



URBAN CLIMATE RISK PROFILE FOR KIAMBU MUNICIPALITY



JUNE 2025



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Publisher: Kiambu County

Publisher Address:

First Edition: 2026

Printed in Kenya

Disclaimer:

The Kiambu Municipality's Urban Climate Risk Profile (2026) is intended solely for planning and informational purposes. The analysis and forecasts are subject to uncertainties in climate science and changing local conditions, and they are based on data available at the time of publication.

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Foreword

Climate change is already affecting Kiambu Municipality through erratic rainfall, flooding, prolonged dry spells, rising temperatures, and increasing strain on water resources and infrastructure. These impacts threaten public health, livelihoods, economic activities, and overall community resilience.

The Urban Climate Risk Profile provides an evidence-based analysis of key climate hazards and vulnerable areas, guiding informed decision-making and climate-responsive planning. It supports the integration of climate action into municipal systems and aligns with national and county strategies.

Building resilience requires collective effort. The Municipality remains committed to proactive, inclusive, and evidence-based climate action to ensure a sustainable and resilient future for Kiambu.



Municipal Manager
Kiambu Municipality
June 2025

Executive Summary

This Urban Climate Risk Profile assesses the current and future climate risks facing Kiambu Municipality. Three key hazards were identified through community consultations and climate data analysis: pluvial flooding, drought and excessive fooding. Using the IPCC risk framework (hazard × exposure × vulnerability), the profile evaluates risks to urban infrastructure, populations, and natural assets under current conditions and future climate scenarios (SSP2-4.5 and SSP5-8.5 for 2050 and 2100).

Key findings:

- Pluvial Flooding poses very high risks to transport, stormwater drainage, and informal settlements today, and these risks will intensify significantly by 2050.
- Drought already creates high risks for water supply, agriculture, and vulnerable groups; future projections show increasing water stress.
- Excessive Heating impacts water supply, infrastructure such as energy and vulnerable populations and likely to intensify by 2050 and 2100.

Most at risk: Residents of low lying areas (Parts of Ting’ang’a, Kiambu Township and Kiamumbi), residents of informal settlement such as Ruturo, elderly persons, small scale traders, boda boda operators.

Priority actions: Upgrade stormwater drainage, expand water harvesting, implement early warning systems, and climate-proof schools and health facilities.

The summary tables below present current and projected risk levels for each hazard.

Table ES-1. Summary of Pluvial Flood Risks for Kiambu Municipality

Category	Risk Level				
	Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Infrastructure & Services					
Stormwater Drainage	High	Very High	Very High	Very high	Very high
Water & Wastewater Management	Medium	High	High	High	Very High
Solid Waste Management	Medium	High	High	High	High
Transport and Mobility	High	Very High	Very High	Very High	Very High
Energy	Low	Medium	Medium	Medium	High
Economic Infrastructure	Medium	High	High	High	Very High
Social Infrastructure	Medium	High	High	High	Very High
Emergency Services	Medium	High	High	High	Very High
Populations					
Urban Residents	High	Very High	Very High	Very High	Very High

Category	Risk Level				
	Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Informal Settlement Residents	Medium	High	High	High	High
Vulnerable and Marginalized Groups	High	Very High	Very High	Very High	Very High
Natural Assets					
Urban Green Infrastructure	Medium	High	High	High	High
Urban Blue Infrastructure	Medium	High	High	High	Very High
Peri-urban and Agricultural Systems	Medium	High	High	High	Very High

Table ES-2. Summary of Drought risks for Kiambu Municipality

Category	Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Infrastructure & Services					
Stormwater Drainage	Low	Low	Low	Low	Low
Water & Wastewater Management	High	Very High	Very High	Very High	Very High
Solid Waste Management	Low	Medium	Medium	Medium	High
Transport and Mobility	Low	Medium	Medium	Medium	High
Energy	Low	Medium	Medium	Medium	High
Economic Infrastructure	Medium	High	High	High	Very High
Social Infrastructure	Medium	High	High	High	Very High
Emergency Services	Low	Medium	Medium	Medium	High
Populations					
Urban Residents	High	Very High	Very High	Very High	Very High
Informal Settlement Residents	High	Very High	Very High	Very High	Very High
Vulnerable & Marginalized Groups	Very High	Very High	Very High	Very High	Very High
Natural Assets					
Urban Green Infrastructure	Medium	High	High	High	Very High

