

UGANDA

# Climate Hazard Assessment – Yumbe District

April 2026



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# Climate Hazards in Uganda's Refugee-Hosting Districts.

## INTRODUCTION

Uganda hosts one of the largest refugee populations in Africa,<sup>1</sup> many of whom live in climate sensitive landscapes highly vulnerable to the impacts of climate change due to its reliance on rain-fed agriculture, limited adaptive capacity, and high exposure to extreme weather events such as floods, droughts, and prolonged dry spells.<sup>2</sup> Over recent decades, the country has experienced more frequent and intense climate hazards, undermining livelihoods, food security, health, and infrastructure.<sup>3,4</sup> Uganda's climate is characterized by a bimodal rainfall pattern; however, this pattern has become increasingly unpredictable, with delayed onset and erratic distribution of rainfall that disrupts agricultural cycles.<sup>5</sup>

## Key National Signals



Temperatures have risen by ~1.0 –1.5°C over the last five decades, increasing heat stress and evapotranspiration.



More erratic rainfall: delayed onset, mid-season dry spells, intense rainfall events



Prolonged dry spells and flooding now co-exist as dominant hazards, disrupting agriculture, water access, transport, and shelter

Climate hazards vary across the country, with distinct patterns between the Northern/West Nile and Southwestern regions, highlighting the need for localized analysis. Although both regions are projected to become warmer and wetter by mid-century, the impacts will differ significantly due to variations in baseline conditions, terrain, and livelihood systems.

In the Northern/West Nile region including Yumbe, Koboko, Adjumani, Madi Okollo, Terego, Obongi, and Lamwo, average temperatures are projected to rise from about 25°C to 30°C by mid-century, while annual rainfall increases from roughly 1,138 mm to 1,587 mm. Despite higher rainfall, increased temperatures will accelerate evapotranspiration, leading to greater soil moisture loss and prolonged dry periods

during key agricultural seasons. According to the Multi-Sectoral Needs Assessment (MSNA), conducted by [IMPACT Initiatives](#) in 2024, long dry spells and heavy rains are the hazard types most frequently reported across West Nile and Southwestern regions. With accelerating climate change, they will remain dominant hazards, alongside a growing risk of flash flooding in low-lying and poorly drained areas.<sup>6</sup>

Hazard Type	West Nile	Adjumani	Terego	Koboko	Lamwo	Madi Okollo	Obongi	Yumbe
Drought/Prolonged dry spell	x	31%	39%	40%	46%	31%	36%	46%
Heavy Rains	x	38%	40%	42%	24%	33%	35%	38%
Extreme Temp. Events	x	19%	13%	12%	18%	26%	13%	7%
Flood	x	13%	8%	6%	12%	10%	15%	9%

Table 1: Climate hazards reported in the MSNA, 2024, Northern/West Nile region

In Southwestern Uganda districts, which include Isingiro, Kamwenge, Kyegegwa, Kiryandongo, and Kikuube, historical temperatures average about **20.3°C** but are projected to rise to around **26°C** by mid-century, marking significant warming. Annual rainfall is also expected to increase from about **842 mm** to roughly **1,372 mm**.

Hazard Type	Southwest	Kiryandongo	Isingiro	Kamwenge	Kikuube	Kyegegwa
Drought/Prolonged dry spell	x	49%	74%	45%	48%	58%
Heavy Rains	x	30%	17%	28%	25%	25%
Extreme Temp. Events	x	16%	6%	23%	18%	13%
Flood	x	6%	3%	4%	9%	3%

Table 2: Climate hazards reported in the MSNA, 2024, Southwestern region

Across both regions, warmer and wetter conditions do not reduce climate risk. Instead, they increase overlapping hazards, with long dry spells, floods, and heat stress occurring in the same districts and seasons. These pressures are especially acute in refugee-hosting areas where land, water, and services are already limited. District-level Climate Hazard Profiles translate national and regional climate trends into local evidence, highlighting key hazards and exposures to support targeted planning and resilience for host and refugee communities.

# Climate Hazard Assessment – Yumbe District

## CONTEXT & RATIONALE

Yumbe District is located in Uganda's West Nile Sub-region, bordering South Sudan to the north and Arua District to the south. The district experiences a **purely tropical climate as a result of its location within the eastern topographical rainfall zone with a bimodal rainfall pattern**. The rainy season occurs from March to October/November, while the dry season runs from December to early March.<sup>7</sup> Yumbe District receives an average rainfall of **1250mm**. The district faces increasing climate vulnerability due to its reliance on rain-fed agriculture, limited adaptive capacity, and exposure to recurrent extreme weather events. In recent years, erratic rainfall, prolonged dry spells, seasonal floods, and rising temperatures have disrupted farming systems, reduced crop yields and strained water resources.<sup>8,9</sup> Rainfall patterns have become more unpredictable, with delayed onset, mid-season dry spells and intense rainfall events, particularly affecting sub-counties such as **Romogi, Ariwa, and Kululu**.<sup>10,11</sup>

Climate projections under the Moderate Socio-economic Path (SSP2-4.5 scenario), which represents a middle of the road development trajectory with moderate emissions and limited climate mitigation, indicate that Yumbe will become warmer and moderately wetter by mid-century. Mean annual temperatures are projected to rise **from 26°C to 28.4°C**, while annual rainfall is expected to increase from **1,277 mm to about 1,441 mm**.<sup>1</sup> Despite this increase in rainfall, intensifying heat stress is expected to pose greater risks to rural households and displaced populations.<sup>12</sup>

Bidibidi Refugee Settlement, one of the world's largest refugee settlements, faces similar climate pressures, as both refugee and host communities depend on the same climate-sensitive resources, including rain-fed agriculture, groundwater and wood fuel.<sup>13</sup> These overlapping vulnerabilities highlight the need to assess climate hazards in Yumbe and understand how exposure to seasonal drought and flooding intersects with displacement dynamics. This analysis therefore seeks to generate evidence-based insights into historical and projected climate trends to inform climate-resilient

humanitarian and development programming in Yumbe District.

By identifying hazard susceptibility, exposure patterns, and future climate hazards, the assessment aims to support OPM, UNHCR, WFP, district authorities and humanitarian partners in developing targeted interventions, strengthening disaster preparedness and enhancing resilience within one of Uganda's largest refugee-hosting districts.

### Key Messages

- Yumbe District currently receives ~**1,277 mm** of annual rainfall, projected to rise moderately to ~ **1,441 mm** by mid-century under the SSP2-4.5 scenario. However, persistent dry-season deficits and higher evapotranspiration will intensify water stress, especially in the southern sub-counties and densely populated Bidibidi settlement.
- Temperatures **are projected to increase** by **2.5-2.9°C** during the **warmest month and driest quarters**, increasing the risk of drought, heat stress and the frequency of very hot days across agricultural and settlement areas.
- Seasonal drought remains a dominant hazard, with the Standard Precipitation Index (SPI) and Vegetation Condition Index (VCI), which capture rainfall deficits and vegetation stress respectively, showing **severe dryness across Romogi, Ariwa, Odravu and Bidibidi zones 1-5**, leading to vegetation stress, reduced crop yields, and limited pasture and water availability.
- Recurrent flooding affects **southern and southeastern Yumbe, including Yoyo, Langi, Erezeli, Okubani and Bidibidi zones 3-5**, where low-lying terrain and poor drainage cause repeated damage to shelter, farmlands, and infrastructure.

climate mitigation, resulting in continued warming and increasing climate variability.

<sup>1</sup> SSP2-4.5 refers to a *moderate climate change scenario* that combines the "Middle-of-the-Road" Shared Socio-economic Pathway (SSP2) with a radiative forcing level of 4.5 W/m<sup>2</sup> by 2100. It assumes continued socio-economic development along current trends, moderate population growth, and limited but ongoing

## Location and Topography

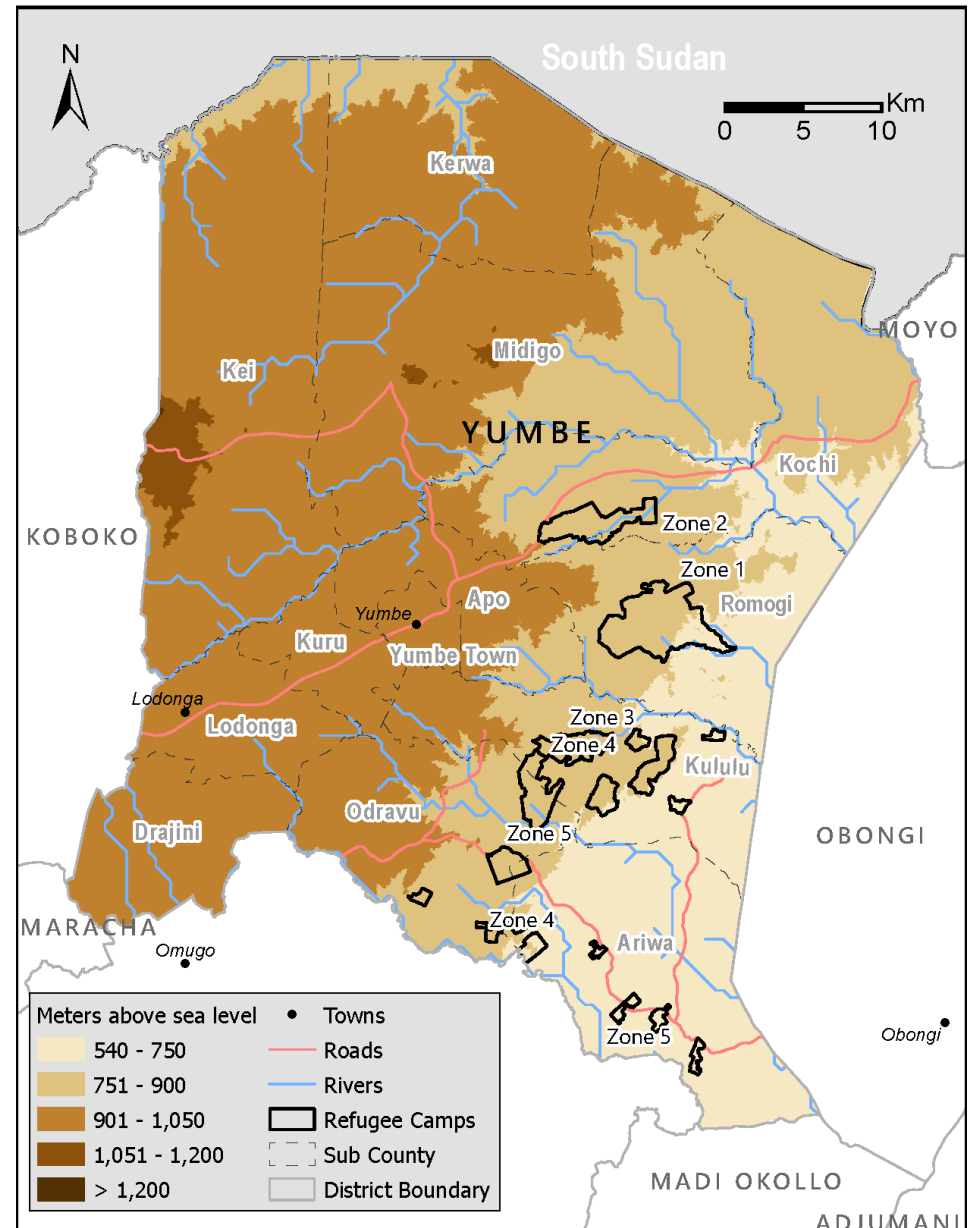
Yumbe District is in the West Nile Sub-region of Northwestern Uganda, sharing an international border with South Sudan to the north. The district lies within the **tropical savannah ecological zone**, characterized by gently rolling plains, seasonal rivers, and scattered woodland vegetation. As shown in *Map 1*, Yumbe District features gently undulating terrain, with elevations generally ranging between **540 and 1,350 metres above sea level**. The district is composed of low hills and broad valleys, which influence both drainage patterns and land use practices, including settlements tending to occupy higher grounds and agriculture being concentrated in low lying valleys.<sup>14</sup> Valleys usually have fertile soils and reliable water sources, making them ideal for crop farming, while hills with steeper slopes can be used for grazing livestock and forestry.

