Wajir County Government; Department of Special Programmes

## 7.3 Flooding in Wajir

Wajir County experiences flooding which occurs after a period of heavy rainfall. Heavy rains that are experienced periodically in most parts of the county have occasioned flash floods that have affected transport systems and marooned villages. As much as flash floods are experienced in the county, seasonal river flooding has been experienced in the northern part of the county that originates from the Ethiopian highlands (NDMA, 2019). The floods in the county come with several negative impacts including loss of lives and livelihood and critical infrastructure. Due to the bare nature of the land, soil erosion has occurred and the formation of water channels evident in most parts. An example is the Buna-BeramuLaga which has occasionally caused flooding in Beramu, Buna, Eldas and Griftu. Proper

measures need to be put in place to address the effects of flooding in the county.

## 7.4 Causes of Floods in Wajir County

### 7.4.1 Poor Drainage

The poor drainage system is a major factor contributing to flooding occurrence. The poor drainages are brought about by the accumulation of sediments from surface runoff and the clogging of drainage channels. Poor environmental management approaches such as dumping litter are big contributors to blockages when it rains. Poor drainage as well makes roads impassable during flooding and spreading the effects to residential areas. Poor drainage in parts of Wajir County has caused flooding in areas such as Qorahey in recent years bringing many activities to a standstill.



**Plate 7. 1:** A flooded street in Griftu, Wajir County **Credits:** department of disaster management and humanitarian coordination, Wajir County.

### 7.4.2 Prolonged precipitation

Prolonged precipitation saturates the soil making the water table rise to the ground surface. When it gets to the ground surface, flooding will be experienced as water will flow in any direction causing destructions.



**Plate 7. 2:** A flooded road in Dambas trading centre, Tarbaj sub county **Credits:** department of disaster management and humanitarian coordination, Wajir County.

### 7.4.3 Deforestation

Removal of tree cover causes water to reach river channels more quickly and also from the highlands to the lowlands in a short period. Wajir County has one gazetted forest, Bute Malaba Forest Ranges covering approximately 19,171,104 Ha. The County has a coverage of 1.99 per cent woodland of the total 6.99 per cent forest cover in the country (

Kenya Forest Service, 2018). Most of its forest cover is comprised of shrubs and woody trees which are used to graze domestic animals and wildlife. Deforestation in Wajir County has happened in the past due to charcoal burning, mushrooming of settlements, agriculture expansion, and illegal logging. This has left the ground bare making it vulnerable to flooding.

### 7.4.4 Topography

High altitude areas experience flash floods as compared to lowland areas. Wajir north which borders Ethiopian highlands is frequently affected by flash floods as a result of heavy rains in Ethiopia.

### 7.4.5 Climate Change

Climate change has impacted the frequency of floods. Several studies that have been done on climate change indicate that there is a chance of increased flooding in the future due to increased storms and increased depth of precipitation. Climate variability has also been known to lead to excessive floods.

## 7.5 Impacts of Flooding

Floods have both positive and negative effects in the areas they occur. The negatives effects always outweigh the positives especially in cases where early warning and response mechanisms are not in place. Some of the positive impacts include sufficient water for irrigation, ease in rainwater harvesting in dams, tanks, and water pans, recharge shallow wells/boreholes, watering grazing areas, increased fish production as the water gets onto the adjacent land, and an increase in soil fertility. The negative impacts of flooding include:

- Loss of lives and livelihoods as people are prevented from doing activities that generate income for their families
- Land may lose value especially floodplains. Investors and other persons may shy away from settling in high-risk areas.
- Disruption of transport and communication due to damage of critical infrastructures such as power lines and telecommunication masts.
- Displacement of people from their inundated homes
- Trauma and stress among the affected individuals.
- Damage to property such as structural damage to buildings, roads, rails and several other properties and public utilities such as hospitals or schools.
- Destruction of land and natural resources areas, in general, causing severe soil erosion, siltation and debris deposit, development of stormwater gullies that make

agricultural activities such as cultivation impossible.

- Increased mortality and morbidity rates amongst the population, including their animals. These either occur through direct or indirect causes such as drowning and injuries from displaced boulders, falling buildings, trees and others.
- Health deterioration due to potential disease outbreaks. This is most common with water-related and other hygiene and sanitation diseases such as malaria, cholera, dysentery etc.
- Contamination of wells and groundwater. This is very dangerous since wells and groundwaters are the main sources of potable water for most Kenyan rural communities.
- Disruption of learning when schools are inundated, pupils and teachers are unable to access the learning facilities.
- Severe soil erosion
- Increase in pests and vectors



**Plate 7. 3:** A section of Buna seasonal river cutting off Buna-Korondille road **Credits:** department of disaster management and humanitarian coordination, Wajir County.

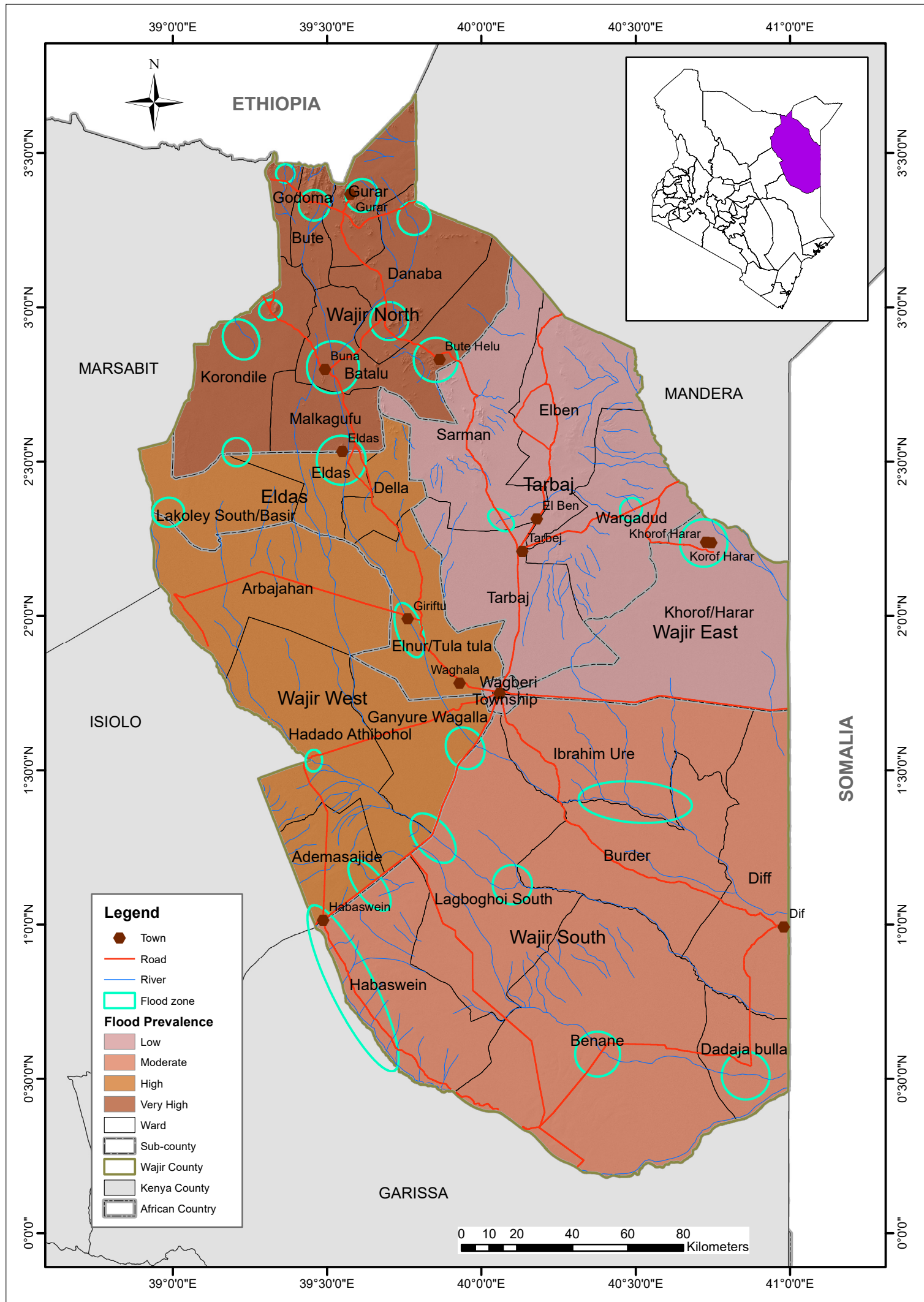


**Plate 7. 4:** Damaged drift connecting Habaswein-Madogashe **Credits:** department of disaster management and humanitarian coordination, Wajir County.

## 7.6 Interventions

- Flood forecasting and early warning are essential for emergency responses and in limiting damages. The meteorological department should inform the locals of impending floods.
- Awareness creation on flooding detailing causes of floods, mitigation measures and need for keeping off harm's way. For instance, need for moving to higher grounds by those persons who live in areas that are prone to flooding.
- The construction of proper drainage channels and the improvement of sanitation will ensure that waste does not clog waterways.
- Afforestation, reforestation and planting of more vegetation that will retain water.
- Coming up with a county spatial plan that will ensure that all important aspects like drainage are taken care of.
- Preparation of floods contingency plan

# Map 7.1: Flood prevalence in Sub-Counties



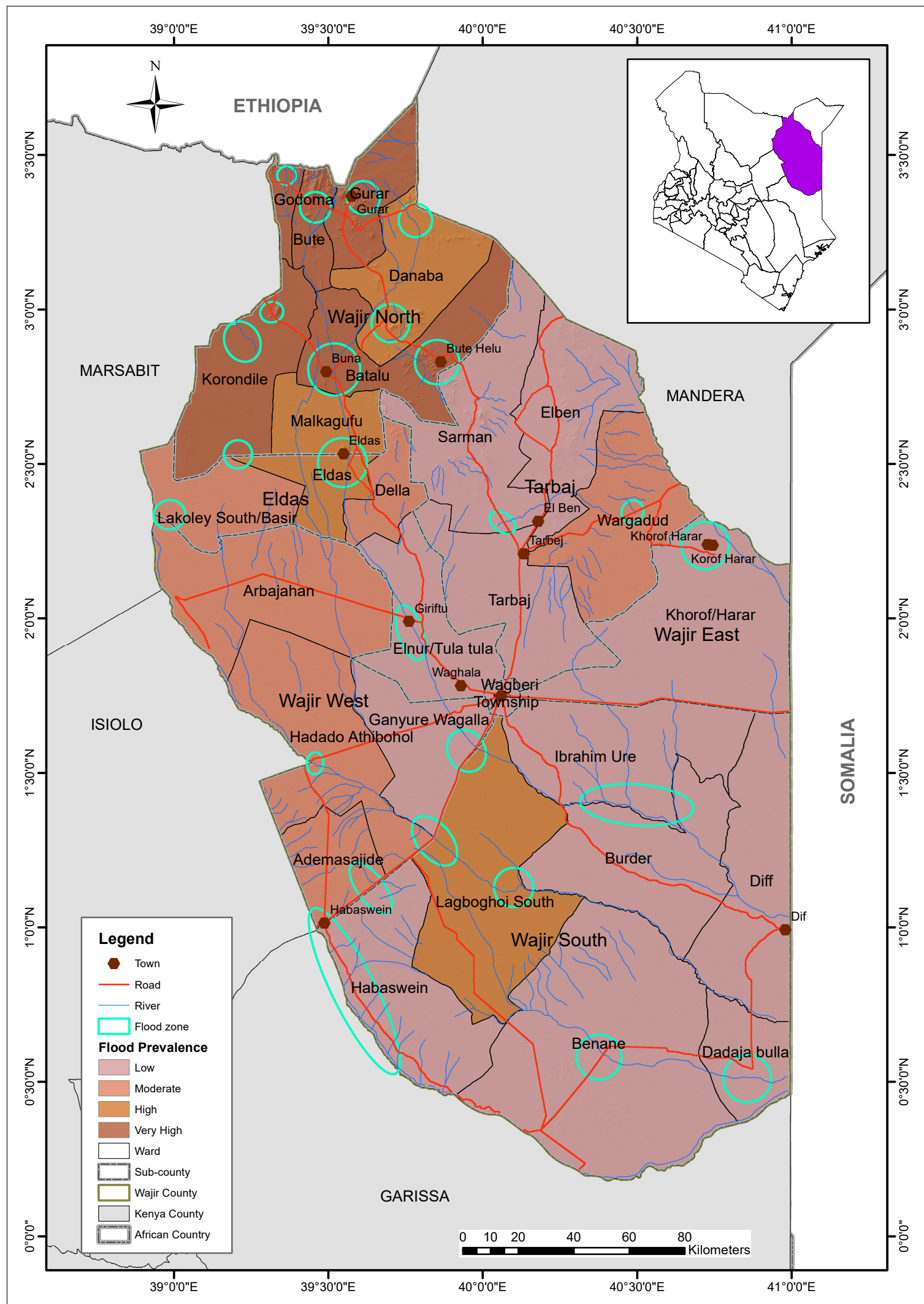
**Data sources:** RCMRD (Flood Prevalence Assessment by County Sector teams)

**Spatial reference:** Geographic, WGS 84

**Administrative Boundaries:** (OCHA ROSEA)

This map shows Flood occurrence in Sub-Counties. The map was generated as a result of being informed by the county stakeholders' participatory mapping workshop in Wajir County. Flooding was said to be Very High in Wajir North; High in Wajir West and Eldas; Moderate in Wajir South; and Low in Wajir East and Tarbaj.