Urban Infrastructure	Blue	High	Very High	Very High	Very High	Very High
Peri-urban Agricultural Systems	&	Very High				

Table ES-3. Summary of Extreme heat risks for Kiambu Municipality

Category	Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Infrastructure & Services					
Stormwater Drainage	Low	Low	Low	Low	Low
Water & Wastewater Management	Medium	Medium	High	High	Very High
Solid Waste Management	Medium	Medium	Medium	High	High
Transport and Mobility	Medium	High	High	High	Very High
Energy	High	High	Very High	Very High	Very High
Economic Infrastructure	Medium	Medium	High	High	Very High
Social Infrastructure	High	High	Very High	Very High	Very High
Emergency Services	Medium	High	High	High	Very High
Populations					
Urban Residents	Medium	High	High	High	Very High
Informal Settlement Residents	High	Very High	Very High	Very High	Very High
Vulnerable & Marginalized Groups	High	Very High	Very High	Very High	Very High
Natural Assets					
Urban Green Infrastructure	Medium	High	Very High	Very High	Very High
Urban Blue Infrastructure	Medium	Medium	High	High	Very High
Peri-urban Agricultural Systems	&	High	High	Very High	Very High

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List of Acronyms

Acronym	Meaning
CCCAP	County Climate Change Action Plan
EMCA	Environmental Management and Coordination Act
FLLoCA	Financing Locally Led Climate Action
GIS	Geographic Information System
IPM	Integrated Pest Management
KEFRI	Kenya Forestry Research Institute
KFS	Kenya Forest Service
KIWASCO	Kiambu Water and Sewerage Company
NEMA	National Environment Management Authority
PCRA	Participatory Climate Risk Assessment
PWD	Person with Disability
RCP	Representative Concentration Pathway
SSP	Shared Socioeconomic Pathway
WEENR	Water, Environment, Energy and Natural Resources
RCRA	Rapid Climate Risk Assessment

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1. Context

1.1. Objective

This Urban Climate Risk Profile aims to:

- Identify and prioritise the key climate hazards affecting Kiambu Municipality.
- Assess the exposure, vulnerability, and impacts of these hazards on urban infrastructure, populations, and natural assets.
- Provide a robust evidence base for the Kiambu Integrated Development Plan and the County Climate Change Action Plan.
- Empower municipal decision-makers and communities with actionable risk information to guide adaptation investments under the FLLoCA programme.

1.2. Urban Context

1.2.1 Geographic area

Kiambu Municipality is located in Kiambu County and forms part of the greater Nairobi Metropolitan area. It covers an area of 100 km² and comprises four wards: Township, Ndumberi, Riabai and Ting'ang'a. Kiambu Municipality is situated at an altitude of approximately 1,500 to 1,800 meters above sea level, It lies immediately north of Nairobi, positioning it strategically as both a residential and commercial extension of the capital city. The municipality serves as an important administrative and economic hub within the county, benefiting from its proximity to Nairobi while maintaining its own distinct urban character.