Located within the West Nile Region of Uganda, Yumbe's elevation contributes to a relatively moderate climate compared to lower-lying districts in Northern Uganda, such as Adjumani and Obongi where elevations drop below 500 metres. The district is predominately characterised by loamy soils, with gravels deposits found in some isolated parts of Kuru, Romogi and Odravu sub-counties. In contrast, the eastern part of the district, particularly along the Nile basin, is mainly composed of sandy soils.<sup>15</sup>

However, the flat plains in the eastern part of Yumbe are more vulnerable to seasonal flooding and waterlogging, especially during periods of intense rainfall, as the limited natural drainage capacity of the terrain exacerbates these hazards. This is particularly true for the sub-counties **Ariwa, Romogi and Kochi**.

## Demographics and Population Distribution

According to the **2024** National Population and Housing Census, Yumbe District has a population of over **945,000** people, making it one of the most densely populated rural districts in Uganda.<sup>16</sup> The majority of the population belongs to the **Aringa ethnic group**, with Islam being the dominant religion, practiced by **over 70% of residents**. The district also has a predominantly young population, with more than half under the age of 18, leading to high dependency ratios and growing demand for social services, such as education and healthcare.<sup>17</sup> A significant portion of Yumbe District's population comprises refugees, predominantly from South Sudan, hosted in the Bidibidi Refugee Settlement. Established in 2016, Bidibidi is among the world's largest



Map 1: Map showing the Location and Elevation of Yumbe District.

refugee settlements, with over **209,000 refugees** as of December 2025.<sup>18</sup> Refugees account for nearly one-third of the district's total population, substantially influencing demographic patterns, population density, and the demand for basic services.

## Livelihoods

The majority of Yumbe District's population relies on **subsistence agriculture** as their primary source of livelihood. Commonly cultivated crops include sorghum, millet, maize, cassava, simsim and groundnuts. Livestock farming is practiced on a small scale, with households typically rearing goats, poultry, and cattle. However, agricultural productivity is constrained by limited access to markets, largely due to poor road infrastructure. Livelihoods are also highly vulnerable to climatic shocks, such as prolonged dry spells and floods, which disrupt planting and harvesting cycles and contribute to food insecurity.<sup>19</sup>

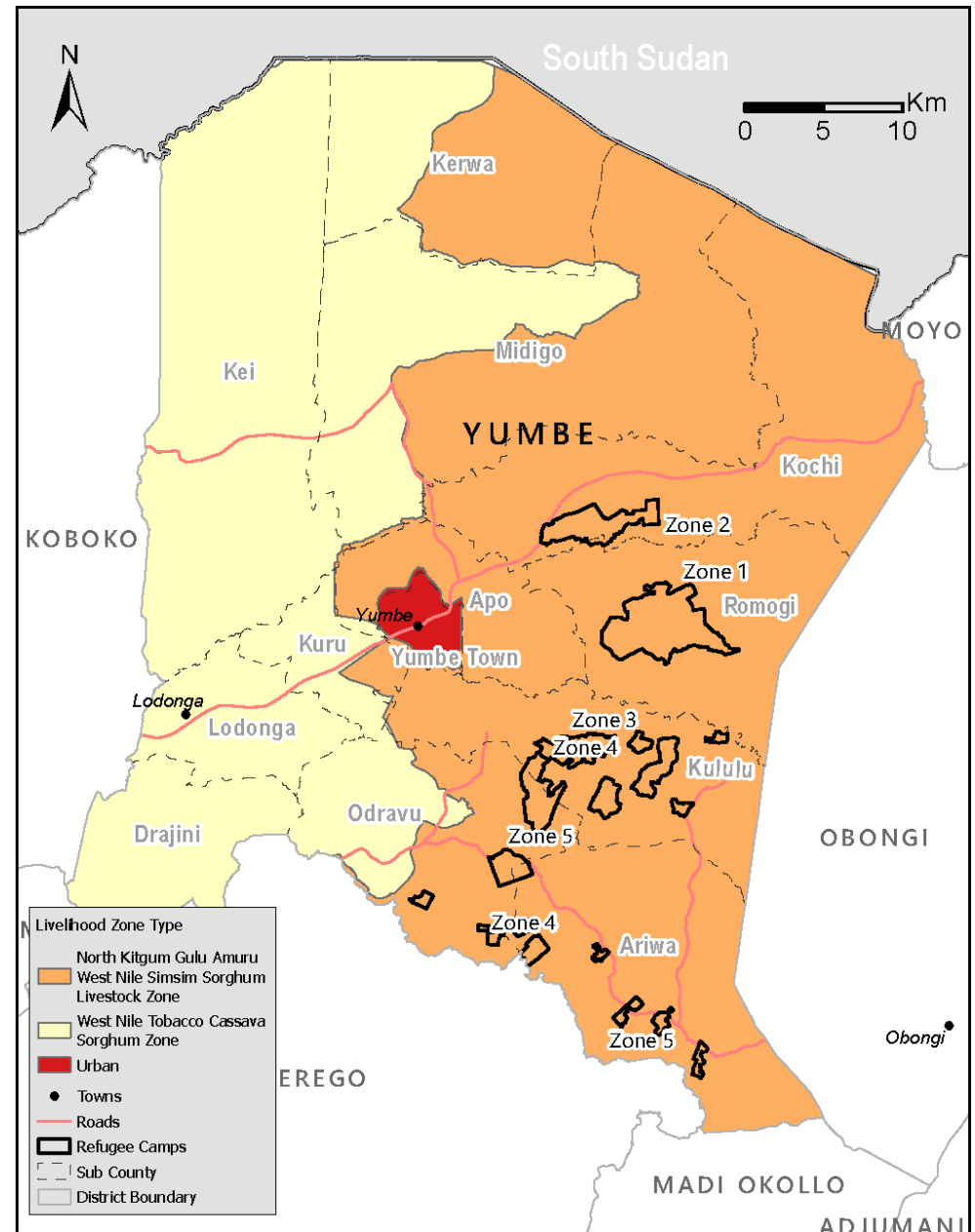
Yumbe's livelihood patterns vary geographically (see *Map 2*). Sub-counties **Kerwa, Kei, and Kuru** in the western and northern parts of the district are dominated by agricultural activities which are rain-fed and hence sensitive to rainfall variability.

The **eastern and southern sub-counties Apo, Kochi, Romogi, Ariwa, and Kululu overlap with Bidibidi Refugee Settlement**, which is divided into zones 1 to 5. These zones host large refugee populations and experience more intensive agricultural land use, defined by continuous cultivation on small plots and limited crop rotation. This results in increased pressure on natural resources and higher rates of land degradation.

In Bidibidi Settlement, refugees depend partly on humanitarian assistance but are also encouraged to engage in farming on small, allocated plots. Despite these efforts, land access remains limited, and environmental degradation, such as soil degradation, water pollution and deforestation, further challenges sustainable livelihoods.<sup>20</sup>

## Environment, Land Use and Land Cover

Yumbe's natural environment comprises savannah grasslands, wetlands, and scattered forest patches. However, these ecosystems have experienced significant degradation



Map 2: Map showing Livelihood Zones in Yumbe District.

due to deforestation, charcoal production, soil degradation, water scarcity, and waste pollution. The environmental degradation observed is mostly caused by the expansion of agricultural land and human settlements. The rapid population increase from an estimated **484,000 in 2014 to 945,000 in 2024** has increased demand for fuelwood and construction materials, and agricultural land.<sup>21</sup> The increase in the district's population is the result of both high birth rates and the official opening of Bidibidi Refugee Settlement in 2016.

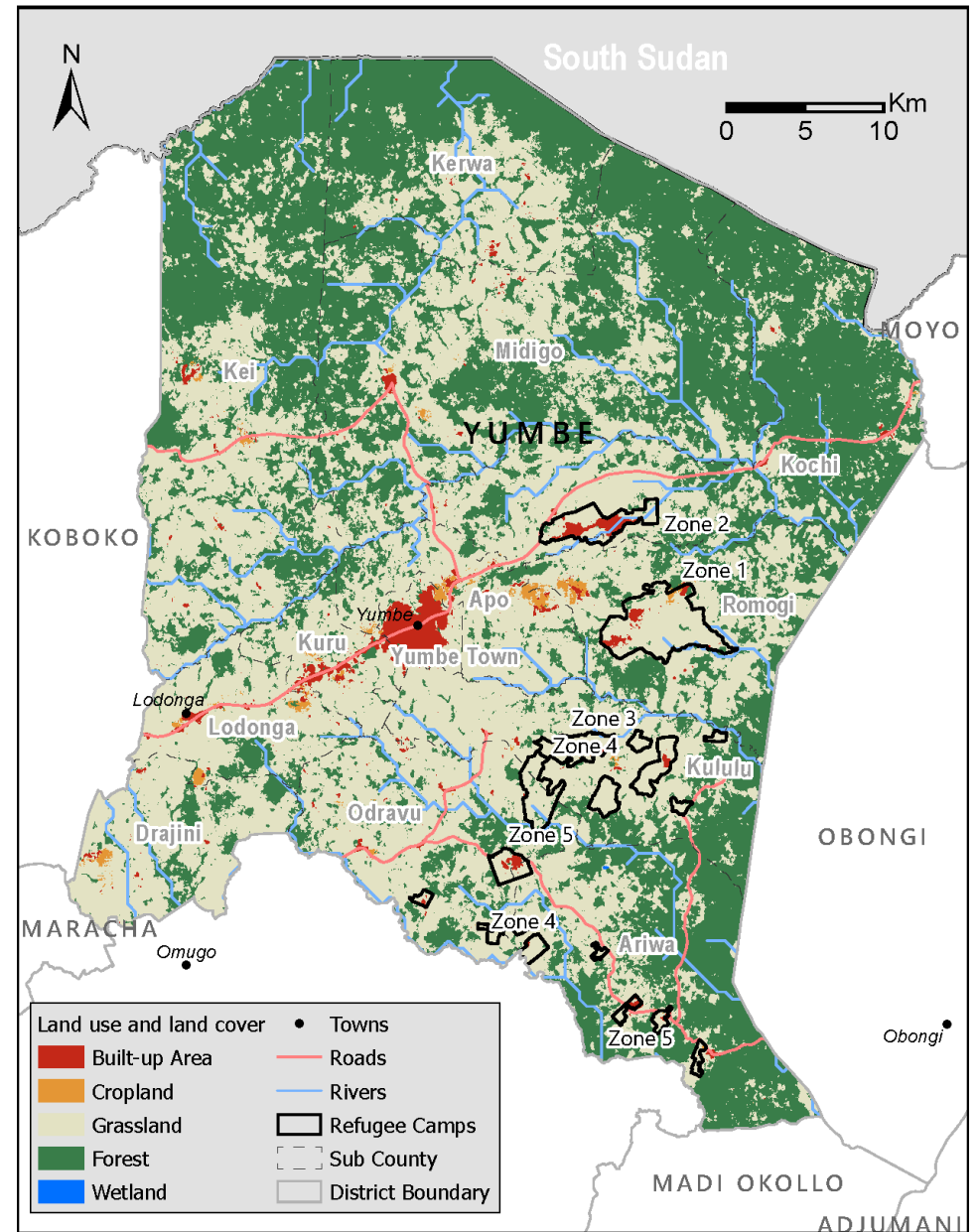
Access to safe and reliable water remains a major challenge, especially during dry spells. During these periods, reduced water availability, combined with increased pressure on limited water sources, contributes to water scarcity and the degradation of catchment areas, threatening both human and ecological health.<sup>22</sup> The district is increasingly exposed to climate-related hazards, such as soil erosion, seasonal flooding, and rising temperatures, which further undermine ecosystem services and reduce resilience to environmental shocks.