## Map 7.2: Flood prevalence in Wards



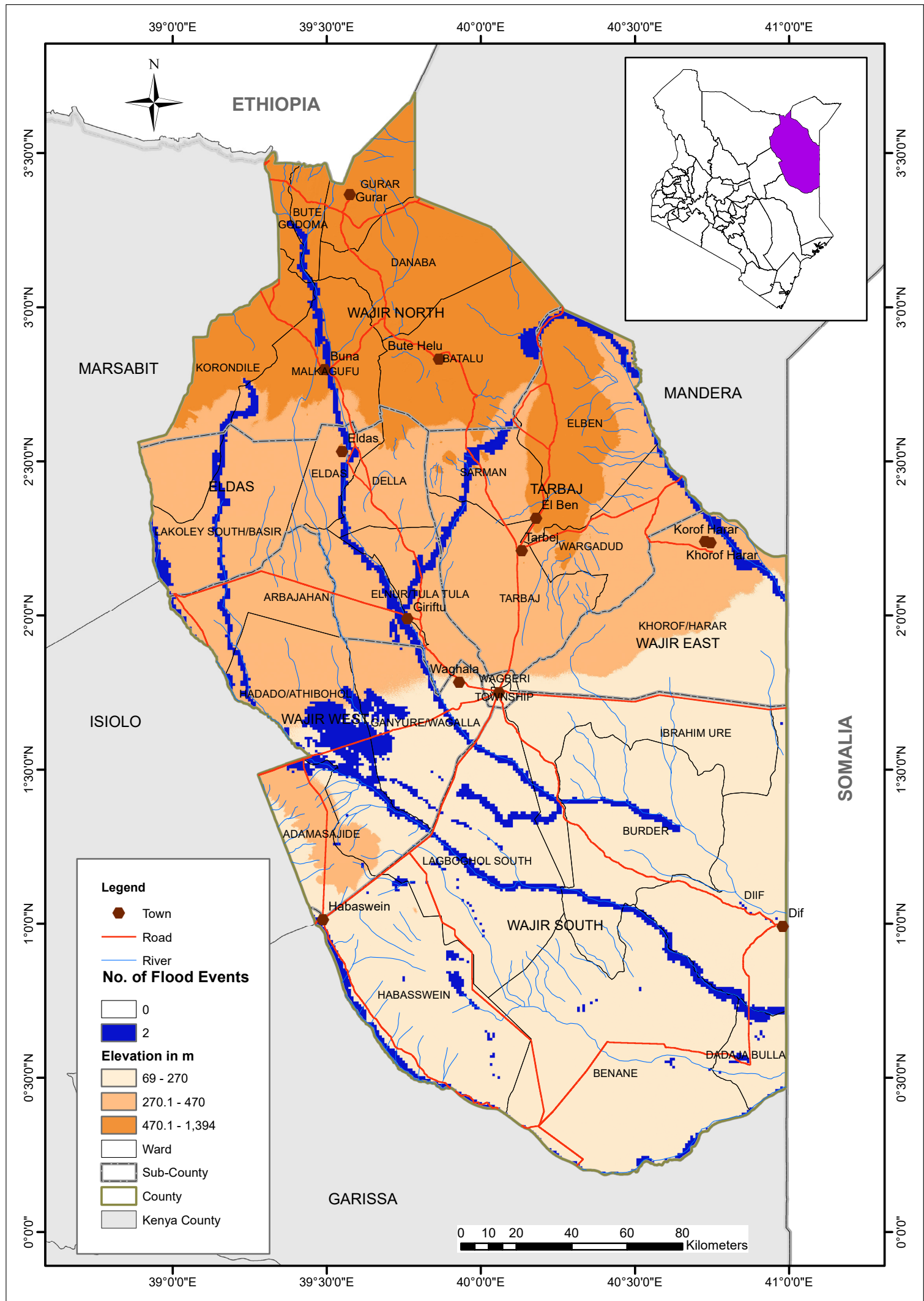
Data sources: RCMRD (Flood Prevalence Assessment by County Sector teams)

Spatial reference: Geographic, WGS 84

Administrative Boundaries: (OCHA ROSEA)

This map shows Flood occurrence in Sub-Counties. The map was generated as a result of being informed by the county stakeholders' participatory mapping workshop in Wajir County. Flooding was recorded to be Very High in Godoma, Bute, Gurrar, Korondile and Batalu Wards; High in Danaba, Malkagufu and Lagboghol Wards; Moderate in Lakoley South/Basir, Arbajahan, Della, Hadado/Athibohol and Ademasajide Wards; and Low in Elben, Saman, Tarbaj, Elnur/Tula tula, Wagalla, Ganyure, Habaswein, Banane, Dadaja bulla, Dif, Khorof/Harar, Tarbaj and Wagberi Township Wards.

# Map 7.3: Flood Frequency



Data sources: UNEP DEWA-GRID

Spatial reference: Geographic, WGS 84

Administrative Boundaries: OCHA ROSEA)

This map shows Flood Frequency in Wajir town. Most flooding occurs in the lowlands along river with an estimate of two flood events annually.

# Chapter 8: Vulnerability Indicators

## 8.1 Introduction

United Nations Office for Disaster Risk Reduction defines vulnerability as the conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards. Exposure to hazards in individuals differs due to age, gender, socio-economic well-being and culture. Poor persons and communities are more vulnerable to hazards because they lack the means and ways of being prepared and respond to hazards. Vulnerability can be addressed by reducing the impact of hazards through mitigation, early warning and preparedness. Climate change and variability are believed to have increased incidences of hazards all over the world. Increasing or decreasing temperatures and unpredictable rainfall have contributed to more drought episodes, flooding and human, livestock and crop diseases. Drought, floods, diseases, environmental degradation and conflicts also affect the livelihood of the people. On the same note, drought, crop diseases, environmental degradation (especially soil erosion) and floods can lead to poor yields or total destruction of crops. Likewise, human and livestock diseases render people too weak to work and cause death of livestock.

## 8.2 Livelihood

Wajir county's livelihood zones are generally classified into pastoral all species which makes 19 per cent of the population, pastoral camel which makes 17 per cent, pastoral cattle which makes 24 per cent, agro-pastoral which makes 23 per cent, and informal employment which makes 17 per cent. (NDMA, 2019)

Pastoralism is practised largely in the county which has influenced land-use patterns greatly. Extensive grazing has been a major source of livelihoods for pastoralists and agro-pastoralists. Livestock herding is the major practice done by at least 53.4 per cent of the households. (SMART, 2019).

The county government has attempted the introduction of alternative livelihoods. This is aimed at eradicating poverty, improving the livelihoods of the population and improving food security. The alternative livelihoods include poultry keeping which has been practised in towns like Habaswein and Wajir. Irrigation has also been introduced in Eldas, Buna and Bute.

Crop farming is minimal in the county and is practised on a small scale. Livestock rearing is common in the entire county. According to KFSSG & Wajir County Steering Committee, the main three livelihood zones in the county are:

- Informal/Formal (17%)
- Pastoral Cattle (24%)
- Pastoral Camel (17%)
- Pastoral All (19%)
- Agro-pastoral (23%)

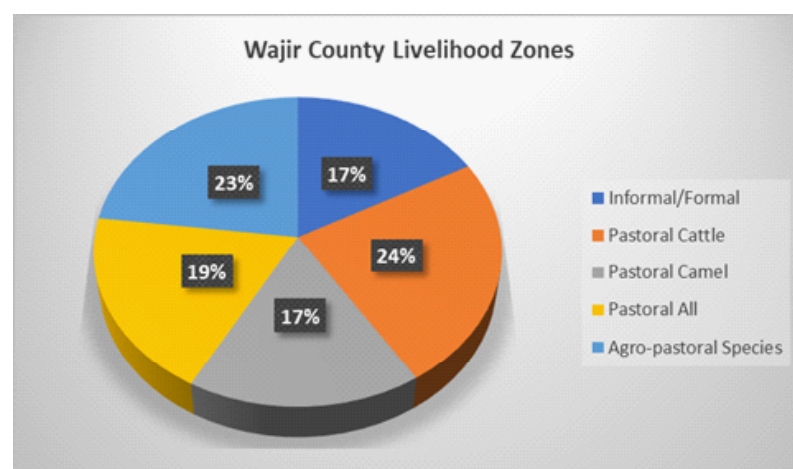
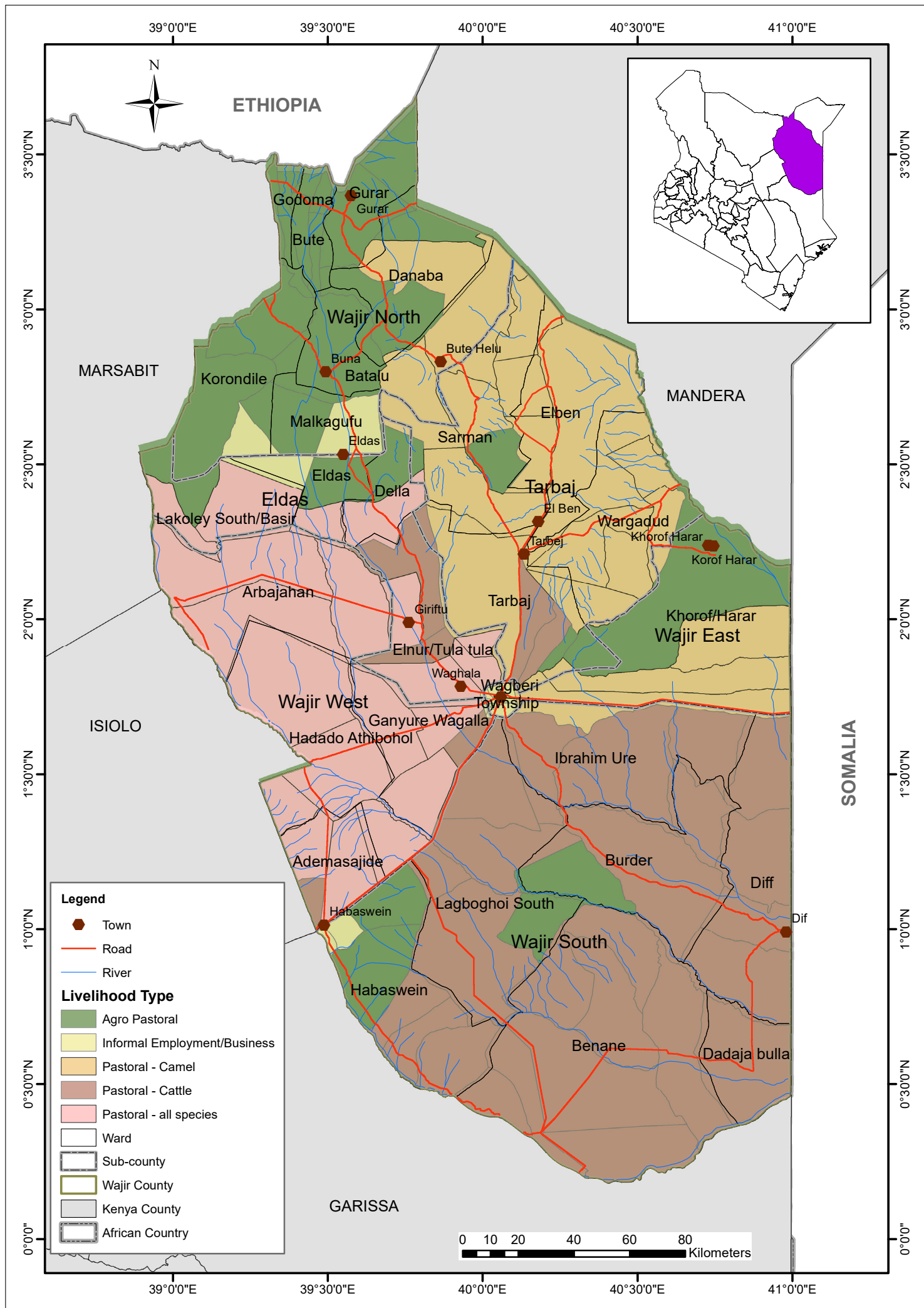


Figure 8.1: Human Population distribution by livelihood (Source: KFSSG & Wajir County Steering Group, 2019)

The map below shows the different livelihood types in Wajir County. The main livelihood types in the County are pastoral cattle in Wajir South, pastoral all species in Wajir West, pastoral camel in Wajir East, agro-pastoral mostly in Wajir North and parts of Wajir South and Wajir East. Informal/formal employment is common in towns such as Eldas, Wajir and Habaswein.

# Map 8.1: Wajir Livelihoods Map



Data sources: NDMA

Spatial reference: Geographic, WGS 84

Administrative Boundaries: (OCHA ROSEA)

The map above shows the different livelihood types and zones in Wajir County. These livelihood types are: Agro-pastoral, Informal Employment/Business, Pastoral-Camel, Pastoral-Cattle and Pastoral-all species.



### 8.2.1 Crop Farming

Crop farming in Wajir County is limited due to the nature of the environment and the minimal rainfall received. Food crops grown include sorghum, maize, millet, cowpeas, beans and green grams; while cash crops are sim sim, tomatoes, kales, spinach, watermelon, onions, capsicum and fruit trees such as pawpaw, citrus, lemon and mangoes (KFSSG & Wajir County Steering Group, 2019). Rainfed agriculture is practised in depressions and along drainage lines while irrigation is practised in areas with permanent shallow wells or water pans (Wajir CIDP, 2018). The main crop-growing areas include Lorian Swamp in Wajir South and along drainage lines in Wajir North (KFSSG & Wajir County Steering Group, 2019). Challenges faced by the agricultural sector include unreliable rains, overreliance on relief food, inadequate funding, inadequate technical support (extension), inaccessibility of markets especially by farmers and costly inputs (Wajir CIDP, 2018). According to KFSSG & Wajir County Steering Group (2019), the destruction of crops by wildlife and high disease and pest incidences are additional challenges that the agriculture sector has to grapple with.



**Plates 8.1:** Onions planted in Wajir County. (Source: RCMRD)

### 8.2.2 Livestock Rearing

Livestock keeping is practised in the entire Wajir county. Main livestock reared include donkeys, sheep, cattle, goats and camels (KFSSG & Wajir County Steering Group, 2019). Poultry keeping is practised in the towns of Wajir and Habaswein. Challenges faced by livestock keepers include droughts, diseases and pests (Wajir CIDP, 2018). Droughts cause migration to other neighbouring counties of Isiolo and Marsabit in search of water and pasture. Cross-border migration can exacerbate conflicts in areas with water points and pasture.



**Plates 8.2 and 8.3:** Camels and Cattle in Wajir County (Credit: Apollonaris Wekesa, WFP-Kenya)

## 8.3 Vulnerability Assessment

Critical factors affecting food security and socio-economic well-being also contribute largely to vulnerabilities of the population and existing systems in Wajir County. Extreme climatic events lead to hazards like droughts and floods, livestock and crop pests and diseases, human diseases, conflict, inadequate access to basic amenities including water, health and education facilities. In the previous chapters, individual hazards have been tackled; this section will look at access to basic amenities as indicators of the population's vulnerabilities. The section will then assess the overall vulnerability of Wajir County based on the IPCC framework and definition of vulnerability with the intention of bringing out the geographical variation of vulnerability stratified into five (3) categories of vulnerability: Low, Medium and High.

### 8.3.1 Major water sources

Wajir County has various water sources which are underground, surface and sub-surface sources. The county has 15 mega pans, 272 boreholes and 260 water pans (Wajir CIDP, 2018). Rainwater harvesting is not commonly practised but waters can be harvested following flash floods in the County. Piped water is available to 2% of the County's population (Wajir CIDP, 2018). The majority of the

population has access to water through water kiosks that are in several centres which are; Eldas, Wajir town, Griftu, Habaswein, Tarbaj, Arbajahan and Masalale. The water sources that are available are not permanent especially the surface water sources. The minority of the households that make an approximate 48 per cent access water from sources that are less than 500 metres while the rest of the households which make 52 per cent of the population travel a distance of more than 500 metres to the nearest water source. According to the Wajir county SMART survey report (2016), about 90 per cent of the population in Wajir County do not queue for water. Among the population that queue, about 57 per cent do for less than 30 minutes, 37 per cent queue between 30 minutes to 60 minutes while 6 per cent of the population queue for more than one hour.

The county has a water company, Wajir water and sewerage company (WAJWASCO), which manages a total of 30 boreholes while the other boreholes are managed by the department of water. The management of the boreholes is not felt much and at the community level, the day to day operations are undertaken by water users' associations that have been formed.

Wajir County has several water sources which are underground, surface and sub-surface sources. The county has 272 boreholes, 15 mega pans, and 260 water pans (Wajir CIDP, 2018). There is a potential for harvesting rainwater which is from flash floods that are experienced during long rains. A need of carrying out geological surveys is necessary to identify areas that have a high groundwater potential.