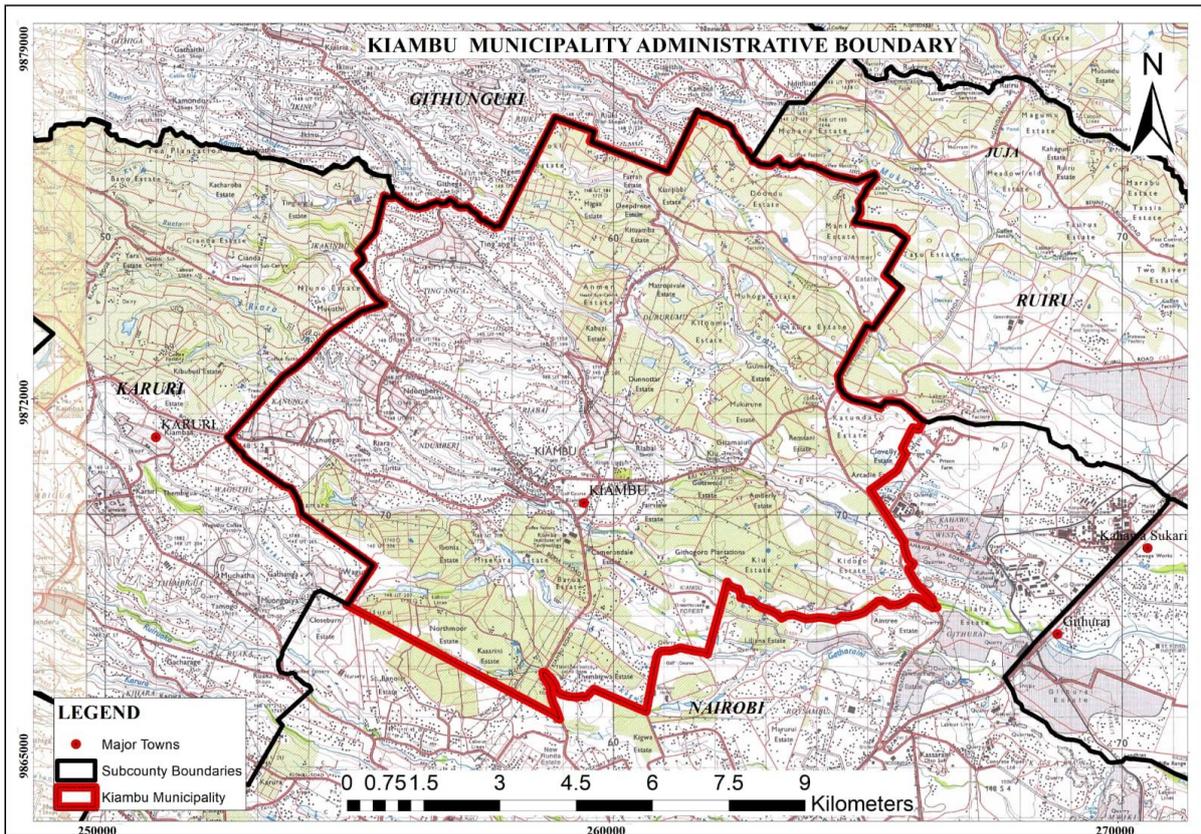


Figure 1: Map of Kiambu Municipality with administrative boundaries.

1.2.2 Governance Structure

Kiambu Municipality is governed by a Municipal Board appointed by the Kiambu County Government, in accordance with the Urban Areas and Cities Act (2011). Key departments involved in climate resilience include:

- **Municipal Manager’s Office** – overall coordination
- **Department of Environment & Waste Management** – lead for this profile
- **Department of Physical Planning & Urban Development**
- **Department of Water & Sanitation**
- **Department of Roads & Public Works**
- **Department of Health & Public Services**

The preparation of this profile was led by a Municipal Technical Working Group, with representation from all departments and community-based organisations.

1.2.3 Socio-economic Context

According to the 2019 Kenya Population and Housing Census, Kiambu Municipality had a population of 145,903. The population is projected to reach approximately 172,000 by 2027, assuming an average annual growth rate of 2.1% as applied in the Kiambu County CIDP 2023–2027 projections.

Population by Ward (Kiambu Municipality)

Ward	Population (2019)	Estimated Households*	Density (persons/km ²)
Riabai	26,854	8,100	540
Township	60,973	18,400	1,950
Ndumberi	31,359	9,500	720
Ting'ang'a	26,717	8,000	600
Total	145,903	44,000	~1,620 (avg urbanized area)

*Households estimated using an average household size of 3.3–3.5 persons per household (KNBS 2019 basis).

Density figures are approximate and vary significantly between urban core and peri-urban areas.

Source: Kenya National Bureau of Statistics (KNBS) 2019; projected using Kiambu County CIDP 2023–2027 growth assumptions.

1.2.4 Economic Context

Kiambu Municipality has a diversified peri-urban economy shaped by agriculture, commerce, light manufacturing, and strong linkages to Nairobi. While urbanization is steadily increasing, agriculture remains a significant economic activity, particularly in the peri-urban wards. Coffee farming, dairy production, horticulture, and small-scale mixed farming continue to support household incomes alongside growing commercial and service-sector activities.

Formal employment within the municipality is concentrated in public administration, education institutions, retail businesses, financial services, and light manufacturing. A considerable proportion of residents commute daily to Nairobi for employment in government, private sector offices, construction, domestic work, and informal trade, reflecting Kiambu's role as a residential and commuter municipality within the metropolitan region.