Yumbe's landscape is predominantly composed of rangeland grasslands, which cover approximately **52.3%** of the total land area. These grasslands stretch across the district and support key livelihood activities, such as livestock grazing and building materials.

Forestland accounts for nearly **46%** and plays a vital role in providing fuelwood, timber, and construction poles, while also contributing to soil fertility and erosion control, making it essential for both ecological stability and household energy needs.

Built-up areas make up **1.6%** of the district's land cover and include settlements, trading centres, and refugee zones such as Bidibidi. These areas also host critical infrastructure, including schools, health centres, and road networks. Although cropland occupies only **0.4%** of the land area, it remains crucial for subsistence farming, with crops such as sorghum, maize, cassava and groundnuts forming the backbone of household food security and income generation.

Although wetlands and open water bodies cover less than **0.001%** of Yumbe District, they provide important dry-season water buffers. Examples include the Kochi Wetland Corridor, seasonal valley bottoms in Kerwa and Kei and small wetland pockets around Apo and Ariwa Sub-counties. These wetlands are vital for water supply, brick making, dry season farming, and livestock watering. Wetlands are both productive agricultural zones and critical ecological buffers that can sustain communities during climate stress. Upland agricultural lands are at times vulnerable to rainfall variability.



Map 3: Map showing Land Use and Land Cover in Yumbe District. Source: ESRI land cover map.

## CLIMATE CONTEXT

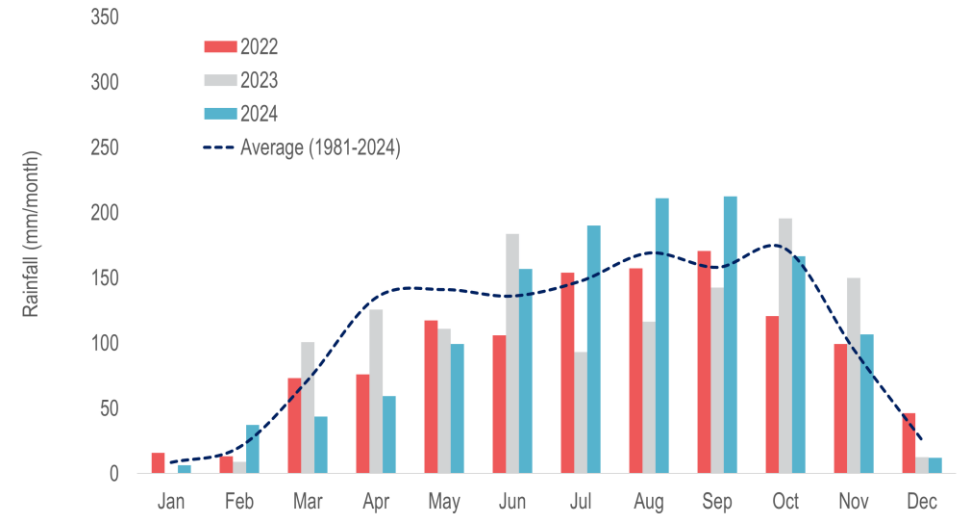
This section presents an analysis of Yumbe District's climate, using key indicators. Rainfall and temperatures are examined from both historical records and future climate projections to understand long-term trends and emerging hazards. The aim is to provide a clear picture of how climate patterns have evolved over time and how they are expected to change in the coming decades, informing both vulnerability profiling and resilience planning.

### Rainfall

Yumbe District experiences a long rainy season stretching from March to October, with notable intra-season variability. The long-term average (1981-2024) shown by the dashed line in *Figure 1* indicates two short dry spells within the rainy season, a dip in rainfall around June-July and another around September before rains peak again in August and early October.

The driest months remain December to February, each typically receiving less than **50 mm** of rainfall. Year-to-year variation is also evident, with 2022, 2023, and 2024 showing different magnitudes and timing of rainfall within these general seasonal patterns. As shown in *Figure 1*, recent observations (2022-2024) reveal year-to-year variability in both the timing and amount of rainfall compared to historical averages. For example:

- **2022:** Rainfall was generally below the 1981-2024 average, especially from April-June, August and October-November. Only March, July, September and December recorded totals close to or slightly above the long-term mean.
- **2023:** Rainfall fluctuated around the 1981-2024 average, with January recording no rainfall at all (0 mm) and below average totals in February, April-May, July-September and December. March, June, October and November were clearly wetter than the long-term mean.
- **2024:** Rainfall departed more strongly from the 1981-2024 average, with below average totals in March-May and December, whereas June to September and November recorded clearly above average rainfall.



*Figure 1: Graph showing Long-term Average Rainfall (2022-2024) in Yumbe District.*

These fluctuations are influenced by climate variability phenomena, such as the El Niño Southern Oscillation (ENSO), which can alter the onset, duration, and intensity of seasonal rains. Historically, the El Niño Southern Oscillation (ENSO) typically occurred in an irregular cycle of two to seven years with the individual El Niño persisting for 9 to 12 months. In recent decades, greater variability in ENSO timing, intensity and impacts has contributed to less predictable rainfall patterns across the region and as a result, Yumbe is increasingly vulnerable to both seasonal droughts and flooding. Prolonged dry spells, especially during the December-February period, lead to water scarcity, crop stress, and pasture depletion. Conversely, intense rainfall events during the August-October peak can trigger flash floods, crop damage, and disruption of transport and livelihoods.

The dry season is also marked by high temperatures, often exceeding **30°C**, and low humidity, contributing to increased occurrences of seasonal drought and water stress. These conditions are exacerbated by land degradation and limited water infrastructure, affecting domestic use, livestock, and agricultural productivity.<sup>23</sup>

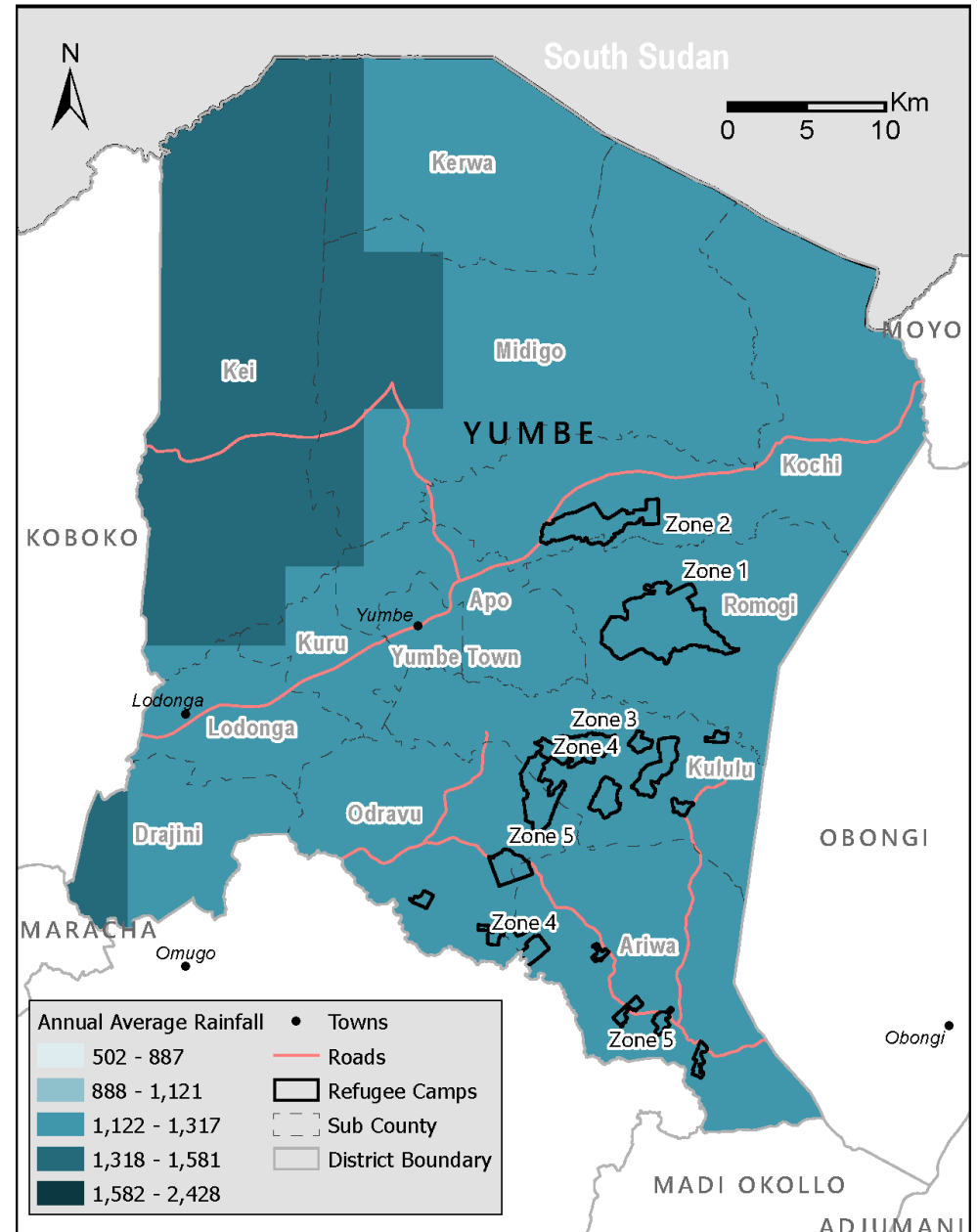
Overall, the increasing variability in rainfall patterns, combined with the district's reliance on rain-fed agriculture, heightens climate hazards for both refugee and host communities. This underscores the urgent need for integrated climate adaptation and resilience strategies to safeguard water availability, food security, and sustainable livelihoods.

Map 4 displays the spatial distribution of average annual rainfall across Yumbe District for the period **1981-2024**, derived from long-term CHIRPS precipitation data. **Yumbe District** straddles the **1,122 -1,317 mm and 1,318 -1,581 mm** annual rainfall zones, with wetter conditions in the western part of the district. Overall, Yumbe receives approximately **1,200 -1,500 mm** of rain per year, placing it within a moderate to moderately high rainfall zone. This rainfall regime is generally sufficient to sustain rainfed agriculture and rangeland vegetation.

The seasonal concentration of rainfall between **March and October**, combined with recent fluctuations in timing and intensity, has increased the risk of prolonged dry spells across Yumbe District. Seasonal rainfall variability often drives environmental degradation, such as soil erosion, soil nutrient loss and water availability, which in turns disrupts traditional agricultural calendar (the timing of planting, growing and harvesting) to which farming communities are adapted.

Overall, the increasing variability in rainfall patterns, coupled with the district's reliance on rain-fed agriculture, heightens climate risks for both refugee and host communities. For example, maize and beans are vulnerable crops: a five-day dry spell can stress these crops, reduce growth and yield, especially if a long dry spell occurs during critical stages, such as flowering and grain filling. With an average maturity of 16 weeks, maize and beans planted in March typically reach flowering between week 6 and 10, meaning May is a crucial period. CHIRPS data for Yumbe District shows that in May, across three consecutive years of 2022-2024, there were more than 15 dry days with frequency of more than two consecutive 5-day dry spell.