**Plate 8.4:** Livestock taking water at a water pan **Credit:** RCMRD

## Challenges facing the water sector in Wajir County

### Technical and management capacity challenges

Water sources are managed by Wajir County Government Water Department and the Wajir County Water and Sewerage Company (WAJWASCO). According to the water governance and development in the drylands report, there are few trained personnel who are mandated to serve over 200 boreholes in Wajir County. There are always conflicts that come with the bigger water management sectors and the local water user associations (WUAs).

### Weak Presence at the community level

One of the major issues that make the water sector not successful in Wajir County is the lack of citizen engagement in the designing of water projects. Sub-county water officers have their work at the county level. These roles have not been put into practice as the presence of the officer at the community level is weak. Communities get to know some of the projects as they are being implemented and most of the livestock herders are not consulted. Water development in Wajir county should be associated with a strong community engagement process. The views of the people should be taken into consideration since they know what problems they face on the ground. A good approach should be undertaken in the development of factors to be considered when it comes to both domestic and livestock water needs.

### Political interference

The water sector has had several challenges from several political issues in the county. Politicians tend to start up water projects just to gain political milestones. New water points are placed by influential individuals without even knowing grazing areas. In the long run, the water points become conflict hotspots. Clear governances' rules are not in place making it difficult to coordinate between the national and the county government.



**Plates 8.3 and 8.4:** shallow wells and people fetching water from a water kiosk in Wajir County **(Credit:** Apollonaris Wekesa, WFP-Kenya)

### 8.3.2 Education

It is said that education is the key to success in life. Kenya has made great strides in ensuring that people have access to affordable education. Millennium Development Goal 2 pushed for the achievement of universal primary education. The government of Kenya introduced free primary education in the year 2003. However, this has been met with various challenges such as increment in enrolment with inadequate facilities and teachers. Vision 2030 recognizes the importance of education as part of the social pillar. Furthermore, Sustainable Development Goal 4 aims at ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all. Education is considered a basic human right. Target 4.1 calls for the completion of free, equitable and quality primary and secondary education by all girls and boys leading to relevant and effective learning outcomes.

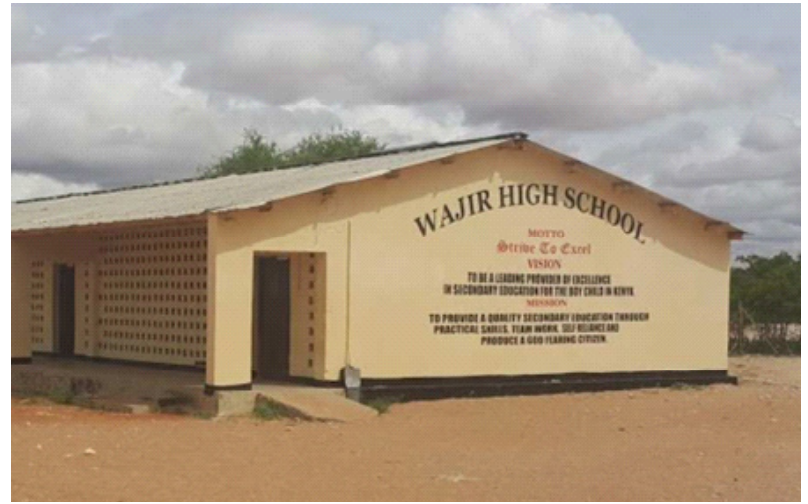
#### Number of learning facilities, Enrolment Levels and Teacher Pupil ratio in Wajir County.

Wajir county has several education facilities from early childhood development to tertiary institutions. Wajir County has 264 early childhood developments Centers (ECD) with a total of 15, 075. The teacher-pupil ratio at ECD Level is 1:25 and a transition rate of 90%(Wajir CIDP, 2018). According to the Wajir County government, Wajir county has 218 primary schools with a total enrolment of 63,912 pupils of which 38,584 are boys and 25,328 are girls. The primary school has a retention of 51 per cent while its transition rate is at 94 per cent(Wajir CIDP, 2018).



Got-ade primary school in Wajir county (**Credit:** Education Department, Wajir County)

In Wajir County, there are 41 secondary schools with a total enrolment of 12,188 of which 4,408 are girls and 7,780 are boys. Due to increased transition from primary schools and the opening up of day schools, the enrolment of secondary schools in Wajir county is expected to increase significantly. An increase in day schools is in line with the national government policy of increasing access to secondary education. (Wajir CIDP, 2018).



A Secondary school in Wajir county (**Source:** Victormakara.com)

Tertiary institutions in the county are one Medical Training College, one Livestock Training Centre (GPTC Griftu), Two Teacher Training Colleges and two other tertiary institutions. Improvement of the institutions is necessary as well as coming up with a constituent technical institution. There are 9 youth polytechnics out of which only 5 are operational i.e Wajir, Habaswein, Khorof Harar, Tarbajand Griftu polytechnics. The total enrolment stands at 197 of which 69 are male and 128 are females. For easy access to all these polytechnics, there is a need to operationalize them. Wajir county has no technical training colleges. Adult literacy is low at 23.6 per cent(Wajir CIDP,2018). There is one private college (Frontier Institute of professional studies) operating in Wajir county.



Fashion design and dress making at Wajir Vocational Training Centre (**Credit:** Education Department, Wajir County)



Motor vehicle mechanic training at Wajir Vocational Training Centre (**Credit:** Education Department, Wajir County)

### Challenges faced by the education sector in Wajir County

#### 1. Inadequate facilities

Wajir County has several learning institutions which have inadequate facilities like laboratories, chairs, desks, dormitories, libraries, toilets, lack of water and electricity. One facility is therefore shared among so many students. This has greatly affected the quality of education in the county which is reflected by the performance in national examinations.

**Solution:** Funds should be provided to equip the various learning institutions to make it conducive for the students. There must be concerted efforts by all education stakeholders in the county to address both physical infrastructure and learning facilities.

#### 2. Shortage of permanent classrooms in primary schools

**Solution:** Government should provide funds for building better classrooms.

#### 3. Few numbers of TSC teachers.

The teacher-pupil ratio in Wajir county indicates the need for more teachers in the county. Other factors that have also led to poor examination performance are absenteeism by pupils to attend home chores and in some instances shortage of role models who have excelled in examinations.

**Solution:** The TSC should employ more teachers to have an improved quality of education.

#### 4. Low enrolment rate to learning institutions and gender imbalance

There is a low enrolment rate for ECDE, primary, secondary and tertiary institutions and gender imbalance. This is attributed to low literacy levels in Wajir county. This is a result of early marriages, female genital mutilation and

exploitation of women among other negative vices.

**Solution:** There is a need for improvement of the enrolment rate and gender imbalance in Wajir county and retain the girl child in school. This will lead to an increase in literacy levels in Wajir county. This can be achieved by increasing awareness campaigns against negative cultural beliefs towards education and especially the girl child education.

#### 5. School dropouts due to drought

Drought is an abnormally prolonged lack of rain resulting in dryness, lack of food and water. Besides the immediate threat of malnutrition and dehydration, the future of the children is at risk because so many boys and girls will be forced to drop out of school (UNICEF, 2013). Wajir is prone to drought therefore it receives much lower rainfall. Crop failure results in a deficient food supply that fails to meet the demands of the greater population. Since pupils cannot go to school on an empty stomach due to prolonged famine, this leads to a high school dropout rate in the region (Robert, 2009).

#### 6. Poverty

Families struggle to make a living from subsistence farming or livestock herding. The harsh climatic conditions and poverty have prevented over 60 percent of eligible children in Wajir from accessing schooling. (UNICEF, 2005, Maiyo, 2010). Also, due to worsening economic conditions, parents prefer to withdraw their children from school to do manual work to supplement their family finances. Considering that getting at least one meal per day is indeed a problem for many children and their families, then school participation becomes less prioritized (Heavens, 2006; Ogada, 2007).

#### 7. The low transition

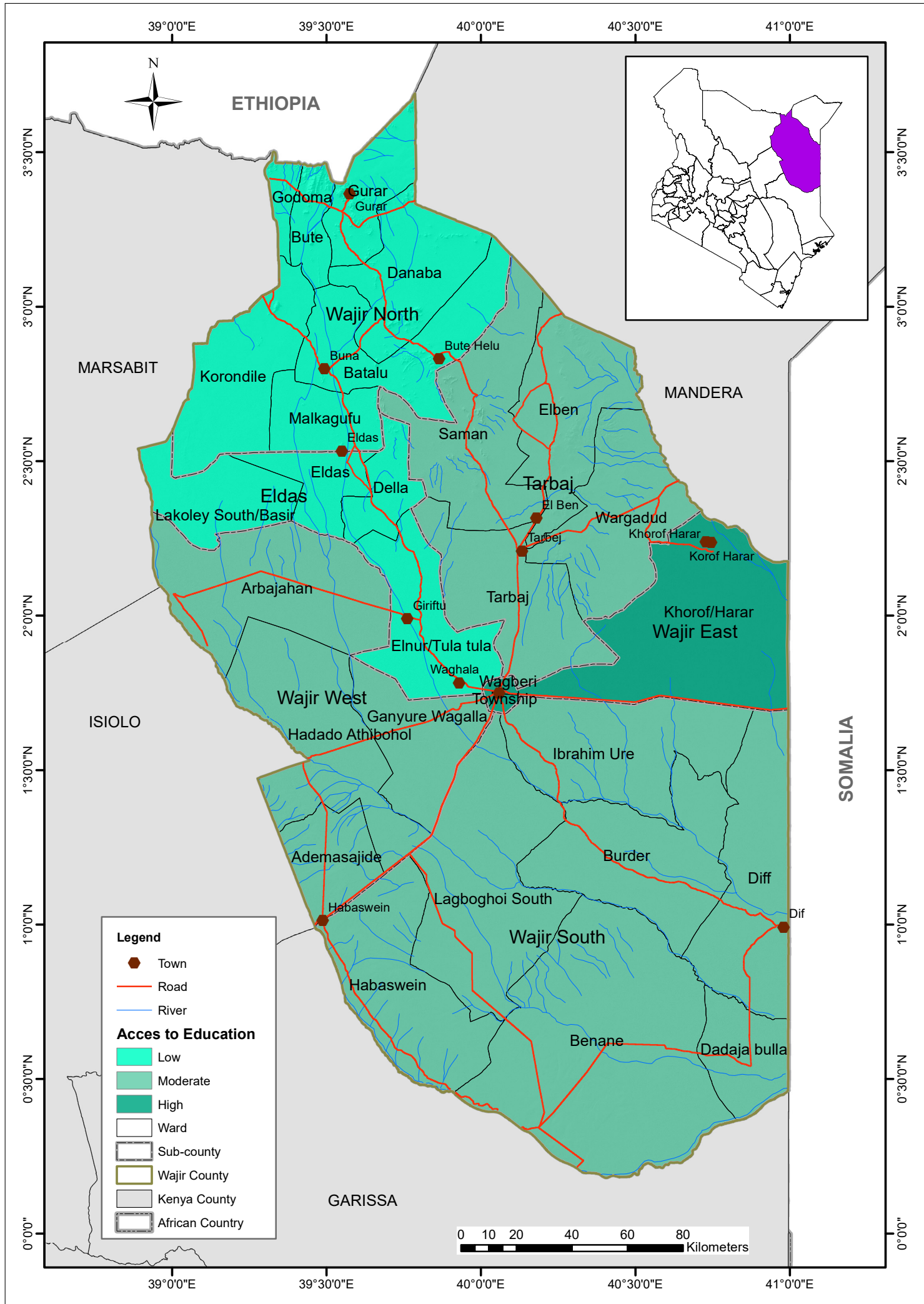
from primary to secondary, from secondary to higher education institutions and from the higher education institutions to the outside needs.

#### 8. Invasion of pastoralists to primary schools

Pastoralists derive their livelihood from natural resources like pasture (Oketch, 2008). They move from one area to another and this movement is not restricted to one area or county. Due to less pasture, it has led to fights for the scarce resources with neighbouring communities causing insecurity which results in frequent disruption of the learning process of pupils at school. Schools might also be shut down due to cattle rustling (Achoka & Maiyo, 2011.)

**Solution:** People need to understand the complex effects of conflict on education in order to improve educational policy responses.

# Map 8.2: Accessibility to Education in Sub-Counties



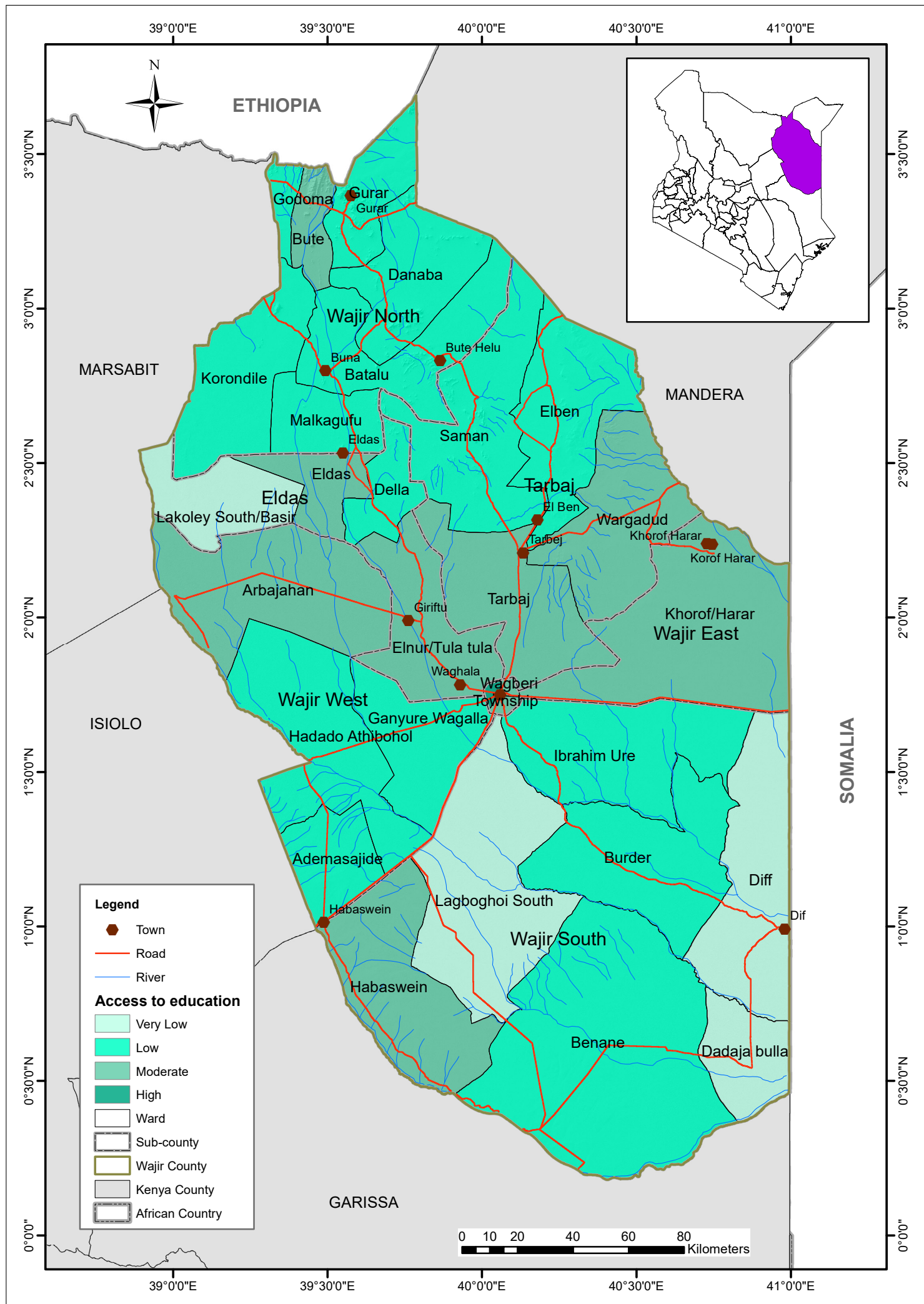
Data sources: RCMRD (Education Assessment by County Sector teams)

Spatial reference: Geographic, WGS 84

Administrative Boundaries: (OCHA ROSEA)

The map above shows the Accessibility to Education in sub-counties across the county. This map was developed and informed by the county stakeholders' participatory mapping workshop in Wajir. Access to Education is High in Wajir East; Moderate in Wajir South, Wajir West and Tarbaj; and Low in Eldas and Wajir North Sub-Counties.