Key economic characteristics include:

- **Agriculture:** Coffee farming remains prominent in areas such as Ndumberi and Ting'ang'a, alongside dairy farming (mainly zero-grazing systems) practiced across all wards. Horticulture and poultry farming also contribute to household incomes.
- **Dairy production:** Milk production supplies local cooperatives and processors within Kiambu, such as Ndumberi Dairy, supporting smallholder farmers.
- **Commerce and trade:** Township Ward hosts the main commercial hub, including wholesale and retail trade, markets, transport services, and small enterprises.
- **Manufacturing and light industry:** Activities include food processing, small-scale manufacturing, construction materials, and agro-processing enterprises.
- **Transport and informal sector:** Boda boda services, small-scale trade, and informal enterprises provide significant employment, especially for youth.

Despite economic opportunities, youth unemployment remains a concern, with estimates ranging between 18–22% based on county-level data. Stakeholder consultations have also identified rising youth vulnerability, including substance abuse and underemployment, as emerging social challenges linked to limited formal job absorption.

Overall, Kiambu Municipality's economy reflects a transition from predominantly agricultural production toward a mixed peri-urban and service-oriented system, strongly influenced by its proximity to Nairobi while retaining important agricultural foundations.

1.2.5 Land-use Context

Land use in Kiambu Municipality reflects its peri-urban character and growing integration within the Nairobi Metropolitan region. The municipality exhibits a mix of urban, agricultural, institutional, and light industrial land uses, with noticeable transitions occurring as urban expansion continues.

- **Residential:** High-density residential developments are concentrated within Township Ward and sections of Riabai, characterized by mixed housing typologies including apartments, informal settlements, and planned estates. Medium-density estates and gated communities are expanding toward Ndumberi and Ting'ang'a, while scattered rural homesteads remain in peri-urban agricultural zones.
- **Commercial:** Commercial activities are concentrated in Kiambu Town and Thindigua (Township Ward), which hosts markets, retail shops, financial institutions, transport hubs, hospitality facilities, and small enterprises. Secondary trading centres are emerging in Ndumberi and Riabai.
- **Agricultural:** Agriculture remains significant, particularly in Ndumberi and Ting'ang'a wards. Land use includes coffee farming, dairy (mainly zero-grazing systems), horticulture, poultry farming, and small-scale mixed farming. However, agricultural land is steadily declining due to subdivision and residential conversion.
- **Industrial:** Industrial land use is limited and largely comprises light manufacturing, agro-processing, construction material yards, and small-scale workshops. Most large-scale industrial activities are located outside the municipality but influence local employment patterns.
- **Institutional:** The municipality hosts public and private schools, health facilities, religious institutions, government administrative offices, and training institutions distributed across all wards.
- **Environmental and Riparian Areas:** The municipality contains riparian corridors along seasonal streams that drain toward the Athi River Basin, as well as small wetlands and low-lying areas that serve important ecological and drainage functions. These areas are increasingly under pressure from encroachment and informal development.

Rapid urbanization and peri-urban expansion are converting agricultural land into residential and commercial developments. This transformation reduces pervious surfaces, increases stormwater runoff, strains drainage systems, and heightens flood risk in low-lying and poorly serviced areas. Effective spatial planning and enforcement of land-use regulations are therefore critical to balancing growth with environmental sustainability.