For example, in recent years, **farmers in Apo and Romogi Sub-counties** reported **crop failure** when the June-July dry spell became longer than usual, **stressing young sorghum and millet crops**. This qualitative evidence is consistent with findings from the *2024 Multi – Sectoral Needs Assessment (MSNA)*, in which host community households in Yumbe identified prolonged mid-season dry spells as a major shock to crop production.<sup>24</sup> Similarly, the unexpected September dip in rainfall has repeatedly affected second-season planting, particularly for simsim and groundnut crops that rely



Map 4: Map showing Average Annual Rainfall (1981-2024) in Yumbe District.

on consistent moisture at germination.

Temperature challenges exacerbate these issues. Although communities are accustomed to Yumbe District's typically warm climate, rising temperatures and more frequent hot days have **intensified evapotranspiration, shortened soil moisture retention, and reduced the viability of late-season crops**. Livestock keepers in Kerwa and Kei Sub-counties have reported **reduced pasture regeneration and longer distances to reach watering points during extended hot periods**.

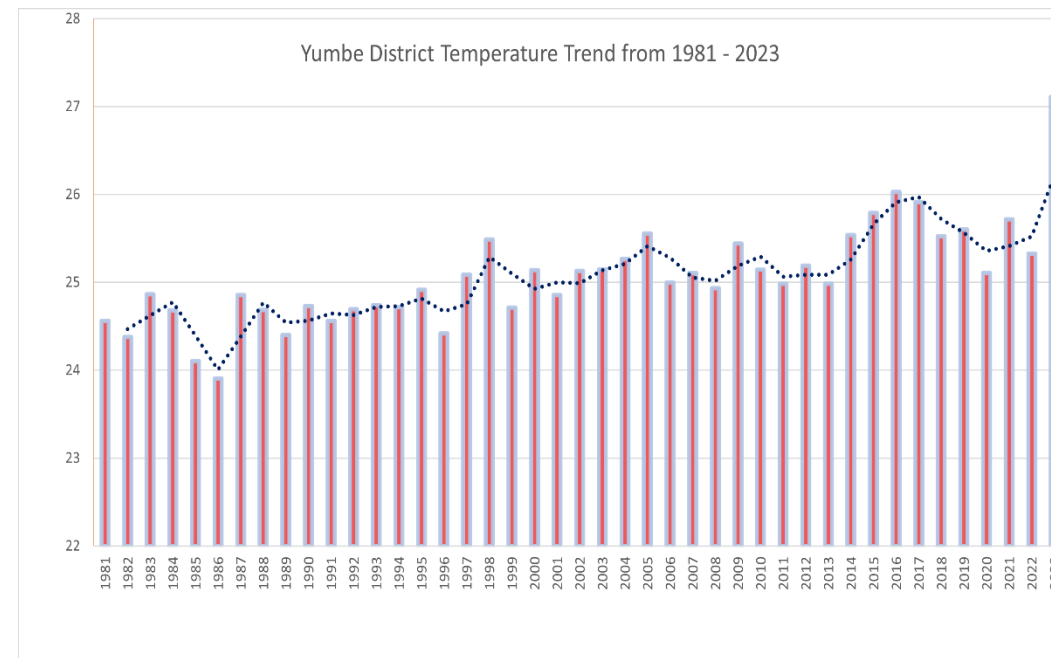
The recent changes pose specific challenges for refugee-hosting areas. Bidibidi Settlement, established in a dryland zone with limited perennial water sources and fragile soils, depends heavily on predictable seasonal rains to sustain small household gardens. When rainfall becomes erratic or temperatures rise sharply, refugees have fewer livelihood alternatives to buffer these shocks. This makes them more vulnerable than host communities whose livelihoods are distributed across a wider landscape and diversified through larger landholdings and livestock.<sup>25</sup>

Overall, it is the increasing variability and rapid shifts in the known climatic patterns that pose growing uncertainties in Yumbe. These shifts influence **water availability, crop performance, pasture regeneration and the reliability of rain-fed farming systems that both host and refugee communities depend upon**.

## Temperature

Over the past four decades, Yumbe District has experienced a significant rise in temperatures, with an increase of approximately **2.7 to 3°C**, a substantial warming trend for a single district. As shown in *Figure 2*, the most pronounced rise has occurred in recent years (2020-2023), indicating a possible acceleration in warming and a growing risk of extreme heat events.

The long-term temperature trend can be summarized as follows:



*Figure 2: Graph showing the Long-term Temperature Trend (1981-2023) in Yumbe District.*

- 1980s-mid 1990s: Average annual temperatures generally ranged between about **23.9°C and 24.8°C**, with modest year-to-year variability and no strong warming trend.
- Late 1990s-2014: Average annual temperatures rose gradually to between **24.8°C and 25.5°C** but remained relatively consistent until 2014.
- 2015 onwards: A clearer warming signal and greater variability, with most years above **25.5°C** and peaks approaching **26°C-26.5°C**, followed by an exceptional spike above **27°C** in 2023.

This consistent upward trend highlights the **growing climate stress in the region**, with **implications for agriculture, water availability, health and overall resilience**.

Seasonal temperature patterns in Yumbe District show consistently warmer conditions during the December-February dry season, when clear skies and high solar exposure drive daytime temperatures above the long-term average. During the March-October rainy period, temperatures remain slightly lower but have been gradually increasing as well. *Figure 3* also indicates a rise in temperature extremes, with recent years showing more days where average daily temperatures exceed the long-term mean. Notably, the sharp increase after 2016 and the peak after 2023 suggest that hotter-than-normal years are becoming more frequent, increasing heat stress on crops, pasture, livestock and water resources. These emerging extremes, coupled with rising seasonal temperatures, highlight Yumbe District’s growing vulnerability to climate-induced heat stress.

The long-term monthly temperature averages (1981-2024), shown by the dashed line in *Figure 3*, indicate two temperature rises within the rainy season that coincide with crop flowering in the first season in April-May and crop germination in the second season in September.

The recent monthly temperature trend (2022-2024) can be summarized as follows:

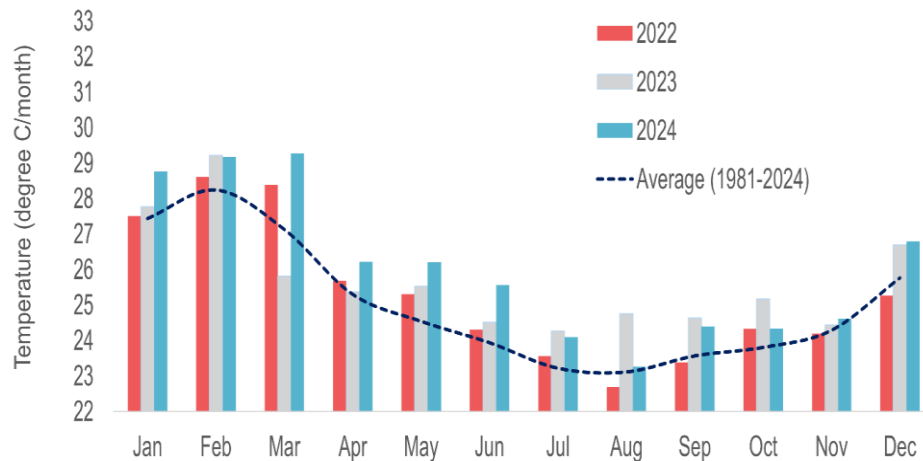


Figure 3: Graph showing Average Annual Temperature (2022-2024) of Yumbe District.

- 2022: Monthly temperature in the crop flowering stage of the first season was above normal of the long-term average in May while is normal in the second season in September.
- 2023: Monthly temperature in the crop flowering stage of the first season was above normal of the long-term average in May-June while is above normal in the second season in August-September.
- 2024: Monthly temperature in the crop flowering stage of the first season was above normal of the long-term average in April-June while is above normal in the second season in August-September.

Above-normal temperatures negatively affect crops at all stages-reducing:

- Germination by accelerating metabolism leading to depletion of energy reserves, impairing starch breakdown and causing poor root development before seedlings establish.
- Flowering by hindering pollination, fertilization, and impairing chlorophyll function, thus lowering carbohydrate supply and leading flowers to drop prematurely.
- Seed development by reducing carbohydrate and oil accumulation in seeds, resulting in smaller seeds, thus lowering the seed germination potential of harvested seeds.

In short, heat stress is most damaging during flowering and seed development. Farmers might mitigate heat stress effect through adjusted sowing dates, use of heat-tolerant varieties and irrigation scheduling.

## CLIMATE CHANGE PROJECTIONS

In this study, bioclimatic variables from WorldClim v2.1, which provide historical high-resolution baseline climate data, such as temperature and precipitation patterns, were compared with future climate projections, generated by the UKESM1-0-LL Earth system model under the SSP2-4.5 scenario, a “middle-of-the-road” pathway. Under this scenario, socio-economic development and moderate mitigation policies lead to stabilizing greenhouse gas emissions. This comparison allows researchers to assess how key climatic factors like seasonal rainfall, temperature extremes, and seasonal drought indices are expected to shift in coming decades, highlighting potential impacts on ecosystems, agriculture, and water resources under a moderately warming future.

### Precipitation changes (1970-2000 vs 2041-2060)

SSP2-4.5 Moderate Emission Scenario  
Annual precipitation changes

**+164 mm**

### Temperature changes (1970-2000 vs 2041-2060)

SSP2-4.5 Moderate Emission Scenario  
Annual Mean Temperature Increase

**+2.7 °C**

Figure 4: Annual precipitation and temperature changes in Yumbe District

## Temperature

Mean annual temperature is projected to rise from **25.7°C** in the historical baseline to **28.4°C** by **2041-2060**. Both minimum and maximum temperatures show substantial increases. The strongest warming (up to **2.76-2.80°C**) is expected in the southern and southwestern sub-counties, including **Lodonga, Drajini, Kuru, and Kei**. Northern sub-counties such as **Kerwa, Midigo, and Lori** experience slightly smaller increases (**~2.57°C**) but still exceed the districtwide warming trend.

An increase in mean temperature during both the **warmest months (+2.5°C)** and **driest quarter (+2.9°C)** indicates more intense heatwaves, particularly during already

dry periods. This combination heightens **heat stress for people, crops and livestock, greater evapotranspiration, and reduced soil-moisture retention**.

An increase in mean temperature during both the **coldest months (+2.9°C)** and **wettest quarters (+2.7°C)** indicates a **general warming across seasons**, including periods that are typically cooler. This suggests reduced seasonal cooling and more persistent heat throughout the year.

These impacts pose challenges for **crop production, livestock, and human health** particularly in areas with limited vegetation cover, including parts of Bidibidi settlement.

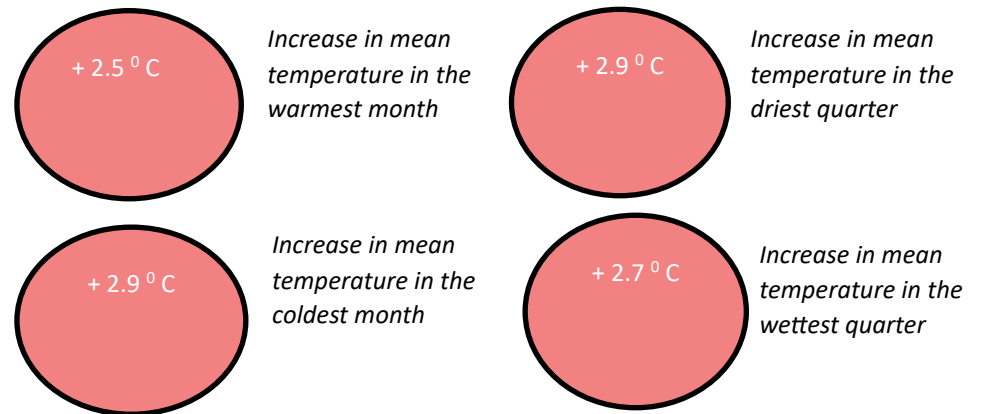


Figure 5: Projected changes in temperature in bioclimatic variables in Yumbe District.

