UGANDA

Climate Hazard Assessment – Kikuube District

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Climate Hazards in Uganda's Refugee-Hosting Districts.

INTRODUCTION

Uganda hosts one of the largest refugee populations in Africa,[1] 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.[2] Over recent decades, the country has experienced more frequent and intense climate hazards, undermining livelihoods, food security, health, and infrastructure.[3][4] 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.[5]

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, prolonged 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.[6]

Hazard Type	West Nile	Adjumani	Terego	Koboko	Lamwo	Madi Okollo	Obongi	Yumbe
Drought/ Prolonged dry spells	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, 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	South west	Kiryandongo	Isingiro	Kamwenge	Kikuube	Kyegegwa
Drought/ Prolonged dry spells	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 prolonged 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 Assessments translate national and regional climate trends into local evidence, highlighting key hazards, seasonal risks, and exposures to support targeted planning and resilience for host and refugee communities.

Climate Hazard Assessment – Kikuube District

CONTEXT & RATIONALE

Kikuube District is located in the Western Region of Uganda, specifically within the Bunyoro sub-region. Created in July 2018, it was carved out of Hoima District and borders Lake Albert and the Democratic Republic of the Congo to the west.[7] The district typically experiences a **bimodal rainfall pattern**, characterized by two distinct rainy seasons, occurring from March to May and August to November respectively. **Rainfall is not uniformly distributed** across the district, with the lowlands often experiencing higher temperatures and more intense, erratic rainfall compared to cooler, steadier precipitation in the highlands.[8] Agriculture is the primary economic activity in Kikuube District, supporting the livelihoods of approximately 90% of the population. Farmers grow both food and cash crops. Main crops include maize, beans, rice, cassava, bananas and coffee. Due to the district's location along Lake Albert, fishing is a major commercial activity, particularly in the sub-counties of Kabwoya and Kyangwali.[9] Kikuube District faces increasing climate variability and environmental degradation that compound existing development challenges. The district is experiencing **increasingly erratic, unpredictable and unevenly distributed rainfall.** This instability is causing severe disruption to agricultural and economic activities.[10] In recent years, prolonged dry spells and floods have become more common in Kikuube District, primarily due to a combination of accelerated climate change and severe environmental degradation.

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 Kikuube will become warmer and moderately wetter by mid-century. Mean annual **temperatures are projected to rise from 23.5°C to 26.1°C, while annual rainfall is expected to increase from 1,147 mm to about 1,285 mm**.[1] Despite this increase in rainfall, intensifying heat stress is expected to pose greater risks to rural households and displaced populations.[11]

Data from 2025 indicates that Kikuube District hosts approximately **155,000 refugees**, living in and around Kyangwali refugee settlement.[12] In recent months, this number has increased significantly due to continued influxes from the Democratic Republic of Congo.[13] The settlement of refugees has **increased pressure on natural resources**, with reliance on wood fuel driving deforestation and rising demand for farmland intensifying land competition, together increasing vulnerability to climate-related shocks.

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

- Kikuube District currently receives **~1,0147 mm** of annual rainfall, projected to rise moderately to **~ 1,285 mm** by mid-century under the SSP2-4.5 scenario. However, persistent dry-season deficits and higher evapotranspiration will intensify water stress, especially in areas like Kyangwali and Kabwoya.
- Temperatures are projected **to increase 2.3-2.4°C during the hottest month and driest quarters**, increasing the risk of seasonal drought, heat stress and the frequency of very hot days across agricultural and settlement
- Seasonal drought remains a dominant hazard, with the Standard Precipitation Index and Vegetation Condition Index (VCI), which capture rainfall deficits and vegetation respectively, showing **severe dryness across Kyangwali and the surrounding low-lying western areas**, leading to vegetation stress, reduced crop yields, and limited pasture and water availability.
- **Flood risk is localized**. The highest flood risk is in areas like **Buhimba** and **Kyangwal**i, where low-lying terrain and poor drainage cause repeated damage to shelter, farmlands, and infrastructure.

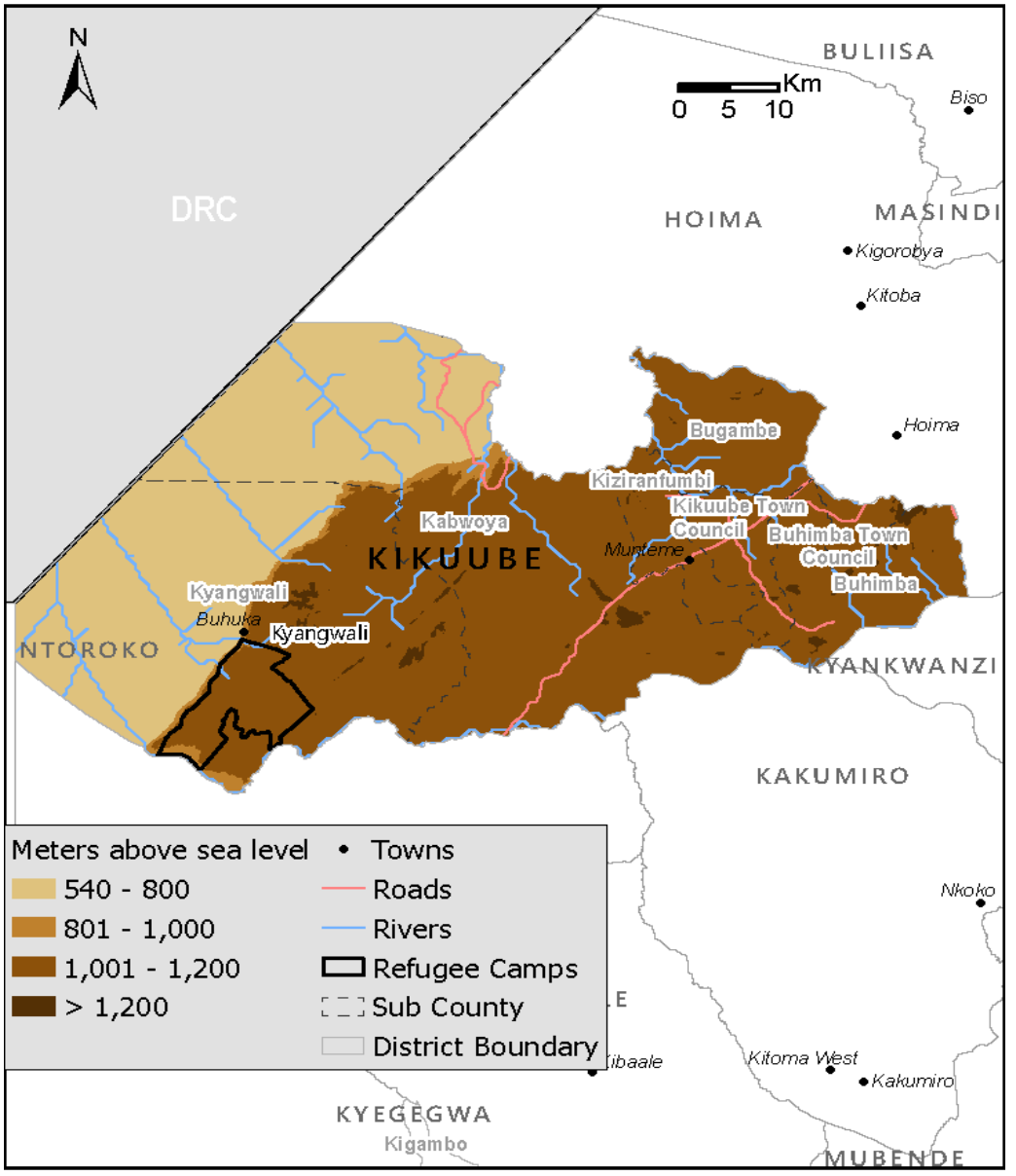
[1] SSP2-4.5 refers to a moderate climate change scenario that combines the "Middle-of-the-Road" Shared Socio-economic Pathway (SSP2) with a radiative forcing level of 4.5 W/m² by 2100. It assumes continued socio-economic development along current trends, moderate population growth, and limited but ongoing climate mitigation, resulting in continued warming and increasing climate variability.

Location and Topography

Kikuube District is located in the Western Region of Uganda. It is situated in the Bunyoro Sub-region, bordered by Hoima District to the north, Kyankwanzi to the east, and Kagadi, Kakumiro, and Ntoroko to the south, with Lake Albert forming its western boundary.

According to *Map 1*, Kikuube District has a **varied landscape that includes low-lying, flat areas along the shores of Lake Albert and a steep, hilly, and rocky rift escarpment that rises into high-altitude ranges**. The district is part of the Albertine Graben (western arm of the Great Rift Valley).[14] In line with its varied topography, elevations range widely, more precisely from 608 meters to over 2,000 meters above sea level.[15] The district's low-lying areas are in the west and form part of the western arm of the Great Rift Valley, bordering Lake Albert and parts of the Kyangwali Sub-county. Elevations here typically range from 900 to 1,000 meters above sea level. High-altitude areas are mostly located in the eastern and central parts of the district, including areas near the Bugoma Forest. These parts fall within the highest and second-highest elevation bands, ranging from 1,001 to over 1,200 meters above sea level. The terrain is dominated by a dramatic drop from the higher eastern/central inland plateaus down to the Lake Albert flats.[16] These areas are heavily used for agriculture (including tea estates), forest and settlements, which has led to increased soil erodibility.[17]

The district's varied terrain influences settlement patterns, agricultural land use and water flow during the rainy seasons. While the high-altitude areas in the eastern and central parts of the district are mostly used for agriculture, the **low-lying areas near Lake Albert in the western part host high-density settlements focused on fishing activities**. During rainy seasons, the high-altitude areas act as catchment zones, with water flowing from them towards the lower, flatter regions.[18] The **low-lying areas are prone to waterlogging and flooding**, receiving excess water from higher grounds, turning them into high-risk zones for structural damage to residential and commercial properties. The district's distinct topography **necessitates location-specific planning and risk-reduction strategies** to address climate sensitivities, including surface runoff and erosion risks across the district.