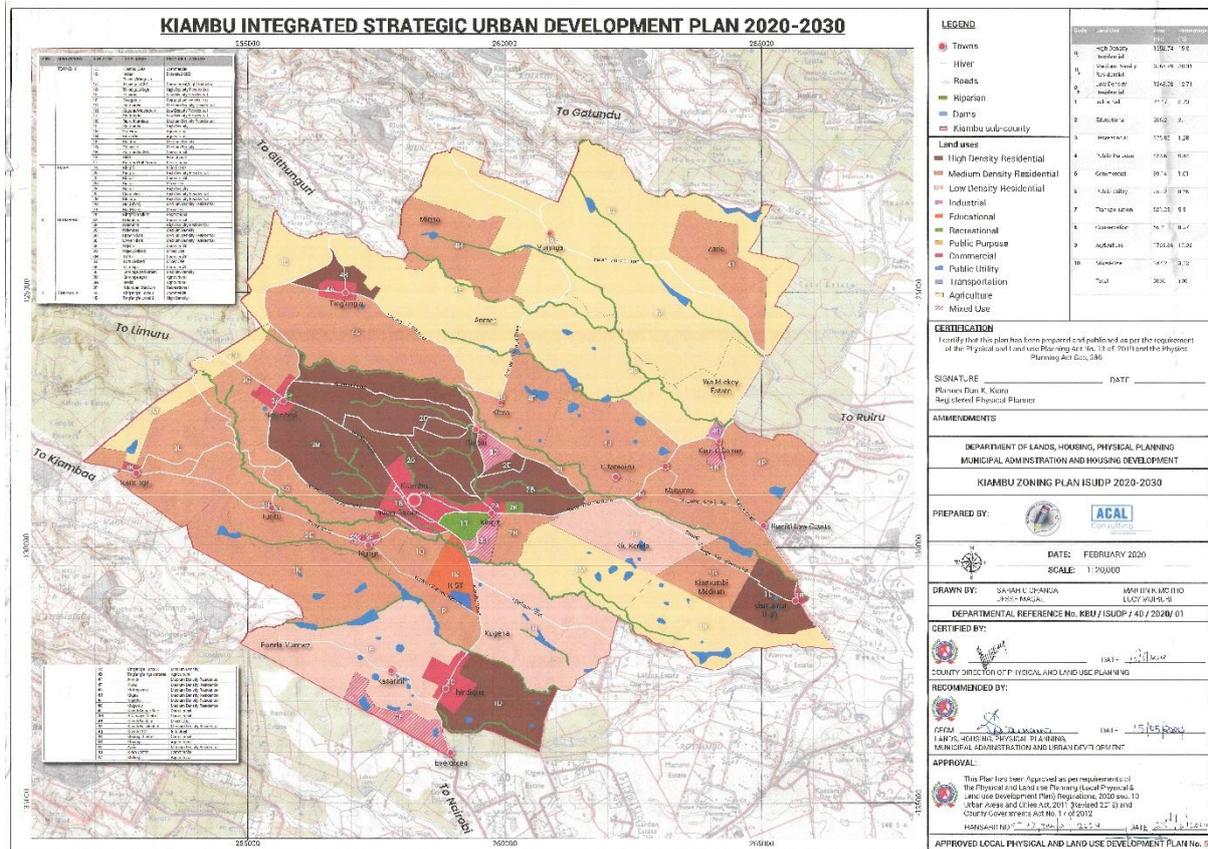


Figure 2: Kiambu Municipality Land use map

1.3. Key Stakeholders & Inclusiveness

Stakeholder engagement followed the Financing Locally Led Climate Action (FLLoCA) principles, emphasizing participation, inclusiveness, and local ownership. A participatory approach was implemented at the ward level, where community members were actively involved in hazard mapping, vulnerability assessments, and the prioritization of climate adaptation and resilience solutions. Special attention was given to ensuring representation of women, youth, persons with disabilities (PWDs), the elderly, and minority groups, ensuring that climate planning reflected diverse perspectives and local needs.

Stakeholder mapping (Influence–Interest Matrix):

	Low Interest	High Interest
High Influence	Kenya Forest Service, Kenya Forestry Research Institute, Kenya Metrological Department Kiambu County Executive Nema, Kenya Power	Kiambu Municipal Board Ward Administrators KIWASCO
Low Influence	General public Private developers Residents of low risk areas Visitors or short term tenants	Community Based Organisations (CBOs) Farmers' cooperatives Boda boda associations PWD self-help groups Youth groups Religious & Learning Institutions

Figure 3. Stakeholder mapping for Kiambu Municipality

Inclusiveness measures:

- PCRA validation workshops held in accessible venues with sign language interpretation.
- Separate focus group discussions for women, youth, and PWDs.
- Use of local language (Gikuyu) during community meetings.
- Targeted outreach to informal settlement residents (Ruturo)

This participatory approach ensured that the climate risk assessment and adaptation planning process in Kiambu Municipality was inclusive, representative, and locally owned, strengthening both legitimacy and effectiveness of subsequent interventions.

2. Hazard Assessment

Kiambu Municipality experiences a bi-modal rainfall pattern, with the long rains occurring from March to May and the short rains from October to December. The municipality enjoys a cool climate, moderated by its elevation within the central highlands of Kenya, which generally ranges between 1,500 and 1,800 meters above sea level.

Historical climate data for the period 1981–2022, as compiled in the Kiambu County Participatory Climate Risk Assessment (PCRA), indicate high inter-annual variability in rainfall and temperature. Trends reveal an increase in the frequency and intensity of extreme weather events, including heavy rainfall episodes, localized flooding and prolonged dry spells. These climate patterns heighten the municipality’s exposure to hazards affecting urban infrastructure, agriculture, water resources, and public health. Understanding these climate and hazard dynamics is essential for targeted risk reduction, informed urban planning, and the design of adaptation measures to safeguard livelihoods and infrastructure in Kiambu Municipality.