## Precipitation

Mean annual rainfall is projected to increase from **1,277 mm to 1,441 mm** by mid-century. However, the distribution of rainfall gains is uneven across the district. The largest precipitation increases (**166-179 mm**) are expected in **Kerwa, Midigo, and Lodonga**, while southern areas, such as **Ariwa, Kululu and Odravu**, show smaller increases (150-165 mm).

An Increase in precipitation of the **wettest month (+41.3 mm)** and **coldest quarter (+77.3 mm)** indicates intensifying rainfall during already wet and cold periods. This may lead to more frequent and intense floods, waterlogging, with potential impacts on agriculture, settlements and access to services.

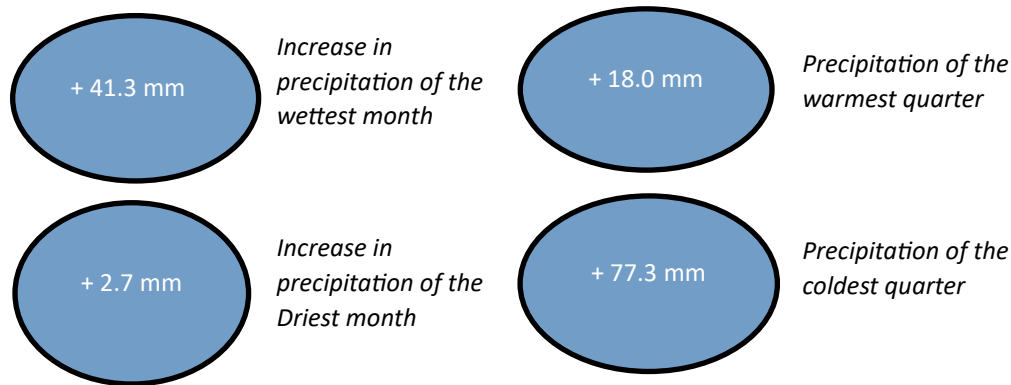
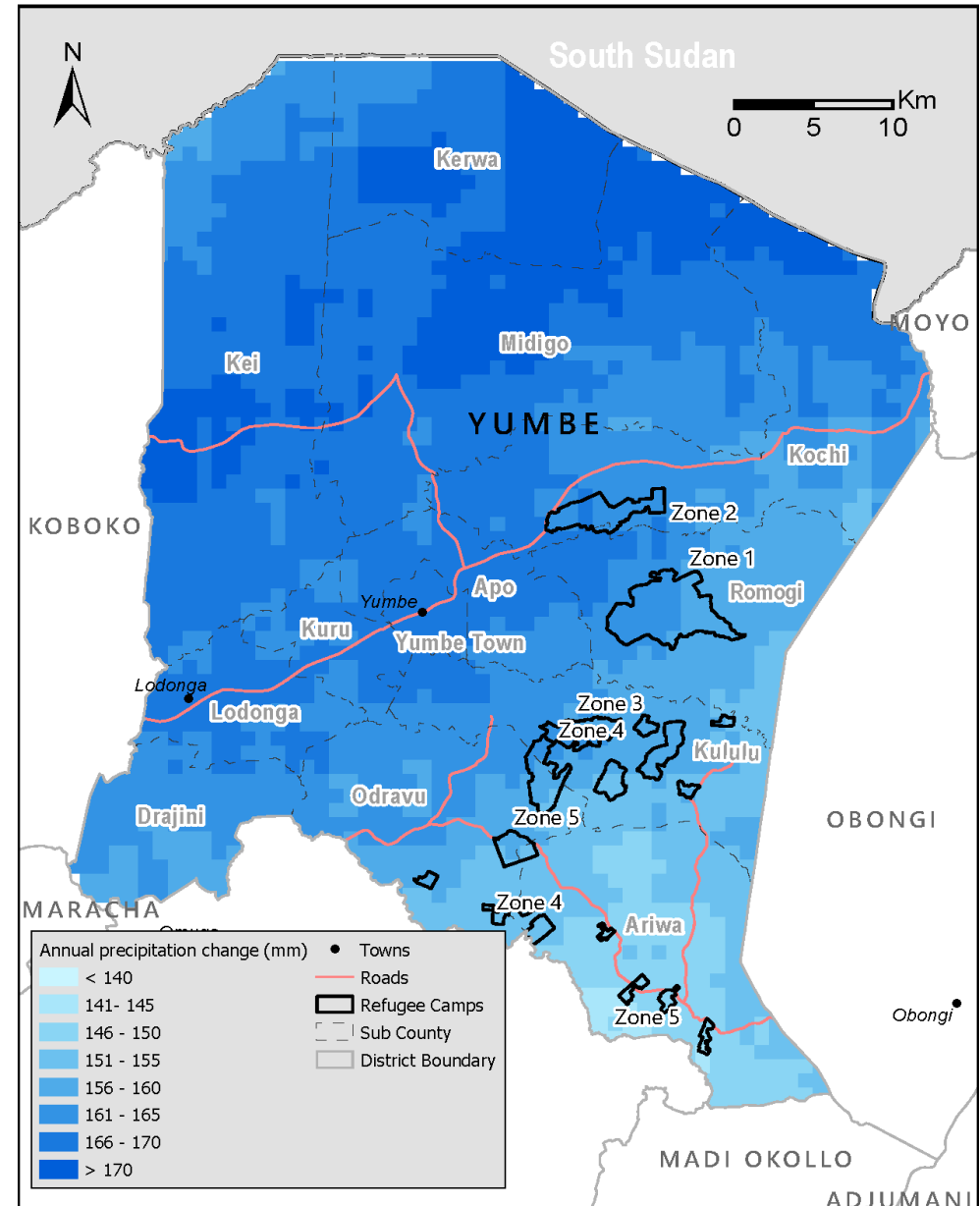


Figure 6: Projected changes in precipitation in bioclimatic variables in Yumbe District.

An increase in precipitation during the **driest month (+2.7mm)** and the **warmest quarter (+18.0mm)** indicates a **shift toward wetter conditions outside the traditional rainy season**, suggesting more evenly distributed rainfall across the year. This means dry-season water scarcity will persist, even under wetter annual conditions. This change **reflects increasing seasonal variability, with implications for agricultural planning, water management, and flood risk during periods that were previously drier or hotter.**



Map 5: Map showing Projected Precipitation Changes from the Baseline (1970-2000) to the Near Future (2041-2060).

Rainfall seasonality also remains largely unchanged, continuing Yumbe District's dependence on a long but highly variable rainy season.

## Implications

The combination of rising temperatures, changes in dry-season rainfall, and moderate increases in annual precipitation creates a complex climate-risk profile for Yumbe District. **Increased evapotranspiration may reduce the benefits of higher annual rainfall, limiting improvements in soil moisture and water availability.** Areas with fragile vegetation cover or high settlement density, such as the zones within Bidibidi Refugee Settlement, are likely to face rising exposure to heat stress, seasonal drought and water scarcity.

Southern Yumbe, which already experiences drier conditions, may face heightened vulnerability to climate-related shocks compared to the northern sub-counties receiving larger rainfall gains. These shifts have significant implications for agriculture, livestock production, water systems, and community resilience.

These projections align closely with broader national and East African climate patterns. According to the Uganda Third National Communication to the UNFCCC<sup>26</sup> and the IPCC Sixth Assessment Report<sup>27</sup>, temperatures across Uganda are expected to rise by 1.5-2.5°C by mid-century, while rainfall is projected to increase with greater variability and intensity. The projected warming and rainfall changes observed in Yumbe District fall within these ranges, indicating that the district is experiencing climate shifts consistent with regional trends.

This comparison reinforces the need for targeted adaptation measures, as increased rainfall intensity, elevated flood risk, and intensified heat stress may further affect agriculture, water resources, and overall livelihood resilience.

## SEASONAL DROUGHT HAZARD ASSESSMENT

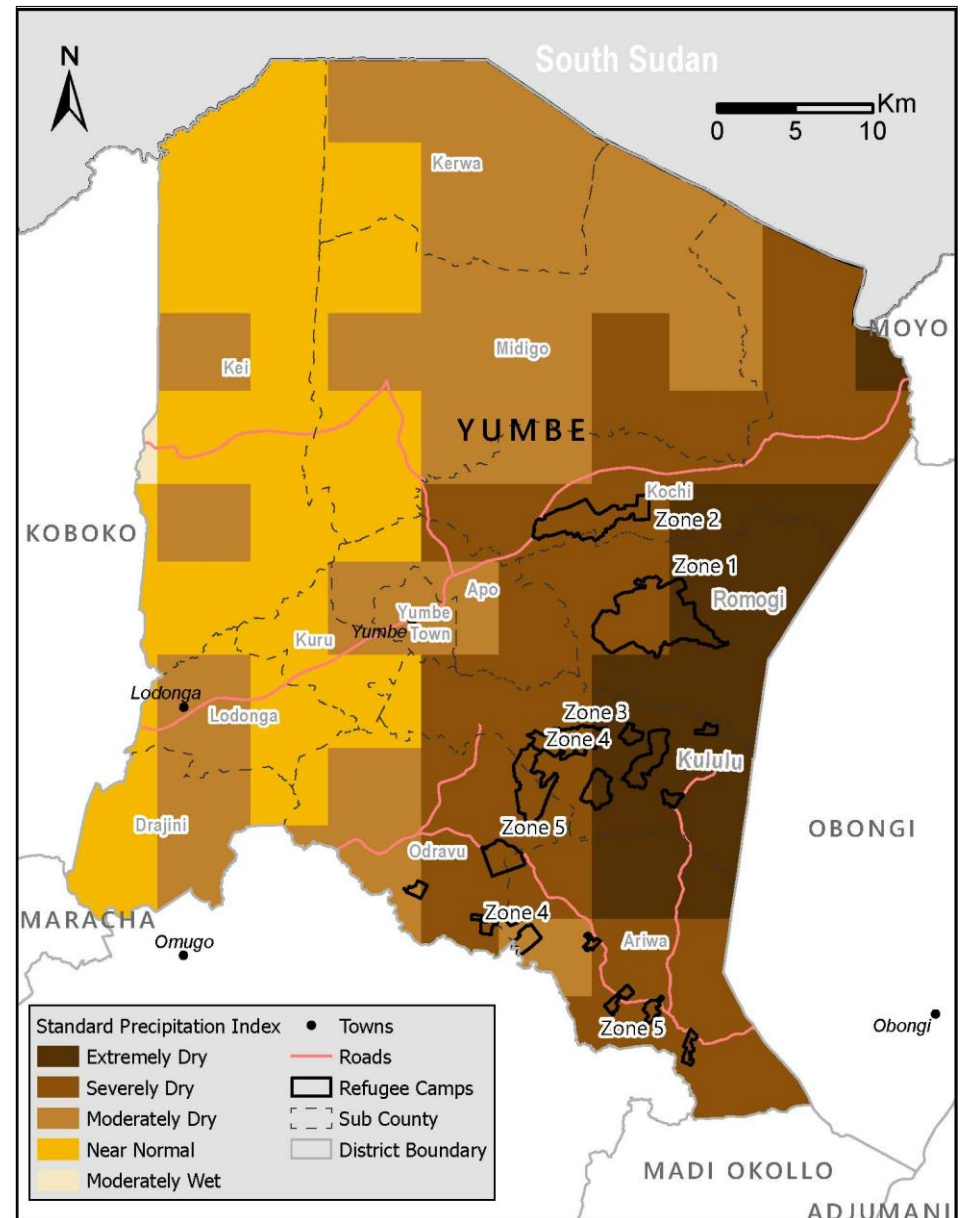
Yumbe District faces increasing seasonal drought risk due to unreliable rainfall, prolonged dry spells, and rising temperatures, which undermine agricultural production and household livelihoods in this predominantly rain-fed system.<sup>28</sup> Both host and refugee communities, including those living in Bidibidi Settlement, experience recurrent seasonal droughts (periods of significantly below-average rainfall) and vegetation droughts (when crops and natural vegetation show stress due to lack of moisture). These conditions disrupt planting seasons, reduce yields, and intensify food insecurity.<sup>14,29</sup>

This analysis applies the *Standardized Precipitation Index (SPI)*, a precipitation-based indicator that measures precipitation/rainfall anomalies by comparing observed rainfall to historical averages and the *Vegetation Condition Index (VCI)*, an NDVI<sup>2</sup> based indicator that shows crop biomass and vegetation health responses to precipitation anomalies/moisture stress. Together, these indices capture both metrological drought conditions and their impact on vegetation, providing an integrated understanding of seasonal drought occurrence and severity.