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

Demographics and Population Distribution

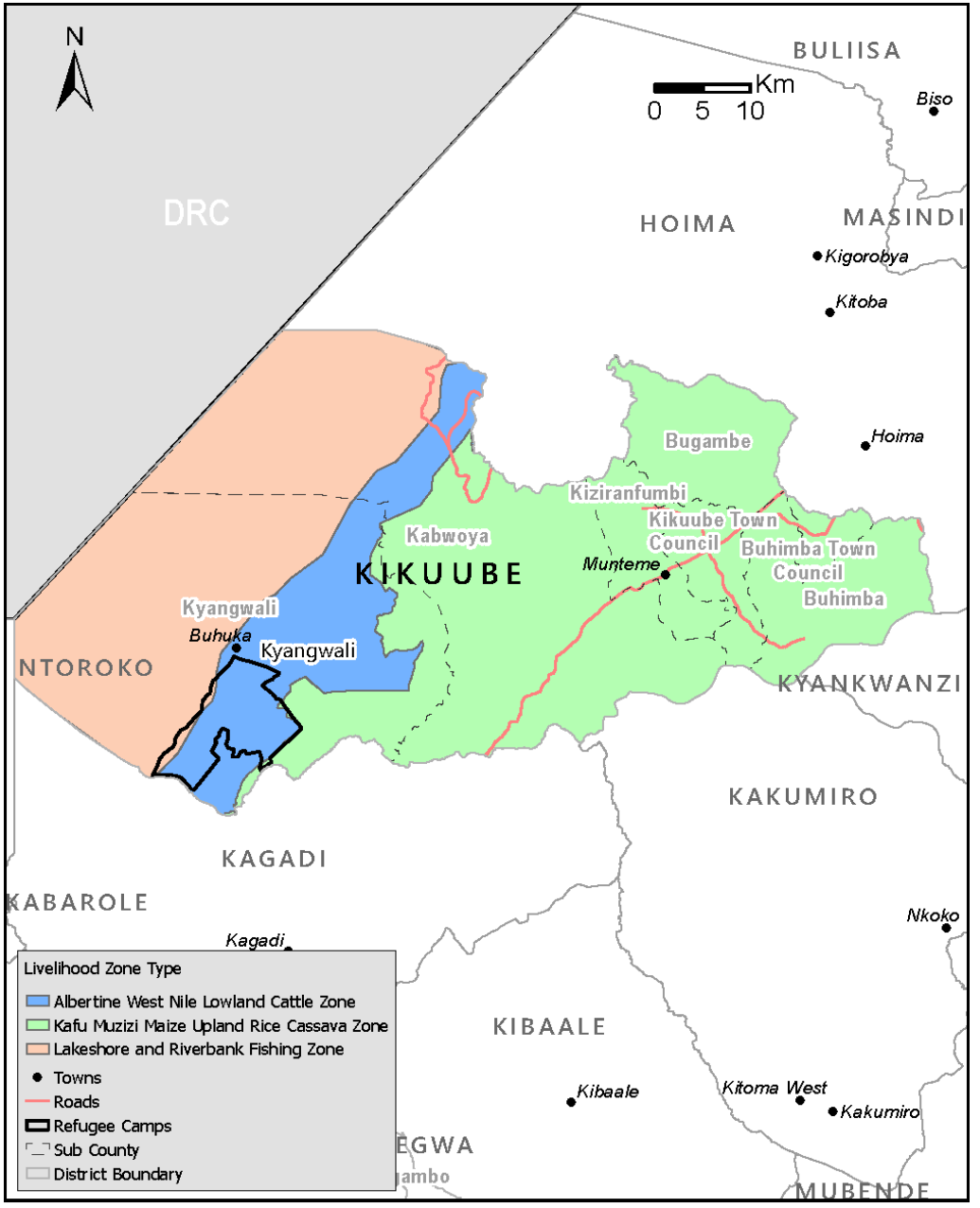
According to the 2024 National Population and Housing Census, Kikuube District has a population of over 379,000, reflecting steady population growth since its creation in 2018.[19] The district is predominantly rural, with a significant part of the population living in villages along the shores of Lake Albert and in two town councils of Kikuube and Buhimba.[20] Kikuube is ethnically diverse, with the Banyoro as the indigenous population, alongside significant populations of Alur, Bakiga, Lugbara, and Acholi. Livelihoods are predominantly driven by agriculture, fishing on Lake Albert, and emerging opportunities in the oil and gas sector.

Kikuube is also a **major refugee-hosting area**, particularly for those fleeing violence in the Democratic Republic of Congo. Refugees are mostly hosted in the Kyangwali Refugee Settlement, situated in Kyangwali Sub-county along the shores of Lake Albert. Data from 2025 indicates that Kikuube District **hosts approximately 155,00 refugees, living in and around Kyangwali Refugee Settlement**. That said, more recent reports suggest that this number is actively rising due to continued influxes from the Democratic Republic of Congo.[21] Refugees account for a substantial share of the district's total population, significantly increasing population density in Kyangwali Sub-county.

This demographic composition has implications for district planning and climate hazard management. Both host and refugee populations depend heavily on climate-sensitive natural resources and basic services, including land, water, education, and health. The high concentration of people in settlement-hosting areas intensifies pressures on land, forests, and water resources, increasing vulnerability to climate-related hazards, such as localized flooding, erratic rainfall and seasonal droughts.

Livelihoods

Livelihoods in Kikuube District are largely based on **agriculture, with most households relying on smallholder agriculture**. However, livelihood patterns vary across the district's main livelihood zones (see *Map 2*), which include the *Albertine West Nile Lowland Cattle Zone*, the *Kafu–Muzizi Maize Upland Rice Cassava Zone*, and the *Lakeshore and Riverbank Fishing Zone*. The western parts of the district along Lake Albert fall within the *Lakeshore and Riverbank Fishing Zone*, where communities depend heavily on fishing, alongside small-scale crop production and livestock keeping



Map 2: Map showing Livelihood Zones in Kikuube District.

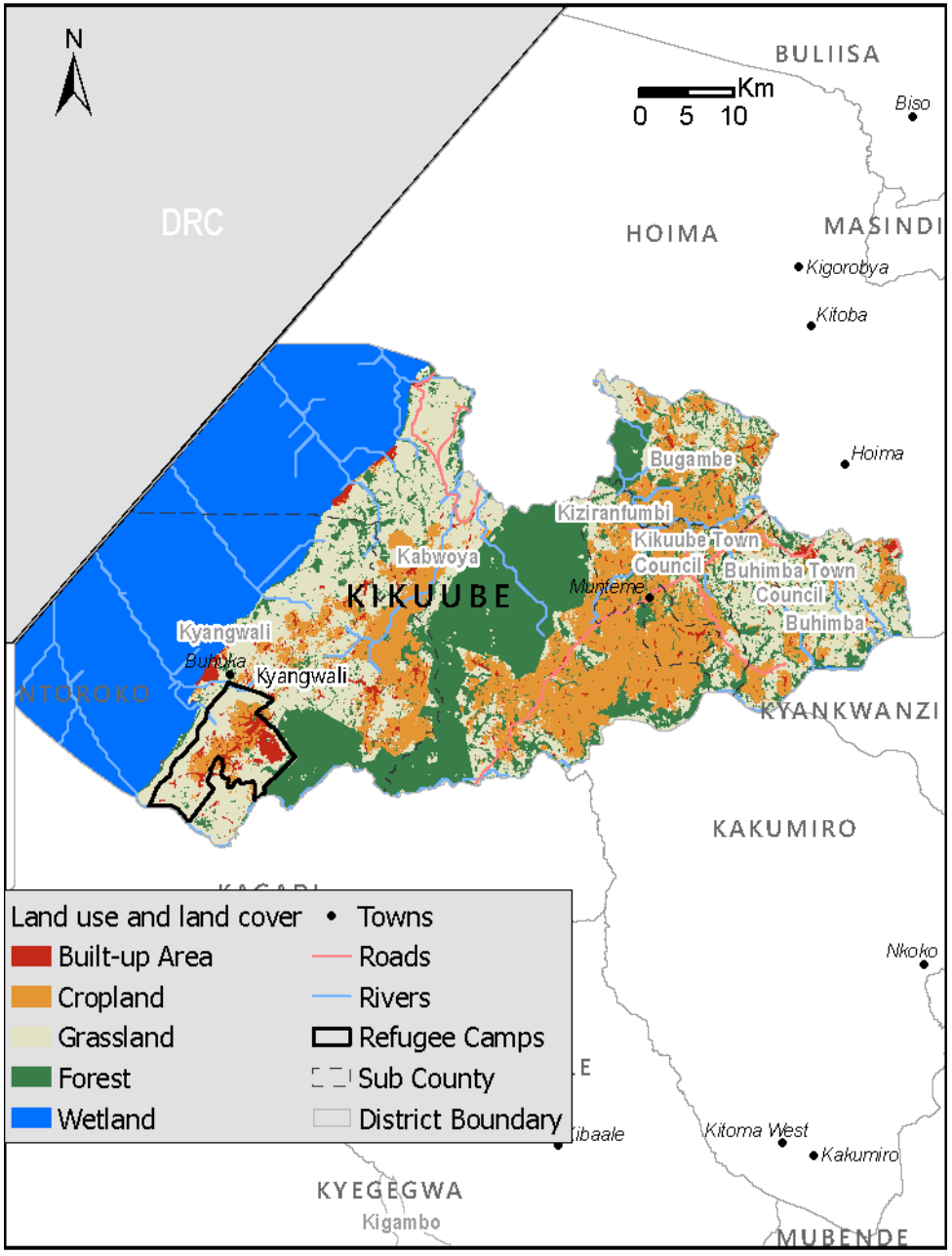
The Kyangwali Refugee Settlement, which is in Kyangwali Sub-county in the western part of the district near Lake Albert, falls within this Lakeshore and Riverbank Fishing Zone. **Livelihoods in and around the settlement are therefore closely linked to fishing and fisheries-related activities**, complemented by small-scale rain-fed agriculture and limited livestock keeping among both refugee and host communities. Environmental conditions influence livelihood opportunities in the area. Kyangwali Sub-county receives approximately 888–1,121 mm of rainfall annually, which is lower than the rainfall levels in many central and eastern parts of the district. The settlement is also situated in a relatively low-lying area at about 540–800 meters above sea level near the Lake Albert basin. These conditions support fishing and some crop production but also limit agricultural productivity and increase exposure to climate variability.