2.1. Key Climate Hazards

A key hazard refers to a climate-related threat that warrants priority attention in planning and decision-making. A hazard is classified as key when it meets three criteria: it is likely to occur within the urban area; it has the potential to cause significant damage or adverse impacts on populations, infrastructure and services, or natural assets; and it represents a high priority based on its frequency, severity, and/or overall magnitude of impact. Identifying key hazards ensures that risk reduction, adaptation planning, and resource allocation efforts are directed toward the most pressing and consequential climate threats facing the urban area.

Table 1: Hazard screening for Kiambu Municipality

Hazard	Hazard Likely (Y/N)	Significant Impact (Y/N)	High Priority (Y/N)	Key Hazard (Y/N)
Heat Stress				
Average surface temperature increase	Y	Y	Y	N
Average ocean temperature increase	N	N	N	N
Extreme heat	Y	Y	Y	Y
Marine heatwaves	N	N	N	N
Flooding				
Changes in precipitation patterns	Y	Y	Y	N
Pluvial (surface level) flooding, including flash flooding and urban flooding	Y	Y	Y	Y
Fluvial (river) flooding	Y	Y	Y	N
Sea level rise	N	N	N	N
Coastal flooding, including storm surges	N	N	N	N
Waterlogging	N	N	N	N
Water Stress				
Drought (meteorological, hydrological)	Y	Y	Y	Y

Hazard	Hazard Likely (Y/N)	Significant Impact (Y/N)	High Priority (Y/N)	Key Hazard (Y/N)
Groundwater salinization	N	N	N	N
Saline intrusion	N	N	N	N

Final key hazards: 1. Pluvial Flooding, 2. Drought, 3. Extreme Heat

2.2. Climate Indicators and Hazard Thresholds

Table 2: Climate indicators and hazardous thresholds

Key Hazard	Climate Indicator	Data Source	Thresholds		
			Low	Medium	High
Pluvial Flooding	Number of days with precipitation >50mm	World Bank Climate Change Knowledge Portal, KMD	<3 days/year	3 – 6 Days/year	>6 days / year
Drought	Standardised Drought Index	SPEI Database	> -1.0	-1.0 to -1.5	< -1.5
Extreme Heat	Number of days with heat index > 35°C (Mean)	World Bank Climate Change Knowledge Portal	<5 days/season	5 – 15 Days/season	>15 days / season

Data sources are detailed in Annex N2.

2.3. Current Hazard Levels and Climate Projections

Kiambu Municipality has experienced notable changes in its climate patterns over recent decades. Historical data indicate a gradual increase in average temperatures, with more frequent hot days and warmer nights. Rainfall patterns have also shifted, showing greater variability, including shorter, more intense rainfall events and longer dry spells. These trends suggest that the climate is becoming less predictable, with pronounced seasonal fluctuations.

The implications of these chronic changes extend to the frequency and severity of acute climate hazards. Rising average temperatures are likely to lead to more intense and prolonged heatwaves, increasing heat stress for residents, particularly vulnerable populations in informal settlement like Ruturu. Variability in rainfall heightens the risk of flooding during heavy storms while exacerbating water scarcity during extended dry periods. These interactions demonstrate how chronic climate shifts can amplify the impacts of acute events, creating compound risks for populations, infrastructure, and natural systems.

Understanding these trends helps highlight key uncertainties for planning: the timing and intensity of extreme rainfall events, the pace of temperature increases, and localized variations in heat and rainfall. Decision-makers can use this insight to prioritize interventions that strengthen resilience to both ongoing chronic stresses and sudden extreme events in Kiambu Municipality.

Future projections are derived from the Kiambu County PCRA, which downscaled CMIP5 models under RCP4.5 and RCP8.5 (equivalent to SSP2-4.5 and SSP5-8.5). For Kiambu:

- **Flooding:** Historical trends show increased frequency of high-intensity rainfall during MAM and OND. Projections indicate a wet signal for annual rainfall (+5–10% by 2050) under both scenarios, but with greater temporal compression – more rain in fewer days. This increases pluvial and fluvial flood hazard.
- **Drought:** MAM rainfall is projected to decrease by 10–20% under RCP8.5 by 2050, while OND rainfall remains variable. Increased evaporative demand due to warming will exacerbate agricultural drought.
- **Extreme Heat:** Temperatures are projected to continue rising under both moderate and high emissions scenarios. Minimum temperatures are projected to rise by 0.8–1.5°C by 2050.