## Map 8.3: Accessibility to Education in Wards



**Data sources:** RCMRD (Education Assessment by County Sector teams)

**Spatial reference:** Geographic, WGS 84

**Administrative Boundaries:** (OCHA ROSEA)

The map above shows the Accessibility to Education in the wards. This map was developed and informed by county stakeholders' participatory mapping workshop in Wajir County. Access to Education is High in Wagberi Township; Moderate in Habaswein, Arbajahan, Eldas, Elnur/Tula tula, Tarbaj, Wargadud, Bute and Khorof/Harar Wards; Low in Banane, Burder, Ibrahim Ure, Ademasajide, Hadado/Athibohol, Ganyure, Wagalla, Korondile, Malkagufu, Della, Saman, Elben, Batalu, Danaba, Gurar, and Godoma Wards; and Very Low Dadaja bulla, Diff, Lagboghoh South and Lakoley South/Basir Wards.

### 8.3.3 Health Access

Good health is a paramount aspect of human welfare and one of the ways it can be achieved is by having quality and affordable health care for the citizens. Provision of quality, affordable and accessible health care to all has been a challenge faced by the counties in Kenya. In recent years, the country has been rocked by both nurses and doctors strikes. The COVID-19 pandemic has posed major challenges in the nation with increased deaths and disease incidences.

Regions in the arid and semi-arid lands in Kenya have been known to have poor health care systems. The regions are prone to poor infrastructure which means that even the number of hospitals in the regions do not meet the required health workers - patients ratio as compared to the population. The National government, County governments and other agencies could boost health access in most of the regions in the ASALs.

The health sector has struggled mostly from gross inadequacy of personnel to corruption. According to the Wajir CIDP (2018), there exists 115 public health facilities, 29 private facilities and 2 facilities that belong to NGOs. The county has 27 clinics, 10 level 4 hospitals, 26 level 3 health centres, 79 level 2 dispensaries, 1 nursing home and 3 private hospitals.

At least 95 per cent of the population cover more than 5 kilometres to get access to a health facility while approximately 4 per cent of the population can get access to a health facility within a distance of 1 kilometre. The county has invested in several health workers having a total of 28 doctors, 327 nurses, 93 registered clinical officers, 57 public health officers, one medical consultant, one dentist, 8 pharmacists, 10 pharmacy technologists, 60 lab technologists, 62 community health assistants and 55 nutritionists. The doctor-patient ratio in the county stands at 1:29,413 which does not conform with the stipulated ratio of 1: 5,000. The nurse to patient ratio stands at 1:2608 which as well do not conform with the internationally recommended ratio of 1:333.

#### Challenges faced by the health sector in Wajir County

##### Inadequate health facilities and health equipment

Wajir county does not have enough health facilities to accommodate the population. Some of the members of the communities need to travel long distances before getting access to medical care. Most of the population cover a distance of more than 5 kilometres to get to a health facility. Most of the health facilities in the county are not well equipped and lack essentials like oxygen. Economic marginalization for years has contributed to setbacks in financing, innovation and technology.

##### Inadequate health workers

Wajir County has inadequate health workers. as indicated by the doctor-patient ratio and nurse-patient ratio of 1:29413 and 1:2608 respectively (Wajir CIDP, 2018). This is way below the internationally recommended ratio. There is a need to address this and ensure that all the county residents have access to healthcare.

##### Poor financing of the healthcare sector

Health function was devolved as per the 2010 constitution of Kenya. County governments are expected to oversee the running of health facilities with funds from the national government. This has come with many challenges with increased medical personnel strikes over the years. Health facilities in rural areas tend to be neglected. Lack or minimal funds affect the delivery of health services thus high mortality rates.

##### Poor management of health facilities

Misappropriation of funds is a major challenge in the country. Embezzlement of funds set aside for the health sector affects normal operations. Projects stall and other development activities in the counties. Transparency and accountability in the counties are important for the betterment of the health sector.

#### Interventions

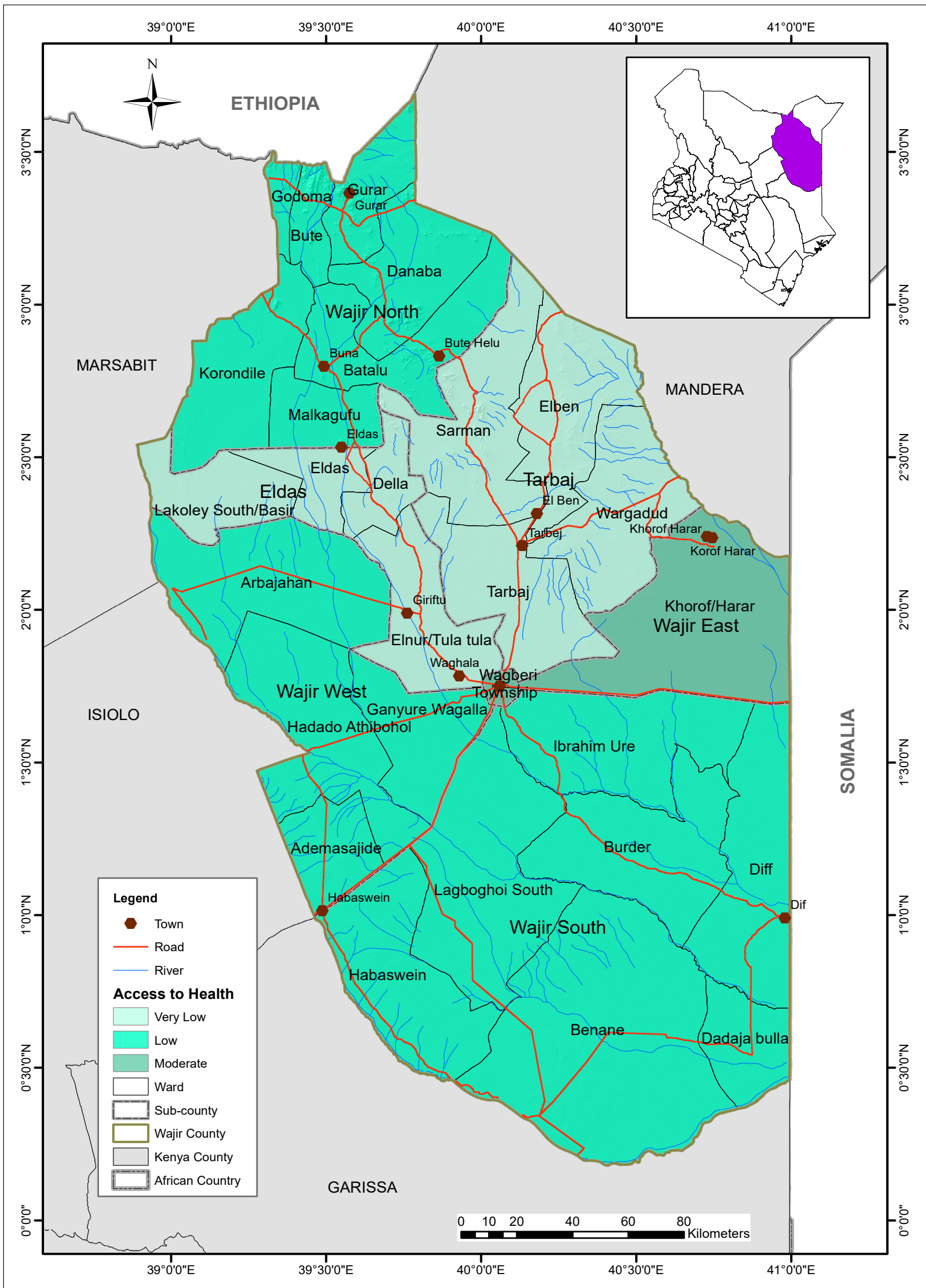
##### Improved leadership and governance

Proper leadership is crucial for development to take place. Issues like misappropriation of funds are easily curbed. Reforms are needed in areas where challenges such as corruption have been reported before.

##### Increase in healthcare facilities and workers

Improvement in the ratio of doctor patients and nurse patients will ensure that there is a better universal health care system. Reduction of maternal mortality and improved health care system will be achieved through adequate workers and health facilities. There is a need for an increase of funds challenged to the county government by the national government.

# Map 8.4: Accessibility to Health in Sub-Counties



Data sources: RCMRD (Health Assessment by County Sector teams)

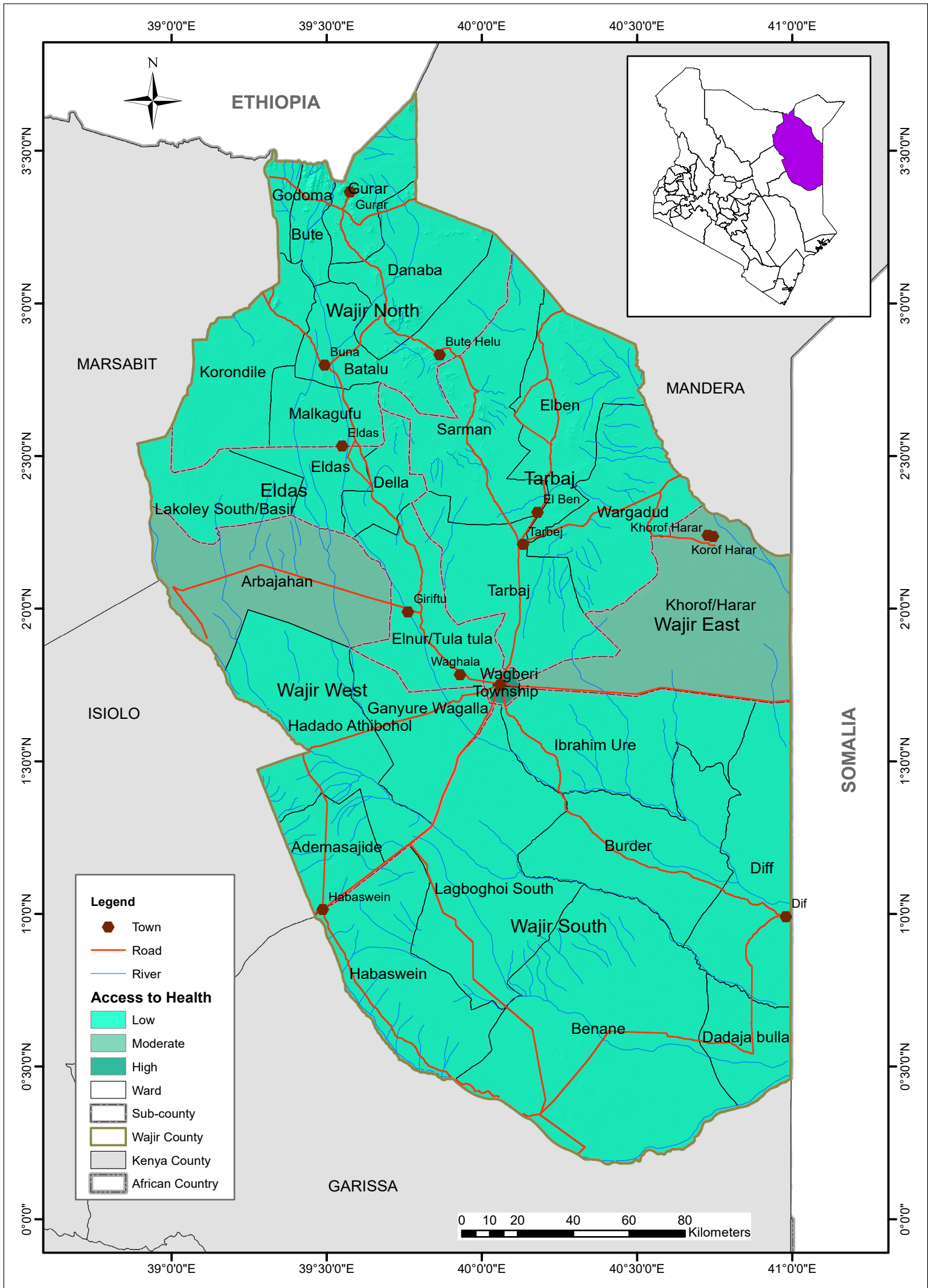
Spatial reference: Geographic, WGS 84

Administrative Boundaries: (OCHA ROSEA)

This map shows sub-county access to health based on Leadership and governance, Health information systems, Service delivery, Health system financing, medical products, vaccines and technologies. This map was developed after county stakeholders' participatory mapping workshop in Wajir County. Health accessibility is moderate in Wajir East. Wajir North, Wajir West and Wajir South have low access. Eldas and Tarbaj have very low access to health.