As a result, communities in and around the settlement face several vulnerabilities. Limited access to land for cultivation, population pressure, and declining soil fertility constrain agricultural production. Heavy reliance on natural resources, such as fishing, fuelwood, and small-scale farming, also contributes to environmental degradation. In addition, rainfall variability and periodic dry spells can disrupt farming activities and affect food availability.

To address these challenges, humanitarian and development actors are supporting interventions aimed at strengthening resilience among both refugee and host communities. These efforts focus on **promoting climate-smart agriculture, supporting livelihood diversification, and implementing environmental restoration initiatives such as tree planting and improved natural resource management**.

Environment, Land Use and Land Cover

Kikuube District features a **varied landscape of low-lying areas near Lake Albert, rolling hills, and mid-altitude plains**, with vegetation ranging from open grasslands to scattered forests. The district is experiencing growing ecological pressures, driven by expanding agriculture, rapid population growth, and intensive use of natural resources. Between 2014 and 2024, the population increased from 267,000 to 379,000, with the Kyangwali Refugee Settlement alone hosting over 154,000 people. This population surge has heightened demand for land, food, and building materials, contributing to wetland encroachment, deforestation, and soil degradation.



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

Kikuube is also vulnerable to climate-related hazards, including erratic rainfall and rising temperatures, which affect farming, fishing, and livestock activities. Low-lying areas near Lake Albert, such as Kyangwali Sub-county, are particularly exposed to these hazards, while the higher central and eastern sub counties receive more reliable rainfall and support more consistent crop production but face pressures from land fragmentation and environmental decline.

The district's land use is diverse, with wetlands covering 30%, grasslands 27%, forests 21%, cropland 20%, and built-up areas 2% (see *Map 3*). The Kyangwali Refugee Settlement itself combines built-up areas, cropland, and grassland, surrounded by forests to the east and cropland to the north and south. These land uses support livelihoods, including fishing, small-scale agriculture, and livestock rearing, but also increase vulnerability to environmental stress. Wetlands and forests, critical for water regulation, soil protection, and biodiversity, are under pressure from settlement expansion and agricultural activities.

CLIMATE CONTEXT

This section presents an analysis of Kikuube's 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 risks associated with these 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

Kikuube District typically experiences a **bimodal rainfall pattern**, characterized by two distinct rainy seasons with moderate to heavy precipitation. The primary, heavier rainy season occurs from March to May, **with peak rains normally in April**, while the second season runs from September to November/ early December, with peak rainfall typically occurring in late October to early November. **The driest months are July, and the period from December to February.** These months record the least amount of rain, historically averaging below 100mm of precipitation, typically in the form of minimal and sporadic showers. Consistent with these patterns, the dashed line in *Figure 1* shows the long-term average rainfall (1981-2024) in Kikuube. **Year-to-year variation is evident,** with 2022, 2023, and 2024 showing different magnitudes and timing of rainfall, when compared against the historical averages. For example:

- 2022: Rainfall was generally closely following the 1981-2024 average, albeit with slight variations. March and December recorded totals above the long-term mean, while April, May and October recorded totals below. July was unusually dry, recording significantly less than 50 mm of precipitation when the historical average is above 70 mm.

- 2023: Rainfall fluctuated around the 1981-2024 average, with May, August, and September experiencing below average precipitation, while November, and March recorded above-average totals. July was an unusually dry month when compared against the long-term average.

- 2024: Rainfall patterns largely followed the 1981-2024 average, with July, August, September and November recording above-average precipitation, while March and April recorded totals below, indicating an unusually dry first rainy season.

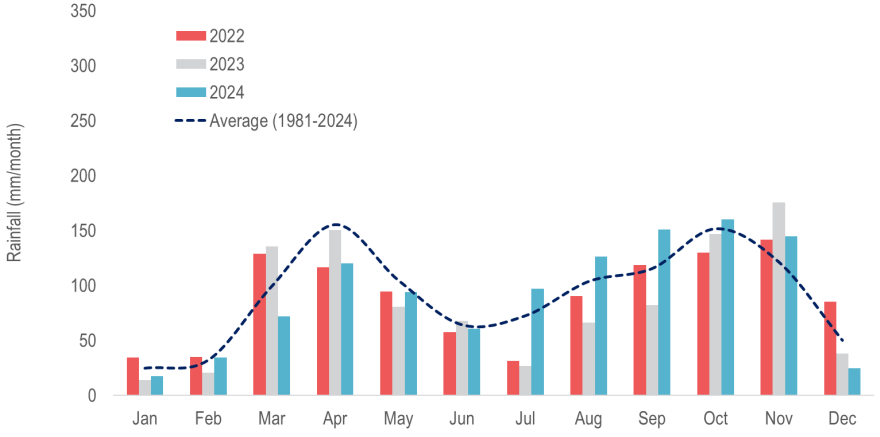


Figure 1: Graph showing Long-term Average Rainfall (2022-2024) in Kikuube District.

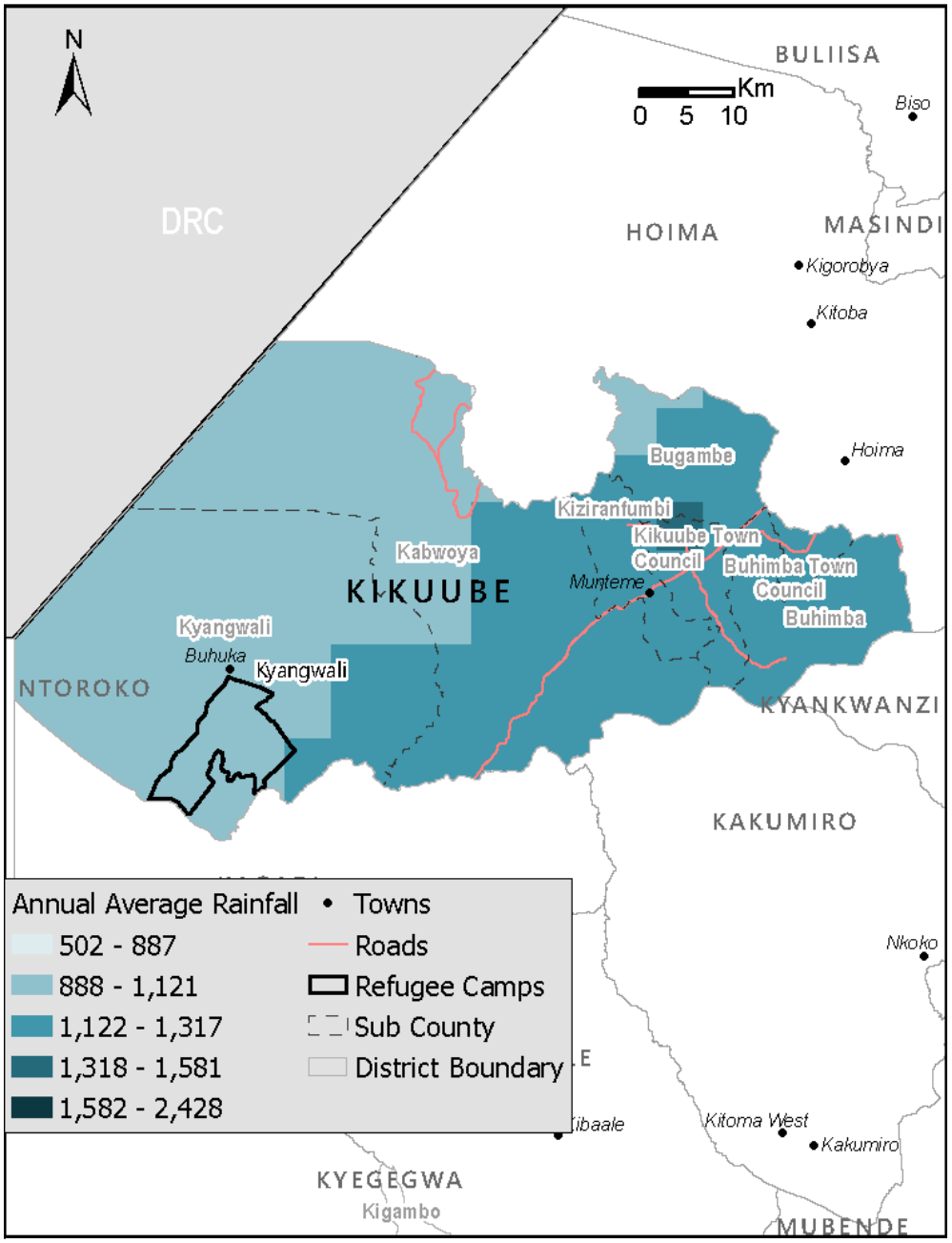
These fluctuations are influenced by climate variability phenomena such as the El Niño Southern Oscillation (ENSO), which can alter the onset, duration, and intensity of seasonal rains. Historically, the El Niño Southern Oscillation (ENSO) typically occurred in an irregular cycle of two to seven years with the individual El Nino 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,