The effects were pronounced in 2023, when severe seasonal drought conditions hit **Ariwa, Odravu, and Kululu Sub-counties and Zones 3 and 4 of Bidibidi Refugee Settlement**, resulting in crop failure, water shortages, and heightened humanitarian needs. While agencies such as WFP, UNHCR, and other partners provided emergency assistance, limited resources and logistical constraints underscored the district's urgent need for sustained investment in seasonal drought/prolonged dry spell preparedness, climate-resilient livelihoods, and long-term adaptation measures.<sup>30</sup>

### SPI Findings

The *Standardized Precipitation Index (SPI)* analysis shows that March-May 2024 was a critical seasonal drought month for Yumbe District, with much of the area experiencing below-normal rainfall. The eastern, southeastern, and central sub-



Map 6: Map showing the SPI Index.

<sup>2</sup> NDVI stands for the Normalized Difference Vegetation Index.

counties including **Kochi, Romogi, Ariwa, and all Bidibidi settlement zones (1-5)** recorded severe to extremely dry conditions, as indicated by the dark brown shades on the map in Map 6. These areas correspond to the district's most drought-prone zones and reflect significant rainfall deficits during the assessment period.

In contrast, the western and northwestern parts of Yumbe District - particularly **Lobe, Oringini, Matuma, and Kechuru** - experienced near normal to moderately dry conditions, suggesting comparatively lower meteorological drought stress. The overall pattern shows a clear west-to-east gradient of increasing dryness, with the most pronounced deficits concentrated in the eastern and settlement-hosting sub-counties (see Map 6).

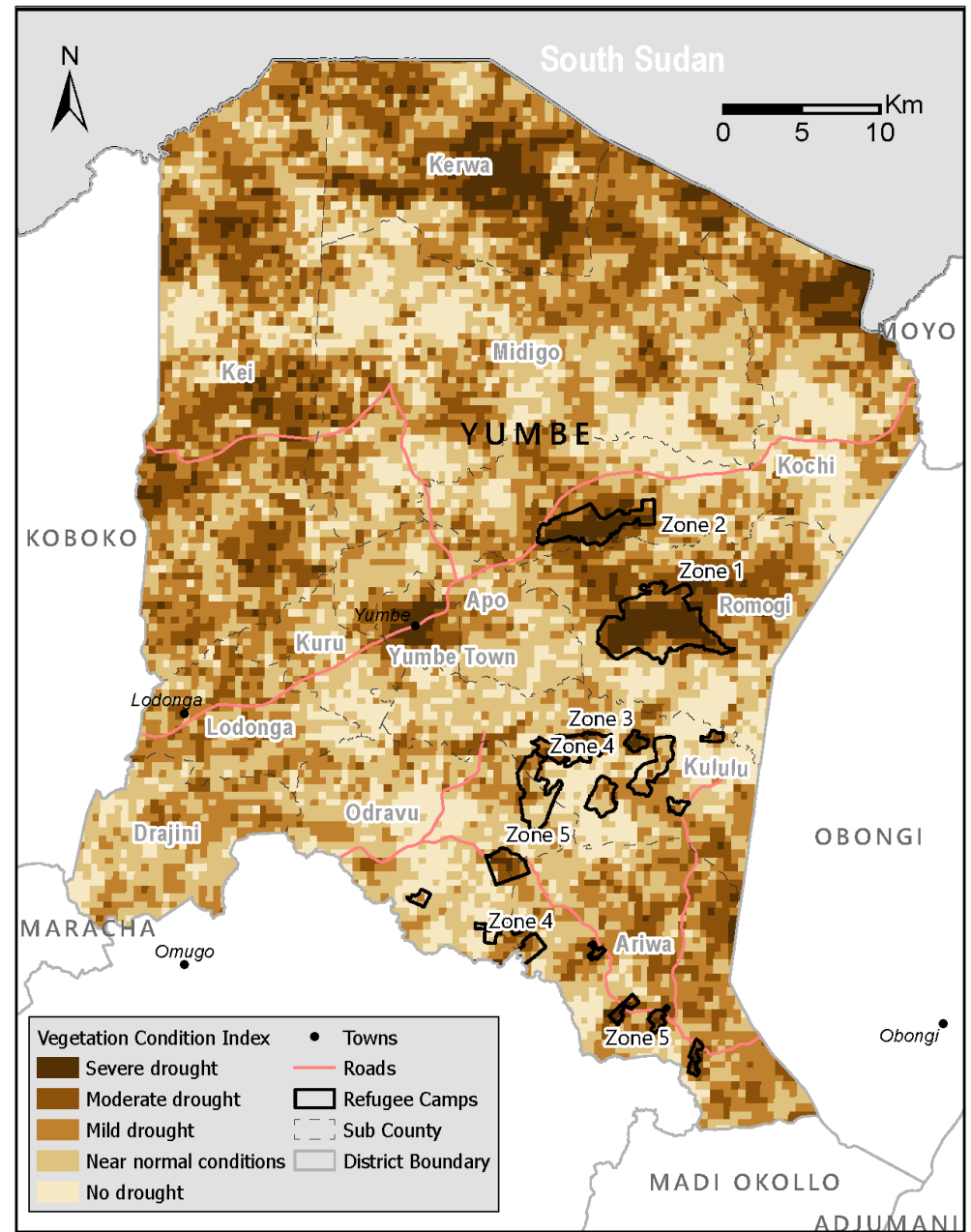
This indicates substantial impacts on **soil moisture availability, crop performance, rangeland conditions, and water access**, particularly in areas overlapping with the Bidibidi Refugee Settlement, where livelihood systems are already highly sensitive to rainfall variability.

## VCI Findings

The *Vegetation Condition Index (VCI)* results confirm **widespread vegetation stress** across Yumbe District in March-May 2024, corresponding closely with the SPI-detected rainfall deficits. Grasslands provide the clearest and most reliable signal of seasonal drought severity because they are shallow-rooted and are highly sensitive to rainfall variability. Croplands follow, depending on crop type and seasonal calendar timing shifts. Forests mask short-term drought because they have deeper root systems and higher biomass, and built-up areas give misleading signals because of bare surfaces and less green vegetation.

The **most affected areas** in Yumbe District include **Romogi, Baringa, Lori, Erezeli, Langi, Okubani Sub-counties and large portions of Bidibidi Settlement (Zones 1-5)**. These areas show **moderate to severe vegetation seasonal drought**, represented by the darker brown tones in Map 7. These patterns reflect reduced vegetation vigour, declining pasture availability and early signs of crop failure.

Meanwhile, the western and northwestern areas, such as **Lobe, Oringini, Matuma, and Kechuru, showed mild seasonal drought and near-normal vegetation conditions**, indicating relatively better environmental performance. The *VCI Map* demonstrates a notable eastward intensification of vegetation drought, consistent with the spatial distribution of rainfall deficits.



Map 7: Map showing the VCI Index.

Overall, the findings illustrate that **vegetation health across much of the district was significantly constrained during this period, affecting both croplands and grazing areas crucial for household food security and livelihoods.**

## Implications

The combined SPI and VCI analyses provide a comprehensive picture of seasonal drought dynamics in Yumbe District, revealing a strong linkage between rainfall deficits (meteorological drought) and declining vegetation vigour (agricultural drought). The simultaneous occurrence of severe SPI dryness and low VCI values in the central, eastern, and northeastern areas, including **Romogi, Ariwa, Lori, Odravu, Erezeli, and Bidibidi Zones 1-5**, indicates that these areas face acute vulnerability during short-term rainfall deficits.

These climatic stressors have real-world consequences. In 2023, unreliable rainfall patterns and short dry spells during critical planting windows hindered crop production for farmers and refugee agricultural groups in the Bidibidi Settlement, reducing expectations for good yields.<sup>31</sup>

Local reporting from the wider West Nile Sub-region (of which Yumbe is part) also documented **dry spells that have withered staple crops like maize, beans, groundnuts, and cassava before maturity**, with farmers describing unpredictable rainfall as a major constraint on production and harvest outcomes.<sup>32</sup> These observed agricultural challenges reflect the link between SPI and VCI signals, and reduced agricultural output, food availability, and livelihood resilience in both host and refugee communities.

The impacts extend across several livelihood dimensions. **Reduced soil moisture and weakened vegetation cover directly undermine crop yields, pasture availability, and water resources, heightening food insecurity** for both host and refugee communities. **Vegetation loss also exacerbates soil erosion and land degradation, weakening the district's overall ecological resilience to future shocks.** These conditions place additional pressure on settlement areas, where higher population density and limited natural resource buffers magnify seasonal drought impacts.

From a preparedness standpoint, the findings emphasize **the need for early warning systems, climate-smart agriculture, water harvesting and storage, and strengthened natural resource management. Integrating SPI and VCI monitoring**

**into district-level disaster risk management frameworks can enhance evidence-based planning, support timely alerts during emerging seasonal drought episodes, and improve resource allocation for both immediate response and long-term climate resilience** across Yumbe District.



*Photo 1: Drought Deepens for Refugees in Yumbe District. Photo Credit: Martin Okudi*

In May 2024, a prolonged dry spell during the first planting season in Bidibidi Refugee Settlement disrupted crop establishment among refugee households. Despite access to land from local nationals and training in climate-smart agriculture, the farmers were unable to plant due to two weeks without rainfall at critical planting time in the growing calendar. The **Loketta farmer group in Zone IV** reported that their cassava plantations on ten acres were especially affected, with unreliable rainfall threatening germination and growth, despite training in climate-smart agriculture.

Local leadership noted that seasonal drought has intensified food insecurity, pushing some refugees to rely more on casual labour and other coping strategies as agricultural production failed.

Source: [Drought deepens crisis for refugees in Yumbe's Bidibidi settlement](#)

## FLOOD HAZARD ASSESSMENT

Flood susceptibility refers to how likely an area, community, or system is to experience harmful impacts from flooding, based on physical, environmental, and socio-economic factors.

Several factors determine how an area exposure to flood is ranked from low to high. These factors include hydrological (e.g. intensity and duration of rainfall), geographical (proximity to rivers, soil type, and topography), land use and community livelihood types.