# Map 8.5: Accessibility to Health in Wards



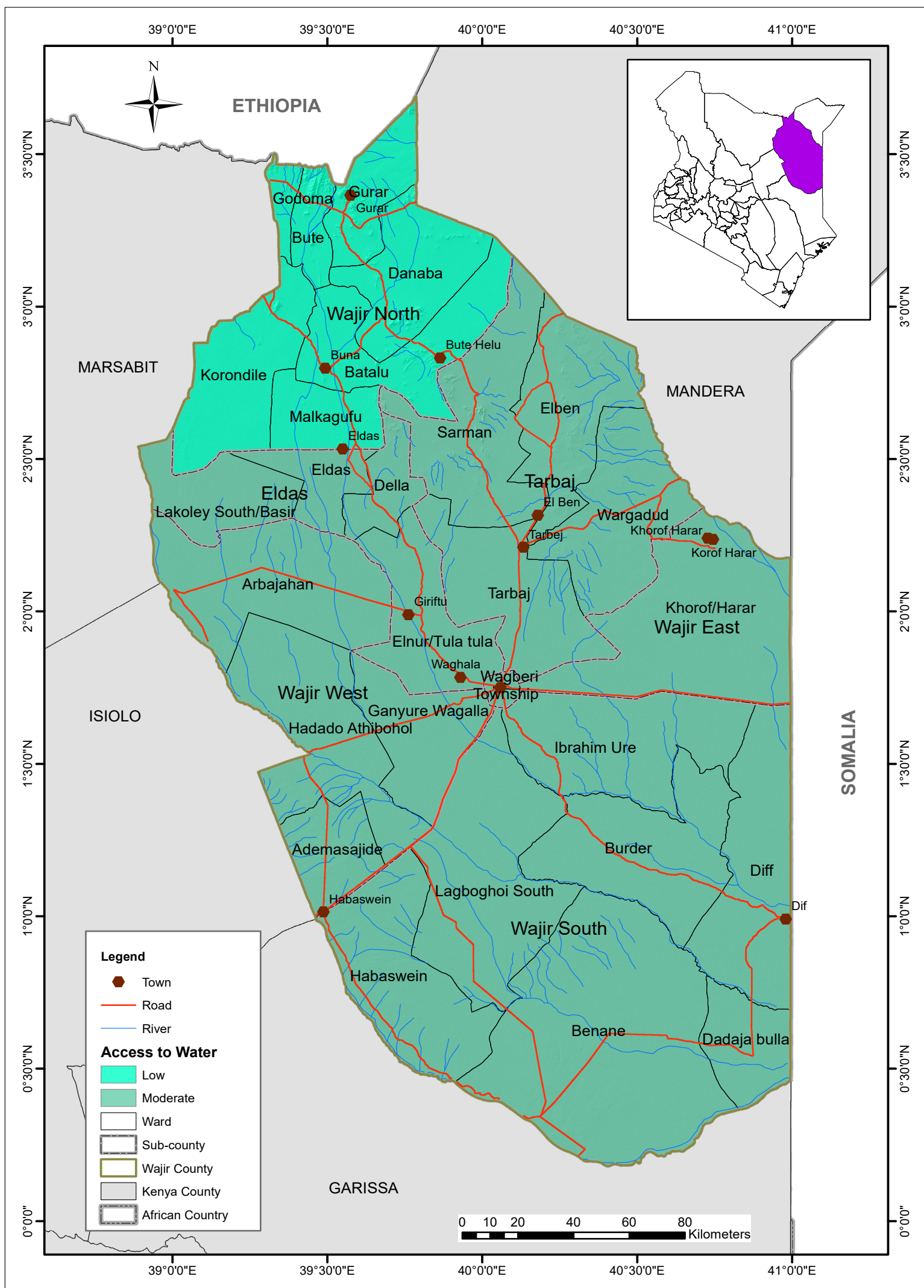
Data sources: RCMRD (Health Assessment by County Sector teams)

Spatial reference: Geographic, WGS 84

Administrative Boundaries: (OCHA ROSEA)

This map shows ward access to health based on Leadership and governance, Health information systems, Service delivery, Health system financing, medical products, vaccines and technologies. This map was developed after county stakeholders' participatory mapping workshop in Wajir County. Health accessibility is High in Wagberi and Township. Moderate in Khorof/Harar and Arbajahan. Low in Batalu, Khorof/Harar, Tarbaj, Wargadud, Korondile, Lakoley South/Basir, Burder, Danaba, Ibrahim Ure, Wagberi, Township, Barwaqo and Arbajahan. Very Low in Godoma and Gurar.

# Map 8.6: Accessibility to Water in Sub-Counties



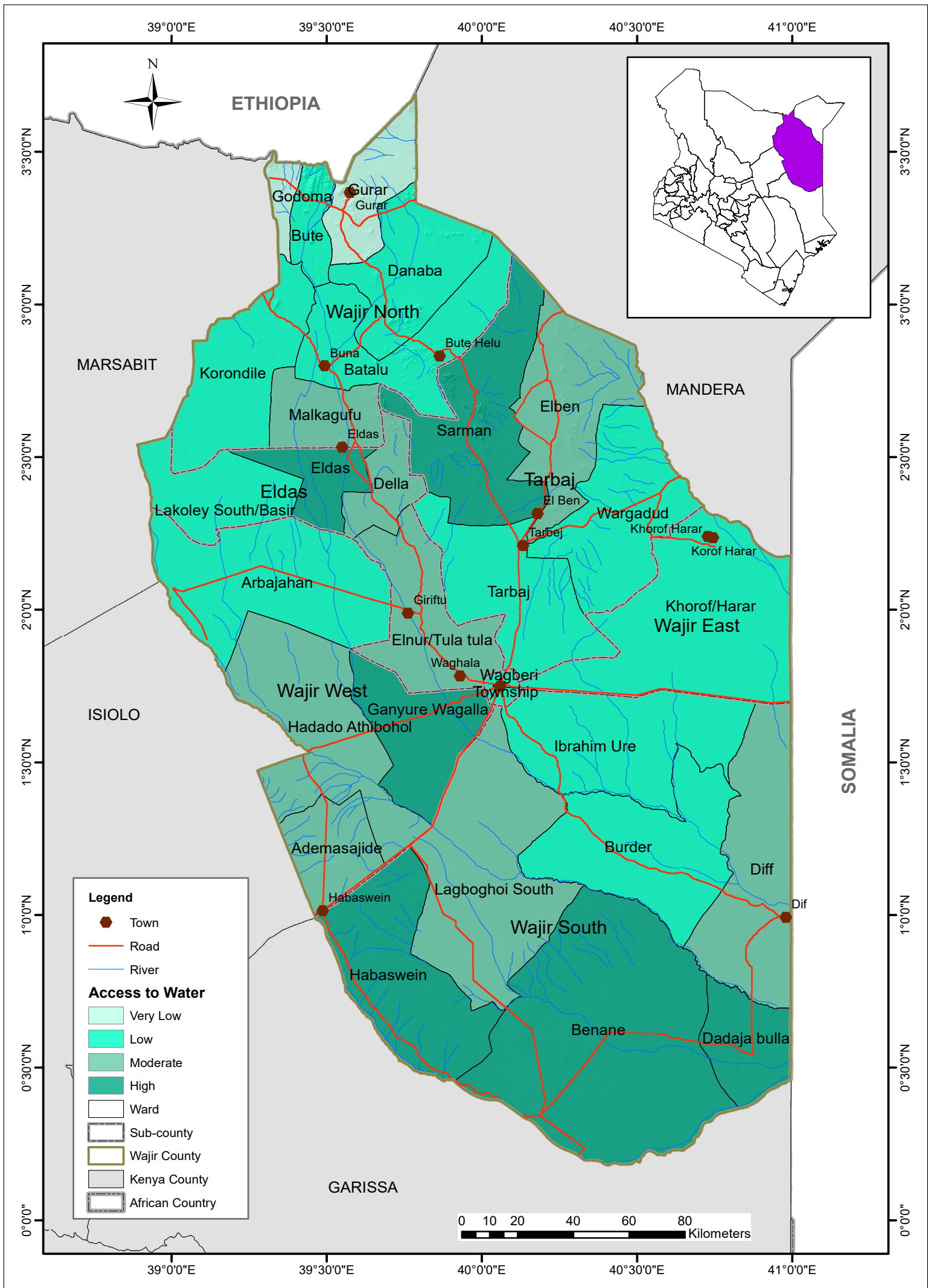
Data sources: RCMRD (Water Assessment by County Sector teams)

Spatial reference: Geographic, WGS 84

Administrative Boundaries: (OCHA ROSEA)

This map shows sub-county access to water. This map was developed after county stakeholders' participatory mapping workshop in Wajir County. Water accessibility is moderate in Wajir East, Wajir South, Wajir West, Eldas and Tarbaj. Wajir North has low access to water.

# Map 8.7: Accessibility to Water in Wards



**Data sources:** RCMRD (Water Assessment by County Sector teams)

**Spatial reference:** Geographic, WGS 84

**Administrative Boundaries:** (OCHA ROSEA)

This map shows ward access to water. This map was developed after county stakeholders' participatory mapping workshop in Wajir County. Water accessibility is High in Sarman, Benane, Eldas, Dadajabula, Habaswein and Ganyure/Wagalla. Moderate in Malkagafu, Elben, Hadado/Athibohol, Elnur, Della, Lagbogol South, Diif and Adamasajide. Low in Malkagafu, Batalu, Godoma, Elben, Sarman, Tarbaj, Wargadud, Hadado/Athibohol, Bute, Korondile, Elnur, Lakoley South/Basir, Benane, Burder, Gurar, Danaba, Ibrahim Ure, Eldas, Della, Dadajabula, Habaswein, Lagbogol South, Diif, Barwaqo, Adamasajide and Ganyure/Wagalla.

The conceptualization used in vulnerability assessment in this atlas is outcome vulnerability (Füssel, 2009), which “represents an integrated vulnerability concept that combines information on potential climate impacts and on the socio-economic capacity to cope and adapt.” The IPCC framework builds on this, in that vulnerability is considered to be a function of exposure to climate impacts, including variability and extremes, and the sensitivity and adaptive capacity of the system being exposed (Parry et al., 2007). The three components are further expanded on as follows:

**Exposure (E)** - the size of the area and/or system, sector or group affected and the magnitude of the stressor.

This factor (exposure) was largely defined by climatic layers these included the drought risk, flood risk, long-term rainfall average and long-term temperature average layers which were ranked in accordance to the risk level.

**Sensitivity (S)** - the characteristics of a system or population and the governance/market structures that

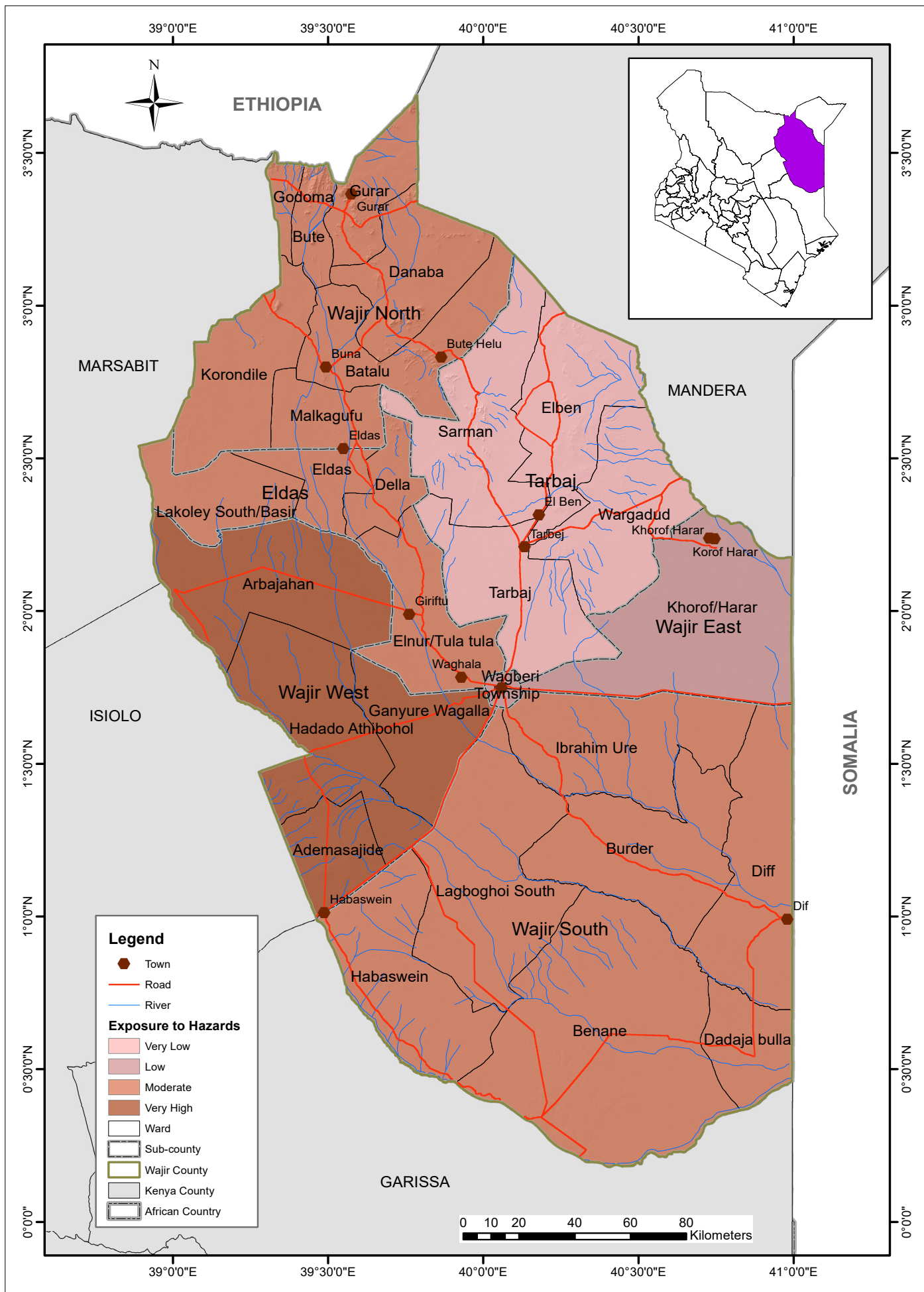
Influence the degree to which it is affected by stressors. This factor (sensitivity) by defined by the following layers: human, livestock and crop diseases.

**Adaptive capacity (A)** - capacities of the system, sector or group to resist impacts, cope with losses and/or regain functions. This component comprised the following layers:

access to health, water and school facilities.