Kikuube is increasingly vulnerable to both seasonal droughts and flooding. Prolonged dry spells during the two dry seasons (December to February and June to August) lead to water scarcity, crop stress, and pasture depletion. Conversely, intense rainfall events during the two main rainy seasons (March-May and September-November/December) can trigger flash floods, crop damage, and disruption of transport and livelihoods.

Recent rainfall patterns in Kikuube District have become **increasingly erratic and unpredictable, characterized by sharp variations in distribution and shifting seasonal patterns.** While the district typically experiences a bimodal rainfall pattern with peaks from March to May and September to November/December, recent trends indicate that these patterns are less reliable than they used to be, particularly affecting the second rainy season from September to November/December. The overall trend moves towards more intense, shorter-duration rain events and less reliable onset of the rainy seasons. These shifting seasonal patterns have had a negative impact on rain-fed agriculture and rural livelihoods, disrupting planting seasons, reducing yields and leading to crop failures, therein threatening residents' livelihoods. 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 Kikuube District for the period 1981-2024, derived from long-term CHIRPS precipitation data. Kikuube District straddles the **888-1,121 and 1,318-1,581 mm annual rainfall zones, with lower-altitude areas bordering Lake Albert experiencing lower and more erratic rainfall** compared to the inland, higher-altitude parts of the district. Total precipitation in the areas bordering Lake Albert is low because the lake lies in a hot, low-lying Rift Valley Floor, situated in a rain shadow, created by surrounding high escarpments and mountain ranges. These mountains block moisture-laden winds causing air to sink and dry out before reaching the lake basin. Rainfall in Kikuube is generally sufficient in volume for rain-fed agriculture, with the region typically experiencing near-normal to above-normal rainfall. However, its reliability for agriculture is increasingly compromised by climate variability, with more erratic, shorter and at times excessively intense and poorly distributed rainfall patterns. Furthermore, specific areas within the district tend to receive below-mean precipitation and are drought-prone. Such areas tend to be located along the Lake Albert shoreline and include Kyangwali and Kabwoya Sub-county.

Similar to trends in neighboring districts, Kikuube District experiences increasingly



Map 4: Map showing average annual rainfall (1981-2024) of Kikuube District.

unreliable and unpredictable rainfall patterns, which presents significant challenges to water security, agriculture and rural livelihoods. Seasonal rainfall variability often drives environmental degradation, such as soil erosion, soil nutrient loss and water availability, which in turn disrupts the traditional agricultural calendar, meaning the timing of planting, growing and harvesting. Overall, the increasing variability in rainfall patterns, coupled with the district's reliance on rain-fed agriculture, heightens climate hazards for both refugee and host communities. For example, maize, one of the main sources of livelihood in the area, is a highly vulnerable crop: highly sensitive to water stress, maize can suffer significant yield losses after 10-14 days without rain during critical periods like tasseling, silking, and grain filling. During early stages, plants can usually withstand only 3-5 days of no rainfall. During peak dry season in July, intense sunlight and lack of water can scorch maize plants, with severe cases causing entire fields to wither.

Fishing, another common source of livelihood in Kikuube, is also impacted by shifting rainfall patterns, longer dry spells and accelerating climate change. Low and unreliable precipitation led to the **drying up of water sources and habitat destruction.** The lack of rain has led to the drying up of vital fish habitats, such as the Luzira-Nsonga lagoon in Buhuuka Parish, Kyangwali Sub-county. The loss of this habitat eliminates breeding grounds for fish and restricts the areas where fishermen can operate. Furthermore, severe water shortages have forced residents to share dwindling water resources with livestock, causing additional environmental degradation and further destroying fish habitats. The reduction in fish populations and shrinking habitats have left local fishermen with significantly reduced catches.

The recent changes pose **specific challenges for refugee-hosting areas**. Kyangwali Settlement is highly susceptible to both floods and prolonged dry spells due to a combination of climate-related, geographical and human-induced factors. The increase in refugee population has led to an immense and unsustainable demand for wood for fuel and shelter construction, leading to massive deforestation and land degradation. Because of this, the soil cannot absorb the water during heavy rains, leading to rapid surface runoff and flash floods. Conversely, during the dry season, the degraded bare soil cannot retain moisture, exacerbating seasonal droughts. The situation is further compounded by wetland encroachment. Wetlands that naturally act as sponges to absorb floodwater have been cleared for farming and residential development. Communities in Kyangwali settlement are particularly sensitive to shifts in seasonal rainfall patterns, given the lack of irrigation infrastructure and their dependence on rain-fed agriculture. Overall, refugee communities are more vulnerable than host communities whose livelihoods are distributed across a wider landscape and diversified through larger landholdings and livestock.

The increasing variability and rapid shifts in the known climatic patterns pose growing risks in Kikuube. 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, Kikuube District has experienced a significant rise in temperatures, with an **increase of approximately 2.2°C to 2.7°C**, a substantial warming trend for a single district. As shown in the graph in *Figure 2* the most pronounced rise has occurred in recent years (2014-2023), simultaneously accompanied by greater year-to-year variability in temperatures.

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

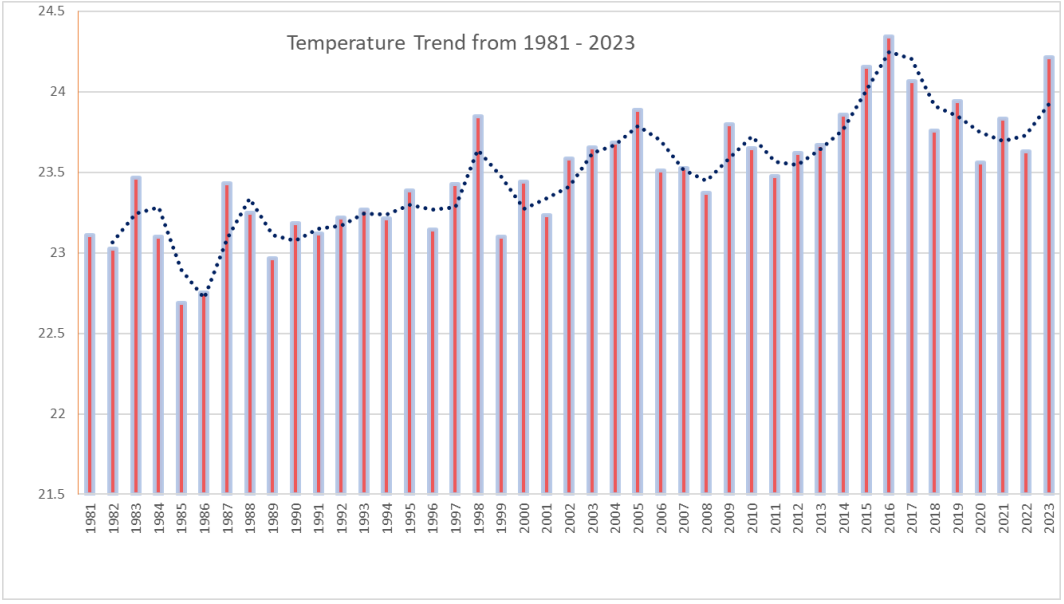


Figure 2: Graph showing the Long-term Temperature Trend (1981-2023) in Kikuube District.

- 1980s-1997: Average annual temperatures generally ranged between about 22.7°C and 23.5°C, with some year-to-year variability, particularly in the mid-1980s, where mean annual temperatures dropped as low as 22.7°C in 1985 from 23.5°C in 1983. That said, overall, there was no warming trend during this time period.

- 1998-2014: Average annual temperatures initially rose to 23.8°C in 1998 and then fluctuate between 23.1°C and 23.9°C. Overall, this period is marked by more year-to-year variability and a clearer warming signal.