For this assessment thirteen indicators were analysed by ranking into five score levels to flood risk. The score rank of the thirteen indicators was summed and ranked into three level of risk.<sup>33</sup>

1. Distance to Permanent water ranked from higher risk to lower risk at 100 meters, 250 meters, 500 meters, and 750 meters.<sup>34</sup>
2. Elevation above sea level ranked from higher risk to lower risk at 600 meters, 700 meters, 800 meters, and 1000 meters.<sup>35</sup>
3. Slope of the area in degrees ranked from higher risk to lower risk at 2, 5, 10, 15.<sup>36</sup>
4. Landcover from higher risk to lower risk as built-up, cropland (include water, flooded vegetation), grassland, shrub and forest.<sup>37</sup>
5. Topographic Position Index ranked from higher risk to lower risk at -8, -6, -4, -2, 0.
6. Normalized Difference Vegetation Index (NDVI) ranked from higher risk to lower risk at 0.2, 0.4, 0.6, 0.8. <sup>38</sup>
7. Normalized Difference Water Index (NDWI) ranked from higher risk to lower risk at 0.6, 0.2, -0.2, -0.6.
8. Flood Return period ranked from higher risk to lower risk at 10 years, 20 years, 50 years, 100 years, 200 years.<sup>39</sup>

9. Rainfall Intensity as average maximum annual rainfall ranked from higher risk to lower risk at 33 mm, 31 mm, 29 mm, 27 mm.<sup>40</sup>
10. Monthly Number of Days with Rainfall ranked from higher risk to lower risk at 13 days, 10 days, 7 days, 3 days.<sup>41</sup>
11. Frequency of -days with continuous Rainfall ranked from higher risk to lower risk at 2, 1.2, 0.8, 0.4.<sup>42</sup>
12. Height Above Nearest Drainage (HAND) ranked from higher risk to lower risk at 2 meters, 5 meters, 10 meters, 20 meters.<sup>43</sup>
13. Soil texture ranked from higher risk to lower risk with (clay, clay loam, silty loam), (silty clay, silty clay loam), (sandy clay, sandy clay loam), (loam, sandy loam), (loamy sand, sand).<sup>44</sup>

Flood susceptibility mapping relies on integrating multiple environmental, hydrological, and climatic indicators to assess risk levels. Recent literature emphasizes that parameters such as proximity to water bodies, elevation, slope, land cover, vegetation indices, and rainfall characteristics are critical determinants of flood vulnerability. Studies highlight that areas closer to permanent water sources, with low elevation and gentle slopes, are more prone to inundation. Similarly, built-up and cropland land covers tend to amplify flood risk due to reduced infiltration capacity, while vegetation indices (NDVI, NDWI) provide insights into soil moisture and vegetation health, which influence runoff and water retention. The inclusion of topographic indices like HAND and TPI further refines susceptibility mapping by capturing micro-topographic variations that affect drainage and water accumulation.

Hydro-climatic indicators such as rainfall intensity, frequency of continuous rainfall days, and flood return periods are equally vital in flood risk assessment. Literature shows that extreme rainfall events, particularly when sustained over consecutive days, significantly increase flood hazards. Soil texture also plays a crucial role, with clay-rich soils exhibiting lower infiltration rates and higher runoff potential compared to sandy soils. Integrating these thirteen indicators into a composite scoring system aligns with established frameworks that rank susceptibility into multiple risk levels. Such multi-criteria approaches are widely recommended because they capture the complex interplay between terrain, hydrology, and climate, thereby improving the accuracy of flood hazard mapping and supporting disaster risk reduction strategies.

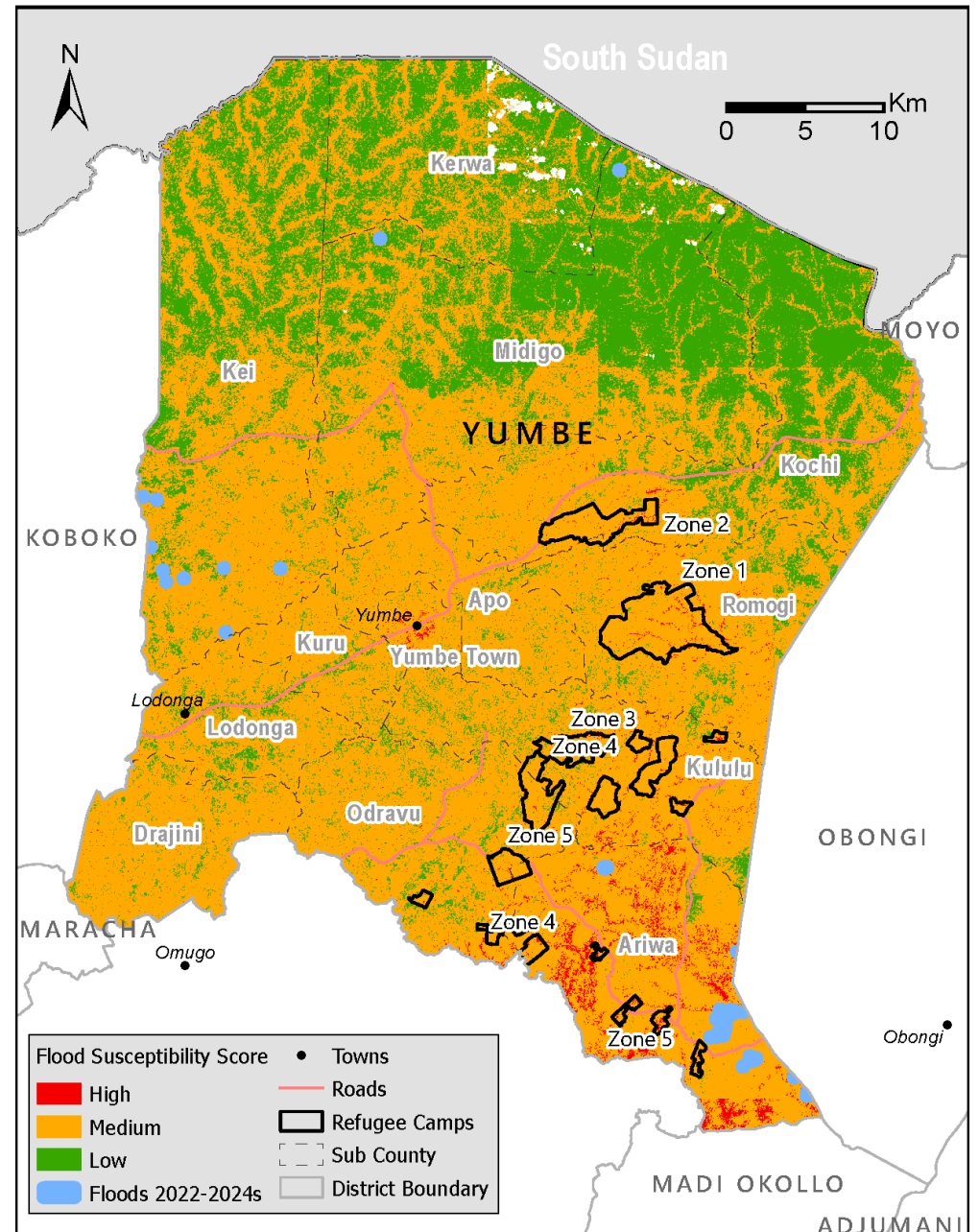
## Findings

Several geographic and infrastructural factors exacerbate flood hazards in the district. Yumbe has predominantly flat terrain, clayey soils, and insufficient drainage infrastructure, limiting water infiltration and increasing surface runoff, particularly in low-lying areas and along seasonal streams.

Field and satellite-based assessments have identified **Kululu, Romogi, Kochi, and Ariwa sub-counties** as the **most flood-prone zones**.<sup>45</sup> Their vulnerability stems from low elevation and proximity to seasonal river channels. **Bidibidi Refugee Settlement, zones 3, 4, and 5** are especially susceptible to flooding. These zones are situated on gently sloping terrain that accumulates runoff during peak rainfall periods, resulting in repeated damage to shelters, latrines, and access roads. Such events disrupt humanitarian operations and pose significant public health threat, including water contamination.<sup>46</sup>

The flood susceptibility analysis for Yumbe District (2022-2024) in *Map 8* shows that flooding is highly localized, with the **greatest concentration** of inundation occurring in the **southeastern parts** of the district. Areas around **Erezeli, and Okubani**, as well as low-lying parts of Bidibidi Refugee Settlement (zones 4-5) experienced the most consistent flooding, with several locations inundated in two or all three years of the study period. In contrast, **the northern and north-western parts of the district, including Midigo, Koka, and Oringini, show only scattered, mostly single-year flooding or no flooding at all.**

Flood recurrence is strongest in areas aligned with seasonal river channels, low-lying plains, and poorly drained terrain, highlighting the influence of local topography and hydrological pathways. Recurrent flooding in southern Yumbe suggests limited natural drainage capacity, potential siltation of watercourses, and increasing surface runoff linked to land cover modification, including vegetation clearance and the expansion of built-up areas within the broader catchment. These conditions reduce infiltration and increase the likelihood of rapid accumulation of surface water following intense rainfall events.



Map 8: Map of Yumbe showing Flood Susceptibility (2022-2024).

## Risk on Cropland and Settlement

The land cover analysis revealed that **grassland covers 52.3%, forest 46%, built-up areas 1.6%, while cropland only covers 0.4 %**. **73% of cropland** falls within the medium- to high-risk flood zone, while **64% of built-up areas** are within the medium- to high-risk flood zone. Cropland emerges as the most affected by flooding when measured in terms of area inundated. However, these estimates represent district-wide averages and therefore conceal substantial spatial concentration of impacts at local levels.

The *Land Use and Landcover Map (Map 3)* shows that most cropland cells are around Yumbe Town and within the southern river valleys. They fall within high-risk flood zones, pointing to chronic exposure for households cultivating around floodplains and poorly drained depressions. For these households, even localized flooding events can result in recurrent crop damage, delayed planting, and yield losses, likely contributing to recurrent income losses and seasonal food insecurity. Built-up areas, which always overlap with cropland around Yumbe Town and Bibibidi Refugee Settlement are within high-risk flood zones.

Overall, the findings indicate that **flood risk in Yumbe is spatially concentrated, persistent in specific terrain types, and closely linked to settlement patterns**. Effective flood risk management will require targeted interventions in the southeastern corridor, such as improved drainage infrastructure, watershed and riverbank restoration, and strengthened early warning systems at the community level. **Integrating flood hazard information into land-use planning and settlement management is essential for reducing vulnerability, particularly in flood-affected sections of the Bidibidi Refugee Settlement.**

The flooding trend corresponds with periods of above-average rainfall and seasonal river overflow, implying a strong link between climatic variability and local hydrological responses. Additionally, expanding settlement and land-use changes, especially around refugee-hosting areas, have contributed to reduced infiltration and increased runoff, thereby amplifying flood recurrence. Overall, the temporal trend points to increasing flood persistence, which poses growing challenges for local livelihoods and infrastructure resilience.

## Flood Impacts

Flooding in Yumbe District has **had multidimensional socio-economic and environmental impacts**. Recurrent inundation has led to **damage of crops and agricultural land, disrupting food production and household income** for both host and refugee communities. **Access roads and footpaths in flood-prone areas become impassable during heavy rainfall, affecting mobility and access to markets, schools, and health facilities**. Floods have also **contaminated water sources and damaged sanitation facilities, increasing the risk of waterborne diseases particularly within the Bidibidi refugee Settlement zones**.



*Photo 2: Submerged Maize Garden in Yumbe District. Photo Credit: Clement Aluma*

In September 2024, heavy and prolonged rainfall in Yumbe District caused extensive crop losses and flooding in several low-lying areas. The lower belt of the district, particularly **Romogi, Kululu, and Ariwa sub-counties**, was hardest hit, affecting an estimated **500 households** dependent on agriculture for food and income. Many farmers reported that crops such as **hybrid tomatoes, cabbage, chili, and maize** were submerged and destroyed when rainfall exceeded normal seasonal patterns, washing out nearly ready-to-harvest fields and undermining household food reserves and planned sales. One resident from **Okubani village, Ariwa Sub-county** described how excessive rain inundated his fields and left him facing not only immediate food shortages but also uncertainty about paying school fees and supporting his family's basic needs.