# Map 8.8: Exposure to Hazards in Sub-Counties



GENERATION OF EXPOSURE								
SUB_COUNTY	FLOOD	DROUGHT	ENVIRONMENTAL DEGRADATION	HUMAN CONFLICT	HUMAN-WILDLIFE CONFLICT	TOTAL	RESCALE	SCALE AGGREGATION
ELDAS	4	4	4	4	2	18	3	3
TARBAJ	2	4	4	3	3	16	0	1
WAJIR EAST	2	4	5	3	3	17	2	2
WAJIR WEST	4	4	5	4	2	19	5	5
WAJIR NORTH	5	4	3	4	2	18	3	3
WAJIR SOUTH	3	4	5	3	3	18	3	3

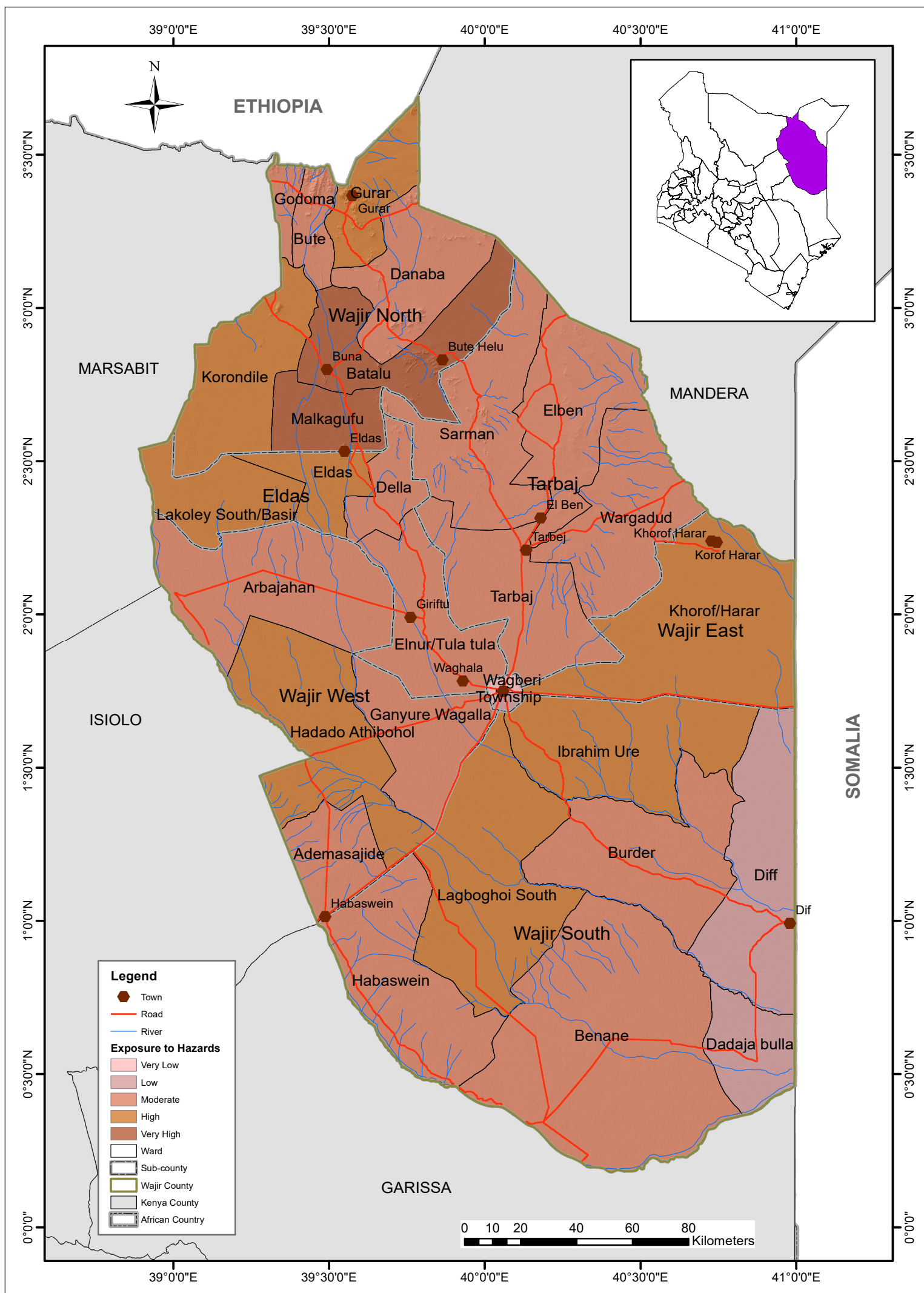
Data sources: RCMRD (Exposure Assessment by RCMRD)

Spatial reference: Geographic, WGS 84

Administrative Boundaries: (OCHA ROSEA)

This map shows sub-county exposure to hazards. This map was developed after county stakeholders' participatory mapping workshop in Wajir County. Exposure to hazards is very high in Wajir West, Moderate in Wajir South, Eldas and Wajir North. Low in Wajir East and Very Low in Tarbaj.

## Map 8.9: Exposure to Hazards in Wards



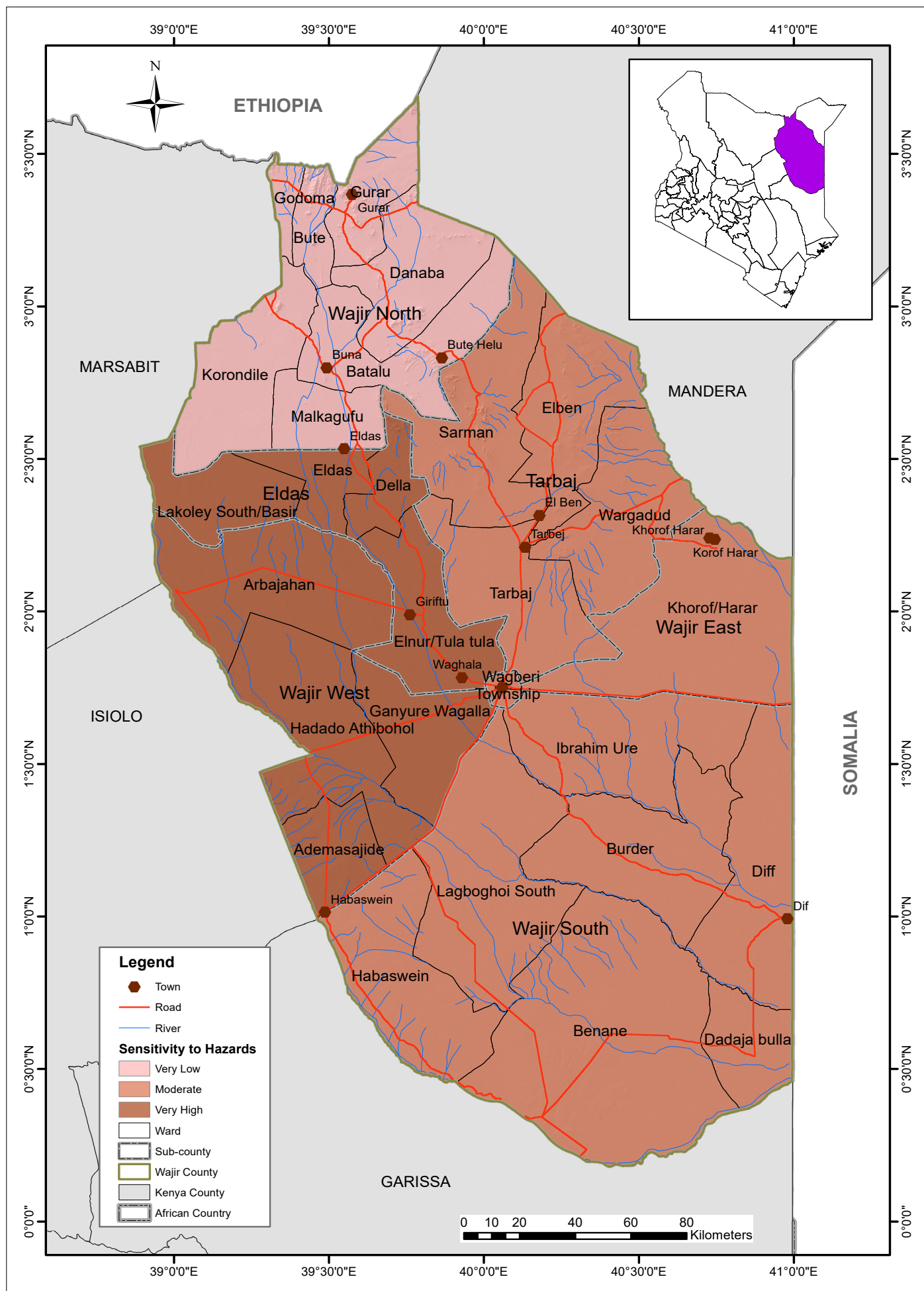
Data sources: RCMRD (Exposure Assessment by RCMRD)

Spatial reference: Geographic, WGS 84

Administrative Boundaries: (OCHA ROSEA)

This map shows ward vulnerability to drought. This map was developed after county stakeholders' participatory mapping workshop in Wajir County. Vulnerability is very high in Hadado/Athibohol, Elnur, Lakoley South/Bair, Benane, Burder, Ibrahim Ure, Eldas, Della, Dadajabula, Habaswein, Lagbogol South, Diif, Arbajahan, Ademasajide and Ganyure/Wagalla. High in Malkagufu, Batalu, Godoma, Khorof Harar, Elben, Sarman, Tarbaj, Wargadud, Bute, Korondile, Gurar, Danaba, Wagberi, Township and Barwaqo.

# Map 8.10: Sensitivity to Hazards in Sub-Counties



GENERATION OF SENSITIVITY						
SUB_COUNTY	HUMAN DISEASES	CROP DISEASES	LIVESTOCK DISEASES	TOTAL	RESCALE	SCALE AGGREGATION
ELDAS	4	3	3	10	5	5
TARBAJ	4	2	3	9	3	3
WAJIR EAST	5	2	2	9	3	3
WAJIR WEST	4	3	3	10	5	5
WAJIR NORTH	3	2	3	8	0	1
WAJIR SOUTH	4	3	3	10	5	5

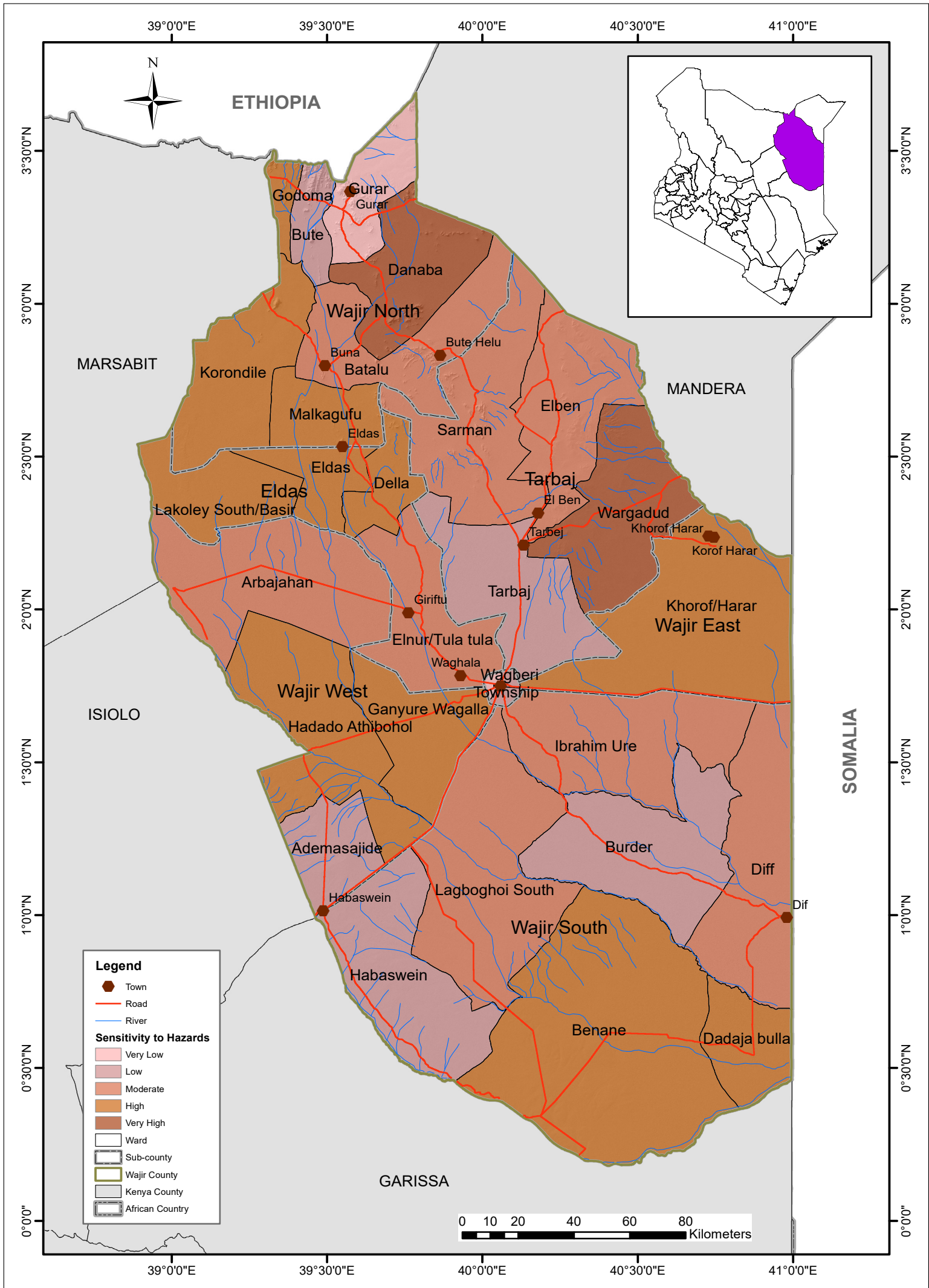
Data sources: RCMRD (Sensitivity Assessment by RCMRD)

Spatial reference: Geographic, WGS 84

Administrative Boundaries: (OCHA ROSEA)

This map shows sub-county sensitivity to hazards. This map was developed after county stakeholders' participatory mapping workshop in Wajir County. Sensitivity to hazards is very high in Wajir West and Eldas. Moderate in Wajir South, Wajir East and Tarbaj. Very Low in Wajir North.

# Map 8.11: Sensitivity to Hazards in Wards



**Data sources:** RCMRD (Sensitivity Assessment by RCMRD)

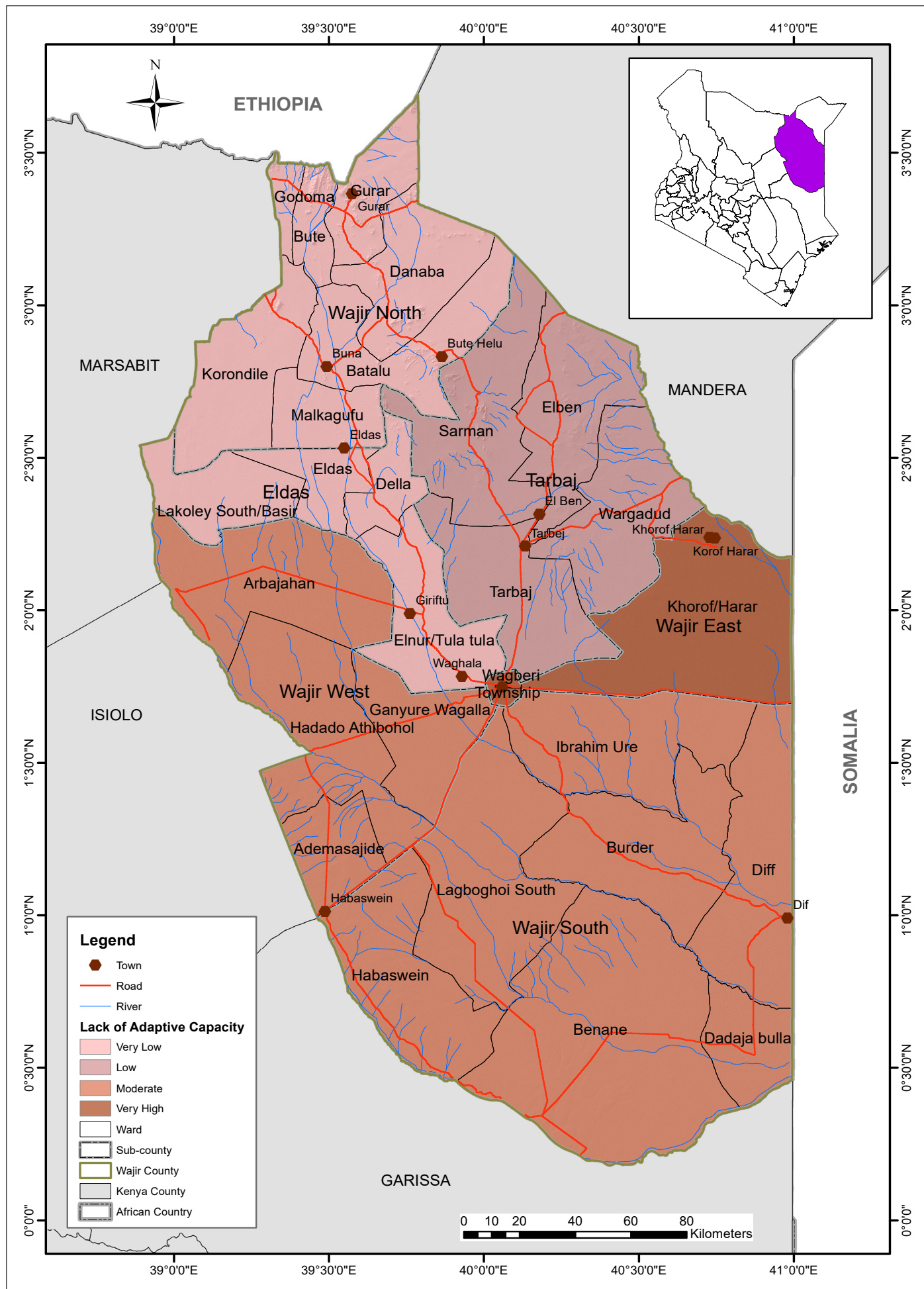
**Spatial reference:** Geographic, WGS 84

**Administrative Boundaries:** (OCHA ROSEA)

This map shows ward sensitivity to hazards. This map was developed after county stakeholders' participatory mapping workshop in Wajir County. Sensitivity is very High in Wargadud and Danaba. High in Malkagufu, Godoma, Khorof Harar, Korondile, Lakoley South/Basir, Bennane, Eldas, Della, Dadajabula and Ganyure/Wagalla. Moderate in Batalu, Elben, Sarman, Elnur, Ibrahim Ure, Lagbogol South, Diif and Arbajahan. Low in Trabaj, Bute, Burder, Wageberi, Habaswein, Township and Adamasajide. Very Low in Gurar and Barwaqo.