- 2015 onwards: A clearer warming signal and even greater variability, with average annual temperatures surpassing 24°C for the first time.

The rise in temperatures coupled with greater variability highlights the growing climate stress in the region, with implications for agriculture, water availability, health and overall resilience.

In Kikuube, the warmer periods generally coincide with the transition into the rainy seasons. The hottest temperatures typically occur during the drier, sunny periods immediately preceding the two main rainy seasons (March-April and September-November). February is often considered one of the hottest months before the March/Aprils rains start. The graph in *Figure 3* indicates a rise in temperatures, with recent years showing more days where average daily temperatures exceed the long-term mean. This suggests 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 Kikuube District's growing vulnerability to climate-induced heat stress.

The long-term monthly temperature average (2022-2024) shown by the dashed line in *Figure 3* indicates two temperature rises within the rainy season that coincide with crop flowering (March-May/June and September-November/December) and crop germination (March-April and September -October).

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

- 2022: Monthly temperature in the crop flowering stage was above normal of the long-term average in March and October.

- 2023: Monthly temperature in the crop flowering stage was above normal of the long-term average in September-October while it was below normal in March-April.

- 2024: Monthly temperature in the crop flowering stage was generally above normal of the long-term average, from March -May/June and September-November/December.

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 prematurely.

- 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 and thus lowering the seed germination potential of harvested seeds

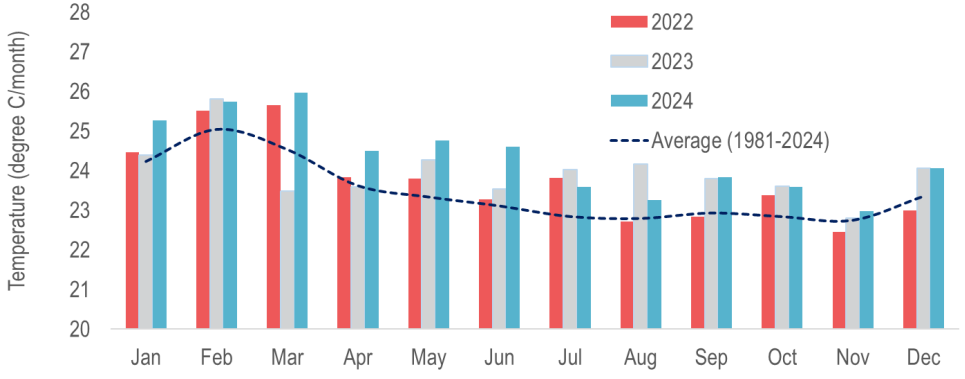


Figure 3: Graph showing Average Annual Temperature (2022-2024) in Kikuube District.

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.

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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 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

+138 mm

Temperature changes (1970-2000 vs 2041-2060)
SSP2-4.5 Moderate Emission Scenario
Annual Mean Temperature Increase

+2.65 °C

Figure 4: Annual precipitation and temperature changes in Kikuube District

Temperature

The mean annual temperature is projected to rise from **23.5°C** in the historical baseline to **26.1°C** by **2041-2060.** Both minimum and maximum temperatures show substantial increases. The strongest warming (up to **2.65-2.70°C**) is expected in **Kyangwali and Kabwoya**.

An increase in mean temperature during both the **warmest months (+2.3°C)** and **driest quarter (+2.4°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 (+3.0°C)** and **wettest quarters (+2.6°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 Kyangwali refugee settlement.

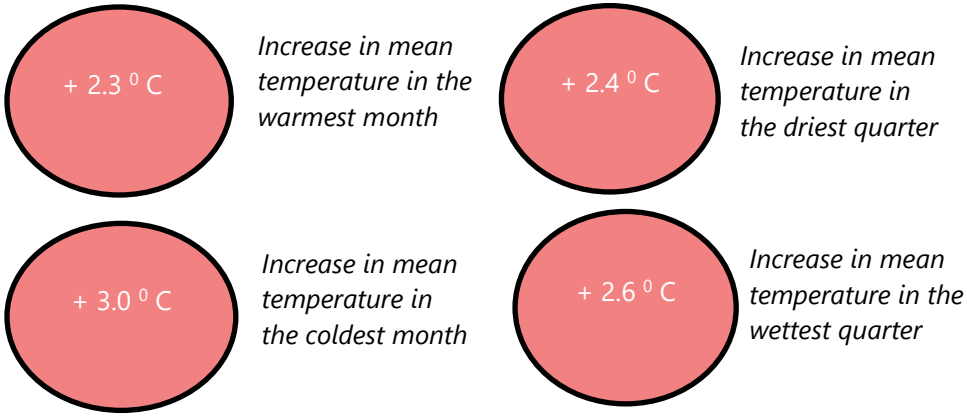


Figure 5: Projected changes in temperature in bioclimatic variables.

Precipitation

Mean annual rainfall is projected to increase from **1,147 to 1,285 mm** by mid-century. However, the distribution of rainfall gains is uneven across the district. The largest precipitation increases **(156 mm)** are expected in **Buhimba, Buhimba Town Council and Kikuube Town Council,** while areas such as **Kyangwali and Kabwoya** show smaller increases (130-135mm).

An Increase in precipitation of the **wettest month (+21.4 mm)** and **coldest quarter (+46.6 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.

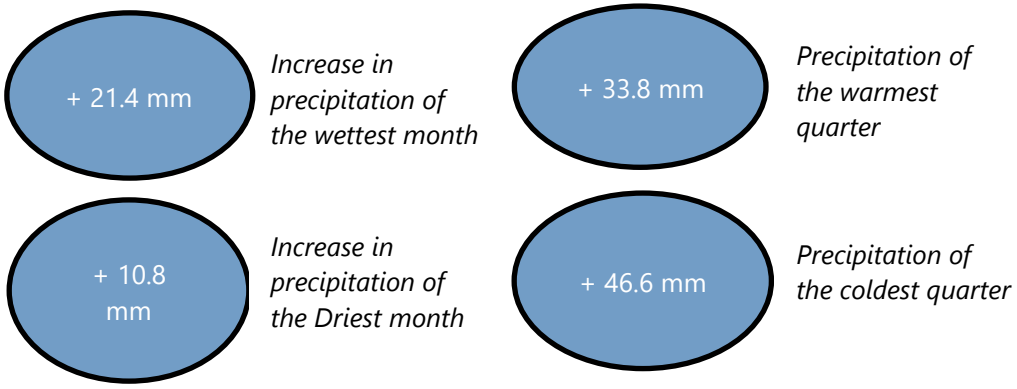
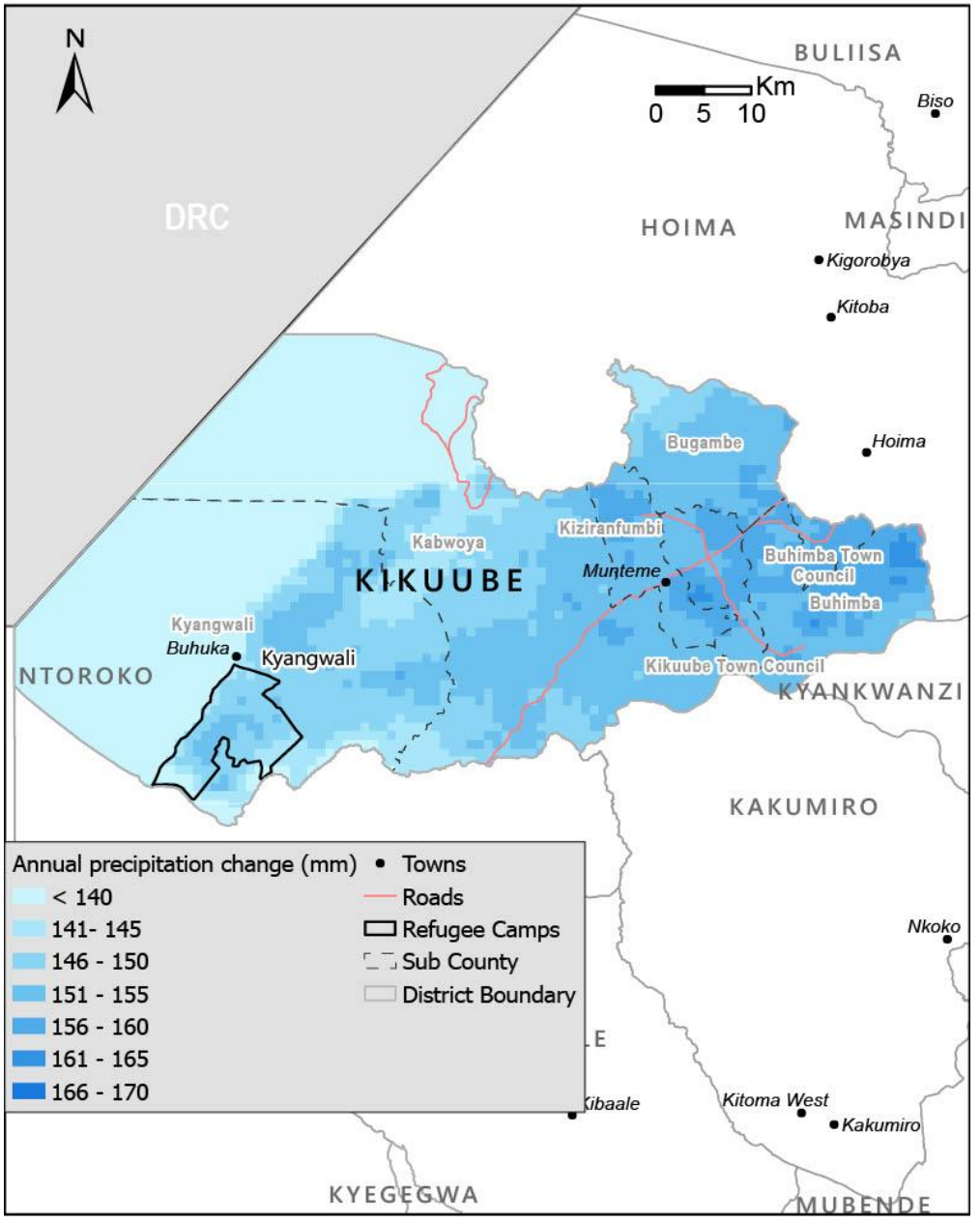


Figure 6: Projected changes in precipitation in bioclimatic variables

An increase in precipitation during the **driest month (+10.8 mm)** and the **warmest quarter (+33.8 mm)** 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 Kikuube District's dependence on two distinct rainy seasons. That said, these seasons become increasingly unpredictable in their timing and intensity.