Source: [Monitor UG - Yumbe farmers suffer major crop losses due to heavy rains](#)

Environmentally, repeated flooding contributes to **soil erosion, sedimentation of streams, and loss of vegetation cover**, which further **degrade the natural drainage systems and exacerbate future flood risk**. Socially, **households in persistently flooded areas often face temporary displacement, loss of shelter, and heightened vulnerability due to inadequate infrastructure and limited adaptive capacity**. These cumulative impacts underline the urgent need for integrated flood management, infrastructure improvement, and community-based adaptation strategies to enhance resilience in Yumbe District

## Conclusion

The findings of this geospatial analysis highlight the substantial influence of climate-related hazards on both refugee and host communities in Yumbe District. Over the assessment period, the district has experienced prolonged dry spells and recurrent localized flooding, which together **pose major risks to agricultural productivity, water availability, and settlement infrastructure**. The SPI and VCI analyses reveal widespread vegetation stress and rainfall deficits, especially during the 2023 crop flowering for first season, while flood mapping indicates high exposure in low-lying sub-counties, such as **Romogi, Ariwa, and Lomunga, and in Bidibidi Zones 1, 2, 4 and 5**. These findings underscore the growing climate vulnerability of Yumbe District, emphasizing the need for targeted adaptation measures, including improved water resource management, resilient agricultural practices, and settlement planning to safeguard livelihoods and enhance resilience for both refugee and host populations.

## Methodology Overview

The climate risk assessment for Yumbe District used a combined geospatial, remote-sensing, and climate-modelling approach integrating historical baselines, future projections, and hazard-specific analyses. Historical climate conditions (1970-2000) were derived from WorldClim v2.1 using BIO1 (Annual Mean Temperature) and BIO12 (Annual Precipitation), clipped to the district and summarised through spatial and statistical analysis. Future projections for 2041-2060 were obtained from the UKESM1-0-LL model<sup>47</sup> under the SSP2-4.5 scenario, processed using the same bioclimatic variables to ensure comparability with the historical baseline.<sup>48</sup>

Seasonal drought assessment followed UN-SPIDER protocols<sup>49</sup>, using SPI calculated in Google Earth Engine (GEE)<sup>50,51</sup> from CHIRPS rainfall data<sup>52</sup> (2014-2024) and VCI derived from NDVI time-series to measure vegetation stress. Agricultural and rangeland areas were manually delineated to improve spatial accuracy, and VCI classification followed Kogan (1995) standards.<sup>53</sup> Outputs were visualized and analysed in ArcGIS.

Flood mapping was conducted using Sentinel-1 SAR imagery processed in GEE to identify inundation for 2022-2024.<sup>54</sup> Annual flood layers were imported into ArcGIS, where raster summation generated a districtwide flood-frequency map. Together, the historical and projected climate datasets, SPI-VCI drought indicators, and multi-year flood mapping provide an integrated picture of climate hazards affecting both host communities and the Bidibidi refugee settlement in Yumbe District.

## Limitations

The assessment primarily relied on remote-sensing and global climate datasets, which, while widely used, may not fully capture localized micro-climatic variations or ground-level conditions affecting vulnerability. Community-level vulnerability indicators such as coping capacity, water access constraints, and infrastructure fragility were not systematically integrated due to limited available data. Field verification of seasonal drought and flood extents was not conducted, though the satellite image processing followed established and validated UN-SPIDER protocols.

Further background information can be found in the [Climate Risk Profiles for Refugee-Hosting Districts in Uganda Terms of Reference \(TOR\)](#).

## Note on Data Sources

Historical climate estimates in this report use both WorldClim (1970-2000 climatology) and ERA5-Land (1981-2024 reanalysis). These datasets use different observational networks, spatial resolutions and interpolation/assimilation methods and consequently report slightly different estimates of mean annual temperature for Yumbe (WorldClim  $\approx 25.7^{\circ}\text{C}$  for 1970-2000, ERA5-Land  $\approx 24.7^{\circ}\text{C}$  for early 1980s-2000). These differences are within the expected uncertainty range for gridded climate datasets and do not affect the overall interpretation of a warm tropical baseline and a clear recent warming trend. All historical temperatures in this report should therefore be understood as approximate values in the mid-20s (around  $25\text{-}26^{\circ}\text{C}$ ) rather than exact point estimates.

**To view/access the Climate Hazard Analyses for any of the following districts:**

- Adjumani District
- Koboko District
- Yumbe District
- Terego District
- Madi Okollo District
- Lamwo District
- Obongi District
- Kyegegwa District
- Kiryandongo District
- Kamwenge District
- Kikuube District
- Isingiro District

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## Definitions

**Hazards:** 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.<sup>55</sup>

**Flood:** The overflow of water onto land that is normally dry, resulting from the temporary inundation of areas due to factors such as intense or prolonged rainfall, river overflow, surface runoff, or failure of water control structures. Floods can vary in scale and duration and may cause damage to infrastructure, livelihoods, ecosystems, and human health.<sup>56</sup>

**Flood Susceptibility:** The likelihood of flooding occurring in an area based on physical, environmental, and climatic factors such as topography, rainfall intensity, and proximity to water bodies.<sup>57</sup>

**Seasonal Drought:** A temporary period of below-average rainfall within a specific season, resulting in soil moisture deficits and vegetation stress, particularly during critical agricultural periods.<sup>58</sup>

**Meteorological Drought:** A period of abnormally dry weather sufficiently prolonged to cause a serious hydrological imbalance, typically defined by a lack of precipitation relative to the long-term average.<sup>59</sup>

**Exposure:** The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas.<sup>60</sup>

**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, determined probabilistically as a function of hazard, exposure, vulnerability and capacity.<sup>61</sup>

**Water Stress:** Water stress occurs when the demand for water exceeds the available amount during a certain period or when poor quality restricts its use. Water stress causes deterioration of freshwater resources in terms of quantity (aquifer over-exploitation, dry rivers) and quality (eutrophication, organic matter

pollution, saline intrusion).<sup>62</sup>

## Disclaimer

This report provides an evidence-based overview of climate trends, hazards, and projected impacts in Uganda's refugee-hosting districts to support informed planning and decision-making. The analysis draws on historical climate datasets, remote sensing products, and modeled projections, all of which are subject to inherent uncertainties, assumptions, and methodological limitations.

The drought assessment presented in this report focuses primarily on seasonal drought conditions, using indicators such as the Standardized Precipitation Index (SPI) and the Vegetation Condition Index (VCI). These indicators capture short- to medium-term rainfall deficits and vegetation stress within specific seasons and should not be interpreted as representing long-term or permanent drought conditions.

Accordingly, the findings should be considered indicative rather than definitive, particularly at localized scales, where microclimatic variability, environmental conditions, and socio-economic factors may differ. While every effort has been made to ensure data accuracy, this report does not replace site-specific assessments or field verification.

The views expressed herein do not necessarily reflect those of any government, organization, or funding partner. This report should not be used as the sole basis for policy, investment, or operational decisions without further contextual analysis and validation.

Users are encouraged to complement these findings with local knowledge, stakeholder consultation, and additional data sources when designing interventions or resilience strategies.

**In case of questions, feedback, or requests for tailored, area-specific remote-sensing products, kindly contact [uganda@reach-initiative.org](mailto:uganda@reach-initiative.org).**

## Endnotes

- <sup>1</sup> [UNHCR, Refugee Response Portal - Uganda](#)
- <sup>2</sup> [UNCDF, Uganda-Climate Risk and Vulnerability Assessment](#)
- <sup>3</sup> [Ministry of Water and Environment \(MWE\). \(2015\). \*Uganda's National Climate Change Policy\*. Government of Uganda.](#)
- <sup>4</sup> [World Bank. \(2021\). \*Climate risk country profile: Uganda\*. Washington, DC: World Bank Group.](#)
- <sup>5</sup> [Uganda National Meteorological Authority \(UNMA\). \(2024, July 24\). \*UNMA explains unreliable rains, urges farmers to harvest water\*.](#)
- <sup>6</sup> [REACH UGA 2024-MSNA-Report July-2025](#)
- <sup>7</sup> [World Bank – Updated Environmental and Social Management Framework \(ESMF\)](#)
- <sup>8</sup> [Ministry of Water and Environment \(MWE\). \(2015\). \*Uganda's National Climate Change Policy\*. Government of Uganda.](#)
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- <sup>12</sup> [World Bank – climateknowledgeportal – Climate data projections - Uganda IPCC Assessment Reports.](#)
- <sup>13</sup> [FAO – Forest Landscape Management Plan for the Bidibidi Refugee Settlement, Yumbe District \(2023\)](#)
- <sup>14</sup> [National Environment Management Authority \(NEMA\). \(2019\). \*State of the environment report for Uganda 2018/2019\*. Kampala: NEMA.](#)
- <sup>15</sup> [World Bank – Updated Environmental and Social Management Framework \(ESMF\)](#)
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- <sup>17</sup> [UNICEF – Child Sensitive Social Protection In Refuge Hosting Districts of West Nile in Uganda](#)
- <sup>18</sup> [UNHCR, Population Statistics Dashboard \(December 2025\)](#)
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- <sup>20</sup> [FAO – Enhancing refugees' self -reliance in Uganda \(The role of cash and food assistance](#)
- <sup>21</sup> [Uganda Investment Authority – Yumbe District Profile \(2021\)](#)
- <sup>22</sup> [IRC + water for people – Climate Change, Water resources and WASH systems in Uganda \(2021\)](#)
- <sup>23</sup> [FAO – Climate Change and Food Security, Risks and Responses](#)
- <sup>24</sup> [REACH UGA 2024-MSNA-Report July-2025.](#)
- <sup>25</sup> [World Vision – Regreening Communities in Yumbe District. Progress Brief \(2021-2027\)](#)
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- <sup>28</sup> [Yumbe District Local Government – Yumbe District Development Plan \(2020-2025\)](#)
- <sup>29</sup> [UN Women – Supporting refugees and host communities in Uganda to increase agriculture productivity and build resilience to climate change risks \(2022\)](#)
- <sup>30</sup> [Royal Danish Embassy – Climate Resilience for Refugee Affected areas and Regions in Uganda -Feasibility Study](#)
- <sup>31</sup> [Nile post-Drought deepens crisis for refugees in Yumbe's Bidibidi settlement - Martin Okudi](#)
- <sup>32</sup> [Marko Taibot. Why malnutrition persists in Yumbe District | Monitor](#)
- <sup>33</sup> [MDPI - Flood Risk Mapping by Remote Sensing Data and Random Forest Technique](#)
- <sup>34</sup> [European Commission - Global Surface Water Explorer, updated data for 2021](#)
- <sup>35</sup> [NASA Shuttle Radar Topography Mission Global 1 arc second V003 – NASA Earth data](#)
- <sup>36</sup> [NASA Shuttle Radar Topography Mission Global 1 arc second V003 – NASA Earth data](#)
- <sup>37</sup> [World Resources Institute - Research for People & Planet](#)

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REACH Initiative facilitates the development of information tools and products that enhance the capacity of aid actors to make evidence-based decisions in emergency, recovery and development contexts. The methodologies used by REACH include primary data collection and in-depth analysis, and all activities are conducted through inter-agency aid coordination mechanisms. REACH is a joint initiative of IMPACT Initiatives, ACTED and the United Nations Institute for Training and Research - Operational Satellite Applications Programme (UNITAR-UNOSAT).

- 38 [sentinel.esa.int](https://sentinel.esa.int)
- 39 [European Commission - Joint Research Centre Data Catalogue-Global River flood hazard maps](#)
- 40 [CHIRPS: Rainfall Estimates from Rain Gauge and Satellite Observations – UC Santa Barbara](#)
- 41 [CHIRPS: Rainfall Estimates from Rain Gauge and Satellite Observations – UC Santa Barbara](#)
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- 45 [Aluma, C. \(2024\). Yumbe farmers suffer major crop losses due to heavy rains. \*Daily Monitor\*. Ibid.](#)
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