# Map 8.12: Lack of Adaptive Capacity in Sub-Counties



GENERATION OF LACK OF ADAPTIVE CAPACITY						
SUB_COUNTY	CLEAN WATER	EDUCATION	HEALTH	TOTAL	RESCALE	SCALE AGGREGATION
ELDAS	3	2	1	6	0	1
TARBAJ	3	3	1	7	1	2
WAJIR EAST	3	4	3	10	5	5
WAJIR WEST	3	3	2	8	3	3
WAJIR NORTH	2	2	2	6	0	1
WAJIR SOUTH	3	3	2	8	3	3

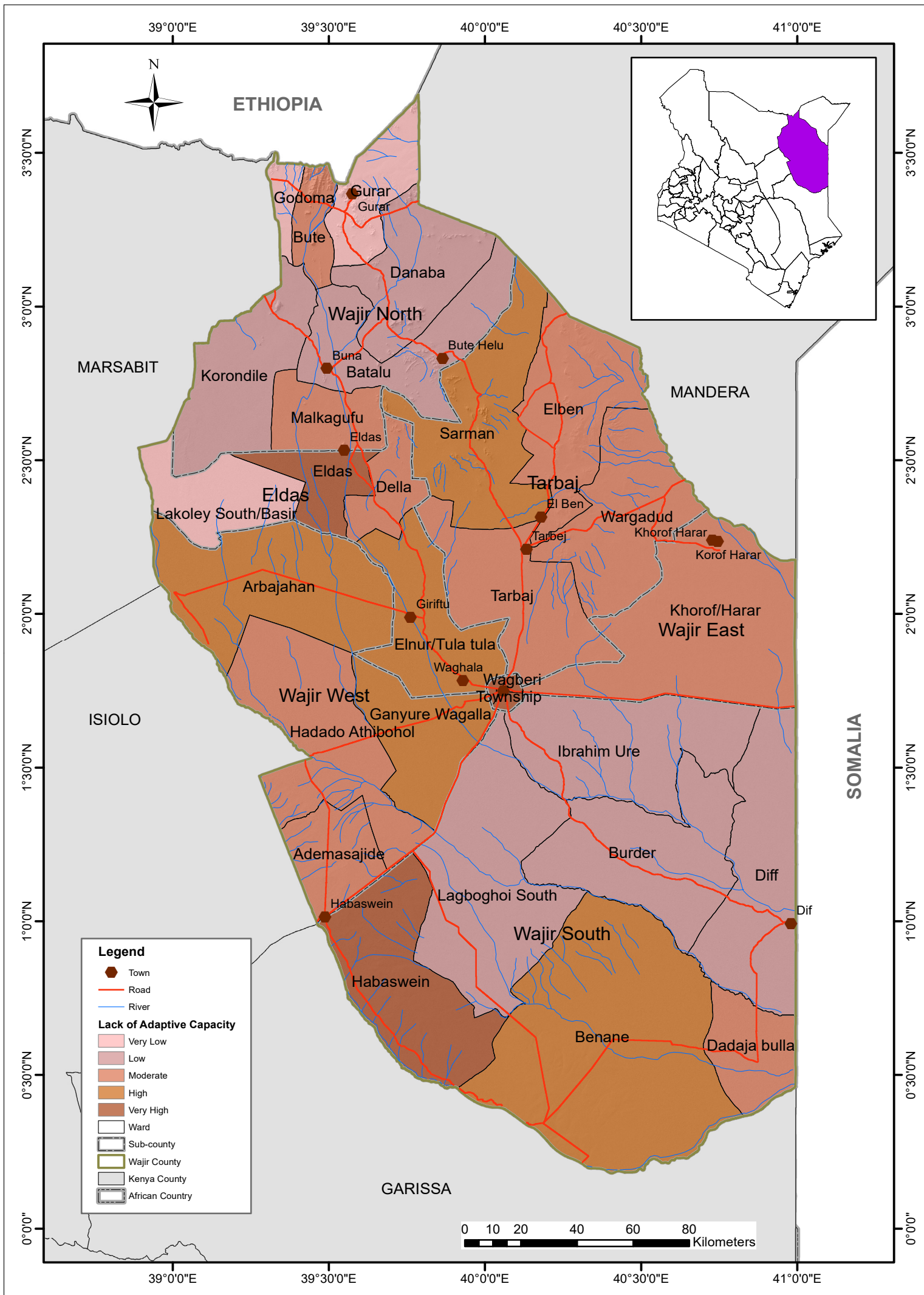
Data sources: RCMRD (Lack of Adaptive Capacity Assessment by RCMRD)

Spatial reference: Geographic, WGS 84

Administrative Boundaries: (OCHA ROSEA)

This map shows sub-county lack of adaptive capacity. This map was developed after county stakeholders' participatory mapping workshop in Wajir County. Lack of adaptive capacity is Very High in Wajir East, Moderate in Wajir West and Wajir South. Low in Tarbaj. Very low in Eldas and Wajir North.

## Map 8.13: Lack of Adaptive Capacity in Wards



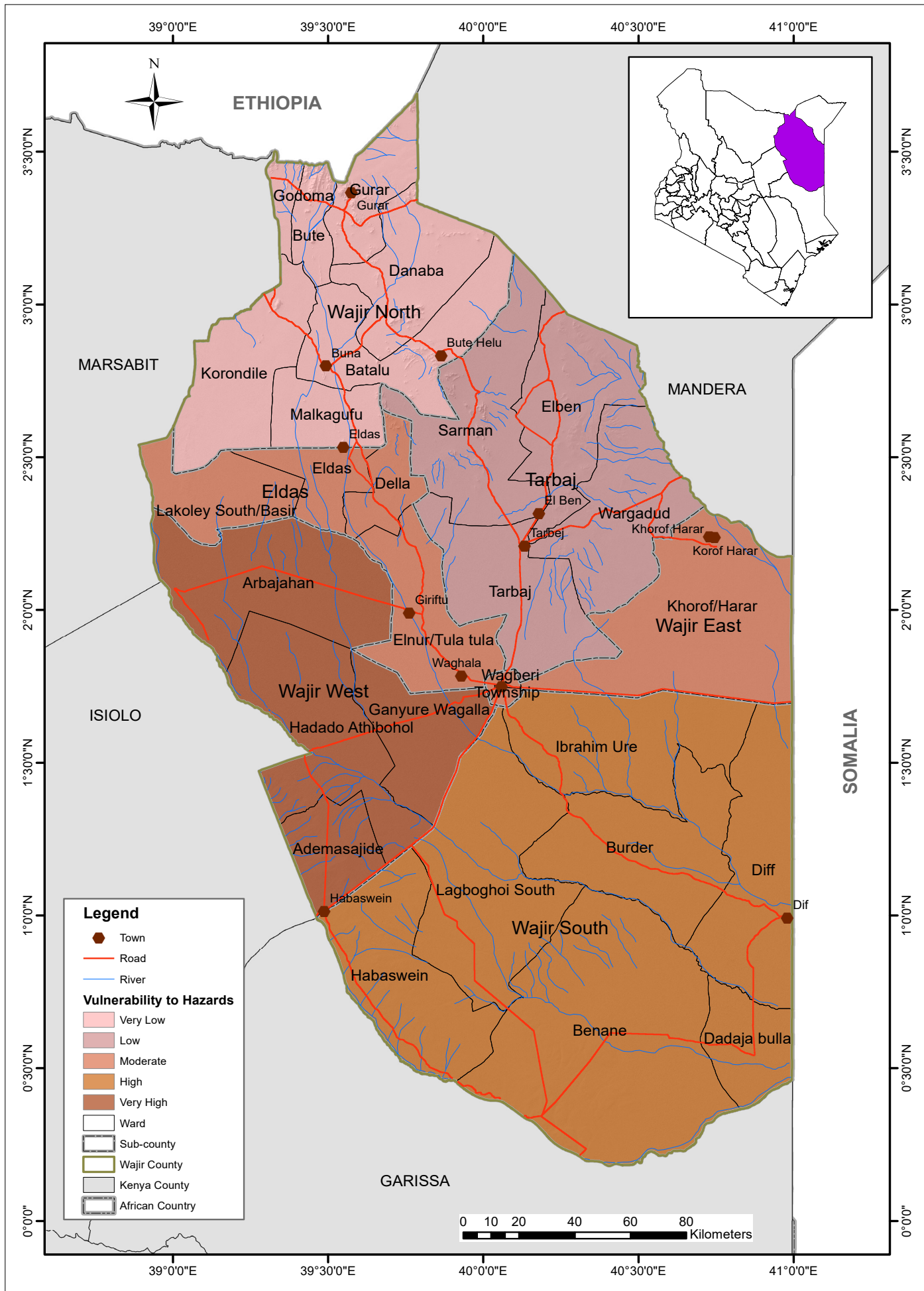
**Data sources:** RCMRD (*Lack of Adaptive Capacity Assessment by RCMRD*)

**Spatial reference:** Geographic, WGS 84

**Administrative Boundaries:** (OCHA ROSEA)

This map shows ward lack of adaptive capacity. This map was developed after county stakeholders' participatory mapping workshop in Wajir County. Lack of adaptive capacity is very high in Wagberi, Eldas, Habaswein, Township and Barwaqo. High in Sarman, Elnur, Benane, Arbajahan and Ganyure/Wagalla. Moderate in Malakagufu, Khorof Harar, Elben, Tarbaj, Wargadud, Hadado/Athibohol, Bute, Della, Dadajabula and Adamasajide. Low in Batalu, Korondile, Burder, Danaba, Ibrahim Ure, Lagbogol South and Diif. Very Low in Godoma, Lakoley South/Basir and Gurar.

# Map 8.14: Vulnerability to Hazards in Sub-Counties



GENERATION OF VULNERABILITY						
SUB_COUNTY	EXPOSURE	SENSITIVITY	LACK OF ADAPTIVE CAPACITY	TOTAL	RESCALE	SCALE AGGREGATION
ELDAS	3	5	1	9	3	3
TARBAJ	1	3	2	6	1	2
WAJIR EAST	2	3	5	10	3	3
WAJIR WEST	5	5	3	13	5	5
WAJIR NORTH	3	1	1	5	0	1
WAJIR SOUTH	3	5	3	11	4	4

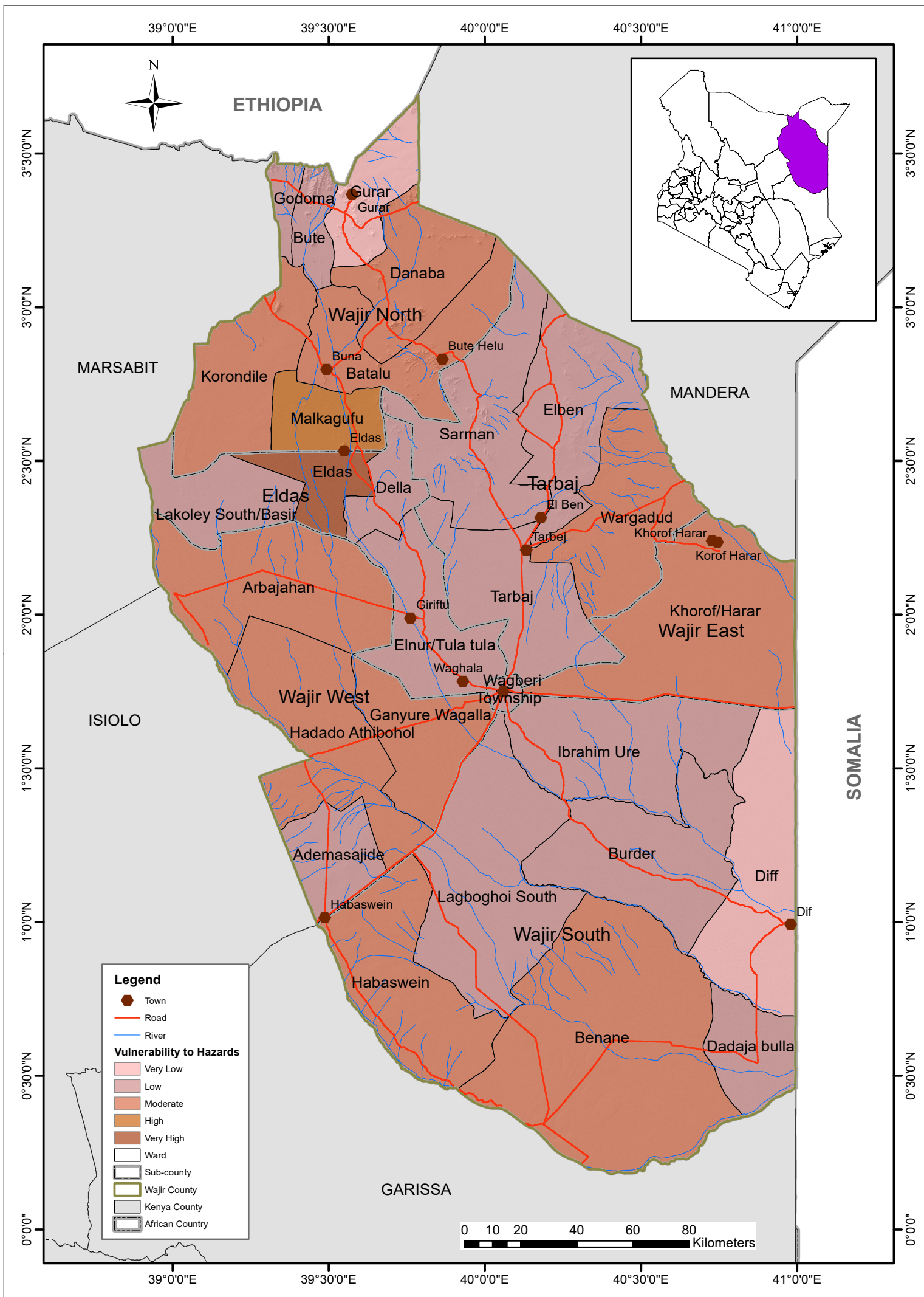
Data sources: RCMRD (Vulnerability Assessment by RCMRD)

Spatial reference: Geographic, WGS 84

Administrative Boundaries: (OCHA ROSEA)

This map shows sub-county vulnerability to Hazards. This map was developed after county stakeholders' participatory mapping workshop in Wajir County. Vulnerability to Hazards is Very High in Wajir West. High in Wajir South. Moderate in Wajir East and Eldas. Low in Tarbaj and very low in Wajir North.