Implications

The combination of rising temperatures, changes in dry-season rainfall, and moderate increases in annual precipitation creates a complex climate-hazard profile for Kikuube 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 Kyangwali Refugee Settlement are likely to face rising exposure to heat stress, prolonged dry spells and water scarcity.

The lower-lying sub-counties bordering Lake Albert, which already experience drier conditions, may face heightened vulnerability to climate-related shocks compared to the rest of the district which receives 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[22] and the IPCC Sixth Assessment Report[23], 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 Kikuube 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

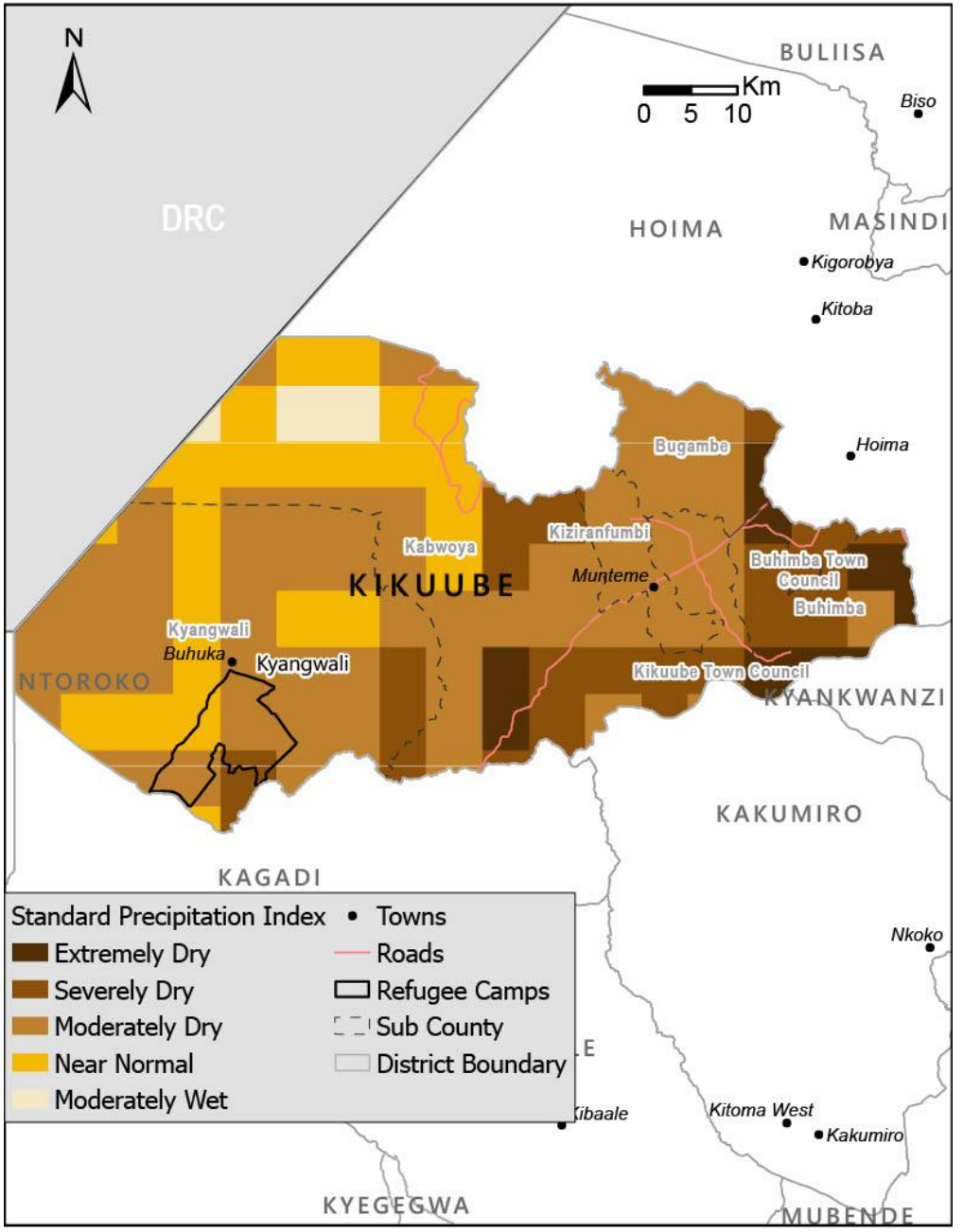
Kikuube District is **increasingly vulnerable to seasonal drought and erratic weather**, as rainfall patterns have become less predictable and more variable, undermining the reliability of rain-fed agriculture. This climatic variability, compounded by human pressures such as deforestation, wetland degradation, and expanding agricultural land, has resulted in prolonged dry spells, crop and pasture stress, and reduced harvests, threatening food security for rural households and smallholder farmers, particularly in sub-counties such as Biguli, Nkoma, and Bihanga. Shifting rainfall patterns and rising temperatures are intensifying these challenges, constraining agricultural productivity and heightening the vulnerability of households that depend on farming as their primary livelihood.

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 NDVI2[2] based indicator that shows crop biomass and vegetation health responses to precipitation anomalies/moisture stress. Together, these indices capture both meteorological drought conditions and their impact on vegetation, providing an integrated understanding of drought occurrence and severity.

Prolonged dry conditions in 2024 severely affected Kikuube District, causing water shortages and stress on crops and pastures that threatened local livelihoods. Communities faced acute water scarcity, often sharing limited sources with livestock, which increased health risks. While humanitarian support helped protect some water points, limited resources highlighted the need for long-term investment in drought preparedness, climate-resilient agriculture, and improved water management.

SPI Findings

Kikuube District is experiencing significant moisture stress, with **large parts of the district under severely dry conditions.** The western and central sub-counties Kiziranfumbi, Bugambe, Buhimba, and Kikuube Town Council are mostly severely dry, which negatively affects soil moisture, crop performance, pasture availability, and water access.



Map 6: Map showing the SPI Index.

[2] NDVI stands for the Normalized Difference Vegetation Index.

Kabwoya Sub-county shows a mix of moderately dry and near-normal conditions, providing slightly better water availability compared to other areas (see *Map 6*).

Kyangwali Sub-county, where the Kyangwali Refugee Settlement is located, falls largely within the severely dry category, with some pockets near normal. The settlement itself lies in the southwestern part of the district near Lake Albert, highlighting heightened water stress and vulnerability for both refugee and host communities.

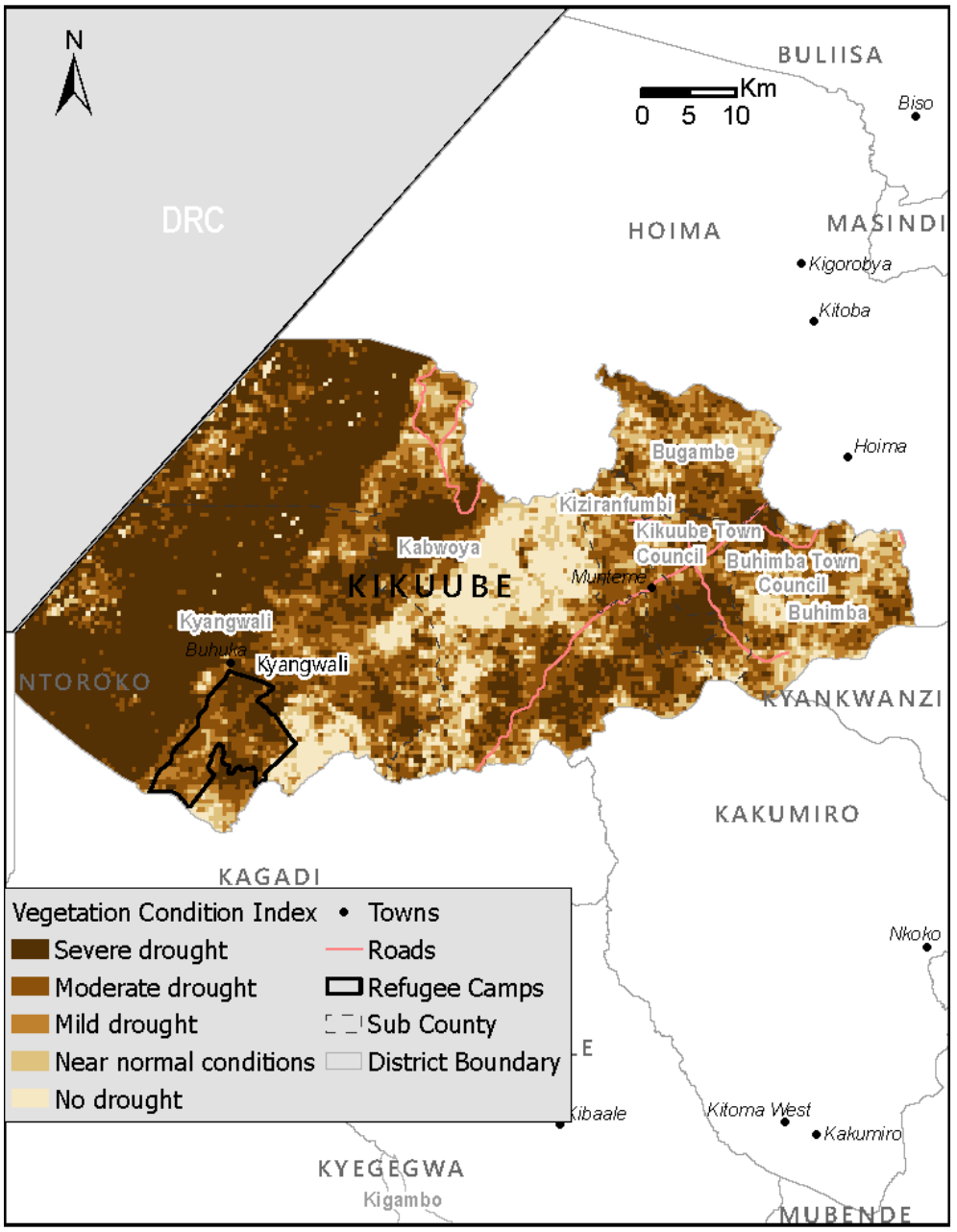
The SPI pattern underscores the district's exposure to seasonal **drought and moisture deficits**. Communities in rain-fed agricultural and fishing zones, particularly those hosting refugee populations, face high risks of reduced crop yields, limited pasture, and constrained water resources. These conditions reinforce the need for targeted interventions to support sustainable livelihoods and resilience in Kikuube District.

VCI Findings

The *Vegetation Condition Index (VCI)* results confirm **widespread vegetation stress across Kikuube District,** corresponding closely with the SPI-detected rainfall deficits. Grasslands provide the clearest and most reliable signal of drought severity because they are shallow-rooted and highly sensitive to rainfall variability. Croplands show varying stress depending on crop type, seasonal planting schedules, and land management practices, while forests mask short-term drought due to deeper root systems and higher biomass. Built-up areas give less reliable signals because of bare surfaces and limited vegetation cover.

The most affected areas, including Kyangwali and the surrounding low-lying western regions, show severe vegetation drought, represented by the darker brown tones on the map (see *Map 7*). These areas combine low rainfall, lower elevation, and intensive land use, including wetlands, cropland, and grasslands, which together reduce soil moisture, limit vegetation growth, and contribute to very poor vegetation health, declining pasture availability, and early signs of crop stress.

Meanwhile, **higher-elevation and more central parts of the district show moderate vegetation stress,** indicating relatively better environmental performance. Here, higher rainfall and less intensive land use help sustain vegetation, though cropland expansion and human activity still exert some pressure. The VCI map demonstrates a clear gradient of vegetation drought from the heavily stressed lowlands to the moderately affected central and eastern zones.



Map 7: Map showing the VCI Index

The findings illustrate that vegetation health across much of Kikuube District was significantly constrained during this period, particularly in low-lying, heavily used areas. These conditions have important implications for croplands, grazing areas, and the livelihoods and food security of both refugee and host communities, especially in the Kyangwali Refugee Settlement.

Implications

The combined SPI and VCI analyses for Kikuube District highlight the significant impact of seasonal drought on both vegetation and livelihoods. Low-lying western areas, especially around Kyangwali Refugee Settlement and adjacent lowland zones, show severe SPI dryness alongside pronounced vegetation stress, signaling that these communities are particularly vulnerable during periods of rainfall deficit. Refugee-hosting areas fall largely within these severely affected zones, underscoring the heightened risks to the livelihoods of both host and refugee populations.

In 2024, extended dry spells and erratic rainfall during key planting and grazing periods disrupted agricultural cycles, reduced crop yields, and limited water availability. Local observations indicate that staple crops such as maize, beans, cassava, and vegetables were negatively affected, with early signs of crop failure evident in the most drought-prone areas. These outcomes directly reflect the combined SPI and VCI findings, resulting in lower food availability and diminished household incomes

The implications extend beyond agriculture. Reduced soil moisture, degraded vegetation cover, and increased environmental pressure compromise pasture regeneration, water resources, and land stability, making the district less able to absorb future climatic shocks. Pressure is particularly intense in settlement areas, where high population density and limited access to natural resources amplify the effects of seasonal drought. These findings point to an urgent need for interventions in in Kikuube focused on climate-smart agriculture, sustainable water management, and restoration of natural resources to enhance the resilience and food security.

From a preparedness and response perspective, the findings highlight **the need for early warning systems, climate-smart farming, water harvesting and storage, and improved management of natural resources.** Incorporating SPI and VCI monitoring into district-level planning can support evidence-based decision-making, provide timely alerts during seasonal drought events, and guide more effective allocation of resources for both immediate relief and long-term climate resilience in Kikuube District.

Photo 1: Dry Spell hits Kikuube Farmers Hard, Nile post; Photo Credit; Alan Mwesigwa

In June 2024, farmers in Kikuube District were hit hard by drought, with unpredictable rainfall causing rice crops to dry and yields to decline. Demo farmers like Doreen Ayebazibwe reported losses and early crop failure due to prolonged dry spells. Changing rainfall patterns made planting unpredictable, and upland farmers struggled with limited irrigation options. Experts from Makerere University advised soil testing, proper fertilizer use, and agricultural insurance to reduce risks. The district, together with Makerere University and the African Plant Nutrition Institute, continues to support rice demo plots and champion farmers, promoting sustainable practices and moving cultivation away from wetlands.

Source: Dry spell hits Kikuube farmers hard

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.[24]

1. Distance to Permanent water ranked from higher risk to lower risk at 100 meters, 250 meters, 500 meters, and 750 meters.[25]

2. Elevation above sea level ranked from higher risk to lower risk at 600 meters, 700 meters, 800 meters, and 1000 meters.[26]

3. Slope of the area in degrees ranked from higher risk to lower risk at 2, 5, 10, 15.[33]

4. Landcover from higher risk to lower risk as built-up, cropland (including water, flooded vegetation), grassland, shrub and forest.[27]

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.[28]

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.[29]

9. Rainfall Intensity as average maximum annual rainfall ranked from higher risk to lower risk at 33 mm, 31 mm, 29 mm, 27 mm.[30]

10. Monthly Number of Days with Rainfall ranked from higher risk to lower risk at 13 days, 10 days, 7 days, 3 days.[31]

11. Frequency of -days with continuous Rainfall ranked from higher risk to lower risk at 2, 1.2, 0.8, 0.4.[32]

12. Height Above Nearest Drainage (HAND) ranked from higher risk to lower risk at 2 meters, 5 meters, 10 meters, 20 meters.[33]

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).[34]