# Map 8.15: Vulnerability to Hazards in Wards



**Data sources:** RCMRD (*Vulnerability Assessment by RCMRD*)

**Spatial reference:** Geographic, WGS 84

**Administrative Boundaries:** (OCHA ROSEA)

This map shows ward vulnerability to hazards. This map was developed after county stakeholders' participatory mapping workshop in Wajir County. Vulnerability to hazards is very high in Eldas. High in Malkagufu. Moderate in Batalu, Khorof Harar, Waragadud, Hadado/Athibohol, Korondile, Benane, Danaba, Habaswein, Arbajahan and Ganyure/Wagalla. Low in Godoma, Elben, Sarman, Tarbaj, Bute, Elnur, Lakoley South/Basir, Burder, Ibrahim Ure, Wagberi, Della, Dadajabula, Lagbogol South, Township, Barwaqo and Adamasajide. Very low in Gurar and Diif.

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# Metadata

## Mapping of Drought Hazard

Total failure or rainfall below expected levels is the major attribute to drought. Lack or excess precipitation directly affects the vegetation conditions. Climate Hazards Group Infrared Precipitation with Stations (CHIRPS) datasets were used to derive seasonal rainfall trends for the years 1981-2013 using GEOCLIM tool and Standard Precipitation Index (SPI) datasets from FEWSNET were used in mapping of drought. Long rains (March-June) and short rains (October-December) for the years 2000, 2009 and 2012 were used as a reference in mapping SPI.

### a. Mapping of Standard Precipitation Index

The Standardized Precipitation Index presents a rainfall anomaly as a normalized variable that conveys the probabilistic significance of the observed/estimated rainfall. By expressing anomalies in terms of their likelihood of occurrence it is easier to evaluate the rarity of the observed event, in the absence of a nuanced understanding of the rainfall regime at a location. This method offers a different, and complementary, perspective compared to anomalies (which can be relatively large, but not very significant in areas with highly variable rainfall) or percent of normal (which can be extreme, but not very significant in dry locations).

To evaluate the likelihood of occurrence, probability distribution functions (PDFs) are fit at each pixel for each accumulation interval. These PDFs are fit to the Collaborative Historical African Rainfall Model (CHARM), which provides a 36-year time series with which to estimate gamma distribution parameters. The CHARM data establishes the shape of the distribution, as well as an estimate of the variance. SPI values which are greater than zero indicate conditions wetter than the median, while negative SPI indicate drier than median conditions. For drought analysis, a SPI less than -1.0 indicates that the observation is roughly a one-in-six dry event, and is termed “moderate”. A SPI less than -1.5 indicates a one-in-fifteen dry event, and is termed “severe”. Values less than -2.0 are typically referred to as “extreme”, indicating the event is in the driest 2% of all events. For more information, please see: <http://earlywarning.usgs.gov/fews/africa/web/readme.php?symbol=sp>

### b. Mapping of Rainfall Trends

Rainfall trends map are the product of CHIRPS datasets. Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS) is a 30+ year quasi-global rainfall dataset. Spanning 50°S–50°N (and all longitudes), starting in 1981 to near-present, CHIRPS incorporates 0.05° resolution satellite imagery with in-situ station data to create gridded rainfall time series for trend analysis and seasonal drought

monitoring. The CHIRPS datasets used in the rainfall trends mapping are products of USGS, CHG scientists, Agency for International Development (USAID) the National Aeronautics and Space Administration (NASA), and the National Oceanic and Atmospheric Administration (NOAA). For more information, please see: <http://pubs.usgs.gov/ds/832/pdf/ds832.pdf>

### c. Mapping of Drought Physical Exposure

Drought Physical Exposure map is a product of dataset that includes an estimate of global drought annual repartition based on Standardized Precipitation Index. It is based on three sources: 1) A global monthly gridded precipitation dataset obtained from the Climatic Research Unit (University of East Anglia). 2) A GIS modeling of global Standardized Precipitation Index based on Brad Lyon (IRI, Columbia University) methodology. 3) A population grid for the year 2007, provided by LandScan™ Global Population Database (Oak Ridge, TN: Oak Ridge National Laboratory). Unit is expected average annual population (2007 as the year of reference) exposed (inhabitants). This product was designed by UNEP/GRID-Europe for the Global Assessment Report on Risk Reduction (GAR). It was modeled using global data. Credit: GIS processing UNEP/GRID-Europe. For more information, please see: <http://www.unisdr.org>

## Mapping of Flood Hazard

Food maps are products of models from regional earth observation datasets based on weighted overlay analysis of flood observation datasets.

### a. Flood Economic Exposure

This dataset includes an estimate of the annual economical exposition to flood. It is based on four sources: 1) A GIS modeling using a statistical estimation of peak-flow magnitude and a hydrological model using HydroSHEDS dataset and the Manning equation to estimate river stage for the calculated discharge value. 2) Observed flood from 1999 to 2007, obtained from the Dartmouth Flood Observatory (DFO). 3) The frequency was set using the frequency from UNEP/GRID-Europe PREVIEW flood dataset. In area where no information was available, it was set to 50 years returning period. 4) A population grid for the year 2010, provided by LandScan™ Global Population Database (Oak Ridge, TN: Oak Ridge National Laboratory). 4) A Global Domestic Product grid for the year 2010, provided by the World Bank. Unit is expected average annual GDP (2010 as the year of reference) exposed in (US \$, year 2000 equivalent). This product was designed by UNEP/GRID-Europe for the Global Assessment Report on Risk Reduction (GAR). It was modeled using global data. Credit: GIS processing UNEP/GRID-Europe, with key support from USGS EROS Data Center, Dartmouth Flood Observatory 2008. For more

information, please see: <http://www.preventionweb.net/english/professional/contacts/v.php?id=2781>

### **b. Flood Physical Exposure**

This dataset includes an estimate of the annual physical exposition to flood. It is based on three sources: 1) A GIS modeling using a statistical estimation of peak-flow magnitude and a hydrological model using HydroSHEDS dataset and the Manning equation to estimate river stage for the calculated discharge value. 2) Observed flood from 1999 to 2007, obtained from the Dartmouth Flood Observatory (DFO). 3) The frequency was set using the frequency from UNEP/GRID-Europe PREVIEW flood dataset. In area where no information was available, it was set to 50 years returning period. 4) A population grid for the year 2010, provided by LandScanTM Global Population Database (Oak Ridge, TN: Oak Ridge National Laboratory). Unit is expected average annual population (2007 as the year of reference) exposed (inhabitants). This product was designed by UNEP/GRID-Europe for the Global Assessment Report on Risk Reduction (GAR). It was modeled using global data. Credit: GIS processing UNEP/GRID-Europe, with key support from USGS EROS Data Center, Dartmouth Flood Observatory 2008. For more information, please see: <http://www.preventionweb.net/english/professional/contacts/v.php?id=2781>

### **c. Flood Frequency**

This dataset includes an estimate of flood frequency. It is based on three sources: 1) A GIS modeling using a statistical estimation of peak-flow magnitude and a hydrological model using HydroSHEDS dataset and the Manning equation to estimate river stage for the calculated discharge value. 2) Observed flood from 1999 to 2007, obtained from the Dartmouth Flood Observatory (DFO). 3) The frequency was set using the frequency from UNEP/GRID-Europe PREVIEW flood dataset. In area where no information was available, it was set to 50 years returning period. Unit is expected average number of event per 100 years. This product was designed by UNEP/GRID-Europe for the Global Assessment Report on Risk Reduction (GAR). It was modeled using global data. Credit: GIS processing UNEP/GRID-Europe, with key support from USGS EROS Data Center, Dartmouth Flood Observatory 2008. For more information, please see: <http://www.preventionweb.net/english/professional/contacts/v.php?id=2781>

### **d. Flood Risk**

This dataset includes an estimate of the global risk induced by flood hazard. Unit is estimated risk index from 1 (low) to 5 (extreme). This product was designed by UNEP/GRID-Europe for the Global Assessment Report on Risk Reduction (GAR). It was modeled using global data. Credit: UNEP/GRID-Europe. For more information, please see: <http://www.preventionweb.net/english/professional/contacts/v.php?id=2781>

### **e. Flood Prone areas**

Flood prone areas map is a product of Dartmouth University. This product consists of individual GIS vector polygons which define the surface water detected by the MODIS 250 m bands and also depict a multi-temporal composite of the accumulating record of flooded land. These data are produced on a routine basis (1-2 day lag time) as part of the Observatory's flood measuring and mapping projects. When cloud cover and satellite coverage allows, vectors are produced from a single image for each flood event listed in the Archives (generally from 2000 forward). Vectors are also produced on a routine basis which shows rivers in non-flood conditions. For more information, please see: <http://www.dartmouth.edu/~floods/DataProducts/MODIS/>

### **Mapping of Malaria Hazard**

Malaria Hazard map is a product of Africa malaria mapping exercise. The methodology is based on household survey data interpolation and climatic suitability modeling. For more information on climatic suitability modelling approach, please see: [http://www.mara.org.za/trview\\_e.htm](http://www.mara.org.za/trview_e.htm)

#### **Mapping of Seismic, Volcanic and Earthquake activities**

Seismic, Volcanic and Earthquake maps were derived from coverage showing the earthquake intensity zones in accordance with the 1956 version of the Modified Mercalli Intensity scale (MMI). The intensity zones describe exclusively the effect of an earthquake on the surface of the earth by integrating numerous parameters including acceleration, duration of earthquake, sub-soil effects, as well as historical reports. The seismic hazard grading is based on its expectation over a period of 50 years, which also corresponds to the mean service life of a modern building. The probability of the degree of intensity being exceeded in 50 years is 20% shown on the maps. GRID digitized the original maps on earthquakes at a scale 1:34,000,000 and further added the coastlines from PC World Databank-II (by ESRI, as modified by GRID)

The zone as provided by the MMI scale (probable of maximum intensity once in 50 years) is 0 – V and below, 1- VI, 2- VII, 3- VIII, 4- IX and above. The data was further validated by experts from the participating IGAD member states and by incorporating expert knowledge, the MMI scales were classified into four levels of seismic risk as follows: Very High (IX and above); High (VIII); Medium (VII) and Low (below VI). For more information, please see:

[http://www.geodata.grid.unep.ch/mod\\_download/download.php](http://www.geodata.grid.unep.ch/mod_download/download.php)

### **Mapping of Livelihood Zone**

Livelihood Zone map is a zones/an area within which people share broadly the same pattern of livelihood, including options for obtaining food and income and market opportunities. A livelihood zoning is essential for

the following reasons:

- It provides geographic orientation of livelihood systems to inform food security analysis and assistance targeting
- It provides the basis for identifying geographically relevant food security monitoring indicators
- It provides a sampling frame for future on-the-ground assessments

Livelihood patterns clearly vary from one geographic area to another, which is why the preparation of a Livelihood Zone Map is a logical first step for livelihoods-based analysis.

## GLOSSARY/ DEFINATION OF TERMS

**Disaster:** A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts.

**Disaster contingency plan:** To address a disaster or impending disaster within a fairly finite time, such as from early warning to response to recovery, including mechanisms for generation of disaster-specific operational plans.

**Disaster preparedness strategy:** A broad exercise, which sets out objectives for disaster preparedness in a country or region, reviews the current status of disaster preparedness capacities in relation to those objectives, and identifies what measures must be taken for maintaining and enhancing those capacities for the objective to be met.

**Disaster Risk:** The potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity.

**Disaster Risk Management:** The application of disaster risk reduction policies and strategies to prevent new disaster risk, reduce existing disaster risk and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses.

**Disaster Risk Reduction:** This is aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development.

**Drought:** Naturally occurring phenomenon that exist when precipitation has been significantly below normal recorded levels causing a serious hydrological imbalance that adversely affects land resource production systems.

**Early warning:** Provision of early and relevant information on potential or actual disasters, and normally involved monitoring hazards, especially in relation to communities or areas known to be vulnerable to their effects, so that more timely and effective response measures is taken.

**Emergency:** An extraordinary situation in which people are unable to meet their basic survival needs, or there are serious and immediate threats to human life and well-being.

**Hazard:** A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation.

**Impacts:** specific effects of hazards or disasters also referred to as consequences or outcomes. Impacts and needs assessment: Assessing the nature and magnitude of a disaster once it occurs, its impact on affected populations, and the type and extent of emergency assistance that is required.

**Agricultural drought:** an agricultural drought is the impact of meteorological droughts and hydrological droughts on crop yields. This kind of drought is associated with extreme heat. It occurs when extended dry periods and general lack of rainfall result in a lack of moisture in the root zone of the soil. This severely damages the plants that live in the area.

**Hydrological drought:** occurs when there are critically low ground water tables and reduced river and stream flow. Hydrological drought is distinguished by a reduction in water resources in reservoirs, lakes, rivers, underground aquifers and streams.

**Meteorological drought:** a reduction in rainfall over a specific period, for example a day, month, season, or year. There is no agreement on what the lack of rain or the time without rain should be before it is considered a drought. Usually the area affected determines these especially in non-arid regions. Meteorological drought leads to depletion of soil moisture and this almost always has an impact on crop production.

**Mitigation:** The lessening or minimizing of the adverse impacts of a hazardous event.

**Preparedness:** The knowledge and capacities developed by governments, response and recovery organizations, communities and individuals to effectively anticipate, respond to and recover from the impacts of likely, imminent or current disasters.

**Prevention:** Activities and measures to avoid existing and new disaster risks

**Response:** Actions taken directly before, during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected.



**Risk:** Combination of the probability of an event and its negative consequences. The probability of a harmful consequence or loss resulting from an interaction between natural hazards and vulnerable conditions of property and people.

**Risk Assessment:** a methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend.

**Vulnerability:** The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards.