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

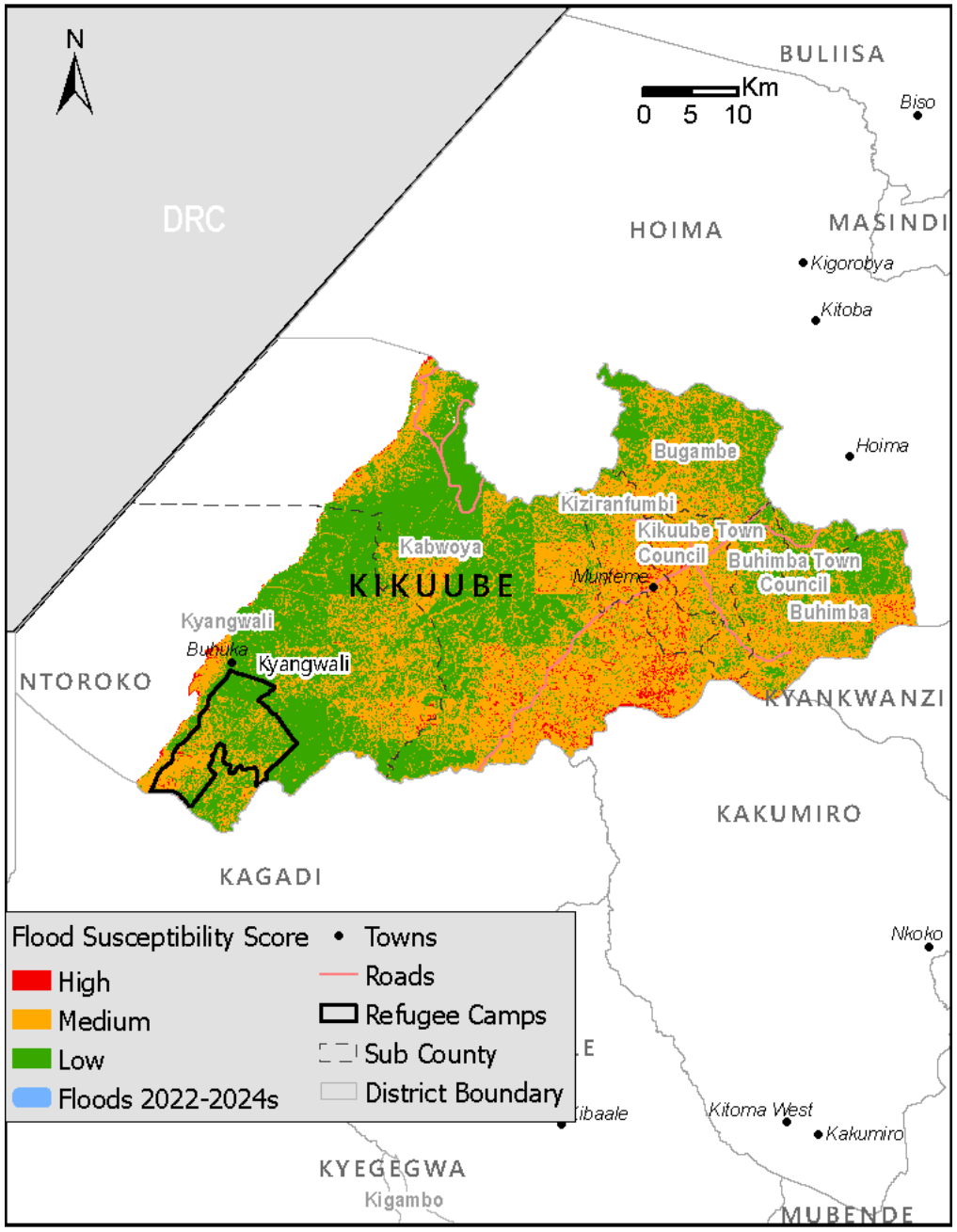
Hydro-climatic indicators such as rainfall intensity, frequency of continuous rainfall days, and flood return periods are equally vital in flood risk assessment. Literature shows that extreme rainfall events, particularly when sustained over consecutive days, significantly increase flood hazards. Soil 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. As part of the western rift, Kikuube's eastern part is a sharp escarpment collecting rainwater, directing it downhill and westward to the low-lying shores of Lake Albert. The soil in the escarpment slope is shallow sandy loams, while it is alluvial at the shore. Insufficient drainage infrastructure limits water infiltration and increases surface runoff, particularly in low-lying areas and along seasonal streams and permanent rivers. Wetland degradation along the Lake shore makes flooding worse.

Satellite-based assessments reveal that apart from the 30% of western Kikuube District that are wetland, **only 46% of the district fall within low-risk flood areas**. Its escarpment terrain with deep valleys makes it prone to flash floods and landslides in the eastern sub-counties like Buhimba and in the western sub-counites like Kyangwali.[35] Although the southcentral areas can be categorized as having high flood risk according to *Map 8*, there were no flood incidents in the last four years. That said, Kyangwali[36] and Buhimba[37] were sub-counties that have experienced recoded floods. Their vulnerability stems from low elevation and proximity to seasonal river channels. Within the refugee settlements in Kikuube, the western parts of Kyangwali next to the shoreline are more susceptible to flooding than the eastern parts, due to their proximity to wetlands. These zones are situated on 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 risks, including water contamination.

The flood susceptibility analysis for Kikuube District (2022–2024), presented in *Map 8*, indicates that flooding is largely localized, with the highest concentration of inundation occurring in the northwestern and western parts of the district. However, some areas appear to show little or no inundation on the map because the zones that frequently experience floods are located within existing wetlands. As a result, the analysis may record these areas as permanent or seasonal wetlands rather than as distinct flood events.



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

Risk on Cropland and Settlement

The land cover analysis revealed that grassland covers 26.8%, wetland 30%, forest 21.0%, built-up areas 2.4% and cropland 19.8%. Less than 25.2% of cropland falls within the low-risk flood zone, while at least 27.6% of built-up areas are within the low-risk flood zone. Cropland areas emerge as the most affected by flooding when measured in terms of the area inundated compared to built-up areas. However, these estimates represent district-wide averages. Therefore, they conceal substantial spatial concentration of impacts at the local level.

The *Land Use and Landcover Map* (*Map 3)* shows that cropland cells are more evenly distributed within the district, falling within low- to high-risk flood zones, pointing to chronic exposure for households cultivating around floodplains and poorly drained depressions, especially in the western half of the district. For households in flood-prone areas, localized flash and lake shore overflow flooding events can result in crop damage, delayed planting, and yield losses, likely contributing to income losses and seasonal food insecurity. Built-up areas which overlap with the cropland around Kyangwali refugee settlement are within medium to high flood risk zones.

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 into wetlands and land use changes, especially around refugee-hosting areas, have contributed to reduced infiltration and increased runoff, thereby amplifying flood occurrence.

Flood Impacts

Flooding in Kikuube District has had multidimensional socio-economic and environmental impacts. That said, flooding is highly localized, primarily affecting the northwestern and western parts of the district. In these areas, repeated flooding has caused significant damage to shelter, crops, and farmland, disrupting food production and reducing household income for both host and refugee communities. During periods of heavy rainfall, roads and footpaths in flood-prone zones often become impassable, limiting movement and restricting access to markets, schools, and health services. Flooding has also polluted water sources and damaged sanitation infrastructure, heightening the risk of waterborne diseases.

Photo 2: Floodwaters submerge homesteads in Kikuube District, Dec 2024. Photo credit: Plus, News Reporter.

In December 2024, heavy rainfall in Kikuube District caused severe flooding that submerged more than 300 homesteads and displaced many households. The floods destroyed houses, crop gardens, and other property, disrupting livelihoods in affected communities. Local authorities reported that several families were forced to seek shelter in safer areas after their homes were inundated. Such flood events frequently occur during Uganda's rainy seasons, leading to displacement, infrastructure damage, and loss of agricultural production in vulnerable communities

Source: Flood Submerge 300 Homesteads in Kikuube - Plus News

Photo 3: Houses submerged by floods at Kyakapere landing site in Kikuube district. Thousands of the flood affected people are languishing in abject poverty. Photo credit: Emmanuel Okello.

In March 2020, rising water levels in Lake Albert caused severe flooding in Kikuube District, displacing more than 1,000 residents from several landing sites including Nsunzu, Nkondo, Kyakapere, Buhuka, and Nsozi. Many affected families lost their homes and property and were forced to take refuge in churches, schools, or makeshift shelters, while others lived under trees. Flood victims reported receiving little or no relief support despite repeated appeals to the government. The disaster left many households struggling with poverty and seeking permanent resettlement to safer areas.

Source: Uganda Radio Network: 1000 Kikuube Flood Victims Languishing in Abject Poverty

Environmentally, it drives soil erosion, stream sedimentation, and loss of vegetation, undermining natural drainage systems and heightening the risk of future floods. Socially, households in affected areas frequently face temporary displacement, property damage, and increased vulnerability due to inadequate infrastructure and limited adaptive capacity. These compounded impacts underscore the need for integrated flood management, targeted infrastructure improvements, and community-based adaptation strategies to enhance resilience across the district.

Conclusion

The findings of this geospatial analysis show that Kikuube District is increasingly affected by climate-related hazards, particularly seasonal drought and localized flooding, which threaten livelihoods for both host and refugee communities. SPI and VCI results indicate significant rainfall deficits and vegetation stress across much of the district in 2024, especially in western and central sub-counties including **Kiziranfumbi, Bugambe, Buhimba, Kikuube Town Council, and Kyangwali**, affecting crop production, pasture availability, and water resources. At the same time, flood analysis shows that flood risk is highly localized, mainly affecting the **low-lying western and northwestern areas near Lake Albert**, particularly **around Kyangwali**. These areas are vulnerable due to wetlands, low elevation, and proximity to drainage channels, leading to periodic damage to crops, shelters, infrastructure, and water sources. The results highlight Kikuube District's growing climate vulnerability and the need for improved early warning systems, climate-resilient agriculture, better water management, and risk-informed land use planning to strengthen resilience for both refugees and host communities.

Methodology Overview

The climate hazard assessment for Kikuube 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[38] under the SSP2-4.5 scenario, processed using the same bioclimatic variables to ensure comparability with the historical baseline.[39]

Drought assessment followed UN-SPIDER protocols[40], using SPI calculated in Google Earth Engine (GEE)[4142] from CHIRPS rainfall data[43] (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.[44] 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.[45] 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 Kyangwali refugee settlement in Kikuube 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 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 Kikuube (WorldClim ≈ 25.7°C for 1970-2000, ERA5-Land ≈ 24.7°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 25-26°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

Kindly click this link below to explore the full series available on the Resource Centre:
Resource Centre | Impact

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.[46]

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.[47]

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.[48]

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.[49]

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[50]

Exposure: The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas.[51]

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.[52]

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).[53]

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

Endnotes

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ABOUT REACH

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).

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