Hazard	Current (Baseline)	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Extreme Heat	Medium	High	High	High	Very High
Pluvial Flooding	Medium	Medium – High	High	High	Very High
Drought	Medium	High	High	High	Very High

Interpretation of hazard levels:

Level	Interpretation
-------	----------------

Very High	Hazard events are likely to occur with very high frequency and/or intensity; extreme events may become the new normal.
High	Hazard events occur frequently; moderate to severe intensity.
Medium	Hazard events occur occasionally; moderate intensity.
Low	Hazard events are rare and/or mild.

2.4. Current and Future Hazard Impact Areas

Pluvial Flooding

Current Impact Areas: Pluvial flooding in Kiambu Municipality is mainly driven by intense rainfall during MAM and OND seasons combined with rapid urbanization and drainage constraints.

Most affected areas include:

- **Township Ward**
 - Kiambu Town CBD (market areas & bus park)
 - Biashara Street and surrounding commercial blocks
- **Ndumberi Ward**
 - Low-lying sections along Kiambu–Ndumberi Road
 - Areas near Kirigiti Stadium drainage corridors
- **Ting’ang’a Ward**
 - Areas near seasonal streams and drainage outlets

Flooding typically occurs during heavy storms when drainage systems are overwhelmed, causing temporary road inundation and property-level flooding.

Future Flood Impact Areas (2050–2100) under SSP2-4.5 and SSP5-8.5:

- Rainfall intensity is projected to increase, with more rain falling in shorter durations.
- Surface runoff volumes will increase, particularly in paved and densely built zones.

By 2050

- Flood-prone zones in Township Ward expand outward into adjacent residential estates.
- Increased flooding frequency along road corridors connecting Kiambu to Ndumberi and Riabai.
- Drainage overflow near seasonal watercourses becomes more frequent.

By 2100 (High Emissions)

- Floodplain expansion along minor tributaries feeding into the Kamiti River system.
- More frequent flooding of commercial and transport nodes.
- Increased risk of infrastructure damage due to repeated heavy rainfall events.

Drought

Current Impact Areas: Although Kiambu is relatively humid compared to western parts of the county, drought impacts are evident in:

- **Ndumberi Ward**
 - Rain-fed smallholder farms and peri-urban agriculture
- **Ting'ang'a Ward**
 - Areas dependent on shallow wells and seasonal streams
- Outskirts toward Riabai with mixed residential-agricultural land use

Water stress is moderate but increasing. Dry spells typically occur in January–February and July–September.

Future Drought Impact Areas (2050 -2100) Climate projections indicate:

- Rising temperatures (+1.5–2°C by 2050; higher under SSP5-8.5)
- Increased evapotranspiration
- More intra-seasonal dry spells

By 2050

- Peri-urban farming zones experience higher soil moisture stress.
- Increased borehole and municipal water demand.
- Water rationing risk increases during prolonged dry periods.

By 2100 (High Emissions)

- Larger portions of Ndumberi and Ting'ang'a experience persistent agricultural drought stress.
- Seasonal water shortages become more frequent.
- Shift toward more drought-tolerant crops likely.

Unlike Ndeiya (western Kiambu), Kiambu Municipality is unlikely to shift to semi-arid classification but will experience **intensified seasonal water stress**.

Extreme Heat

Current Impact Areas: Extreme heat is emerging rather than historically dominant in Kiambu Municipality. Urban heat island effects are already observable during hot months (Jan–Mar).

Most affected areas:

- Township Ward (CBD and dense estates)
- Major road corridors with high surface heat absorption
- Areas with limited tree canopy

Future Extreme heat impact areas (2050 -2100)

Projected temperature rise:

- +1.2–1.8°C by 2050 (SSP2-4.5 to SSP5-8.5)
- Potentially >3–4°C by 2100 under SSP5-8.5

By 2050

- Expansion of high-heat exposure from CBD into residential estates.
- Increased nighttime temperatures (warmer nights).
- Elevated health risks for elderly and outdoor workers.

By 2100 (High Emissions)

- Town-wide heat stress becomes significant.
- Frequent hot days exceeding historical norms.
- Greater cooling demand and reduced outdoor productivity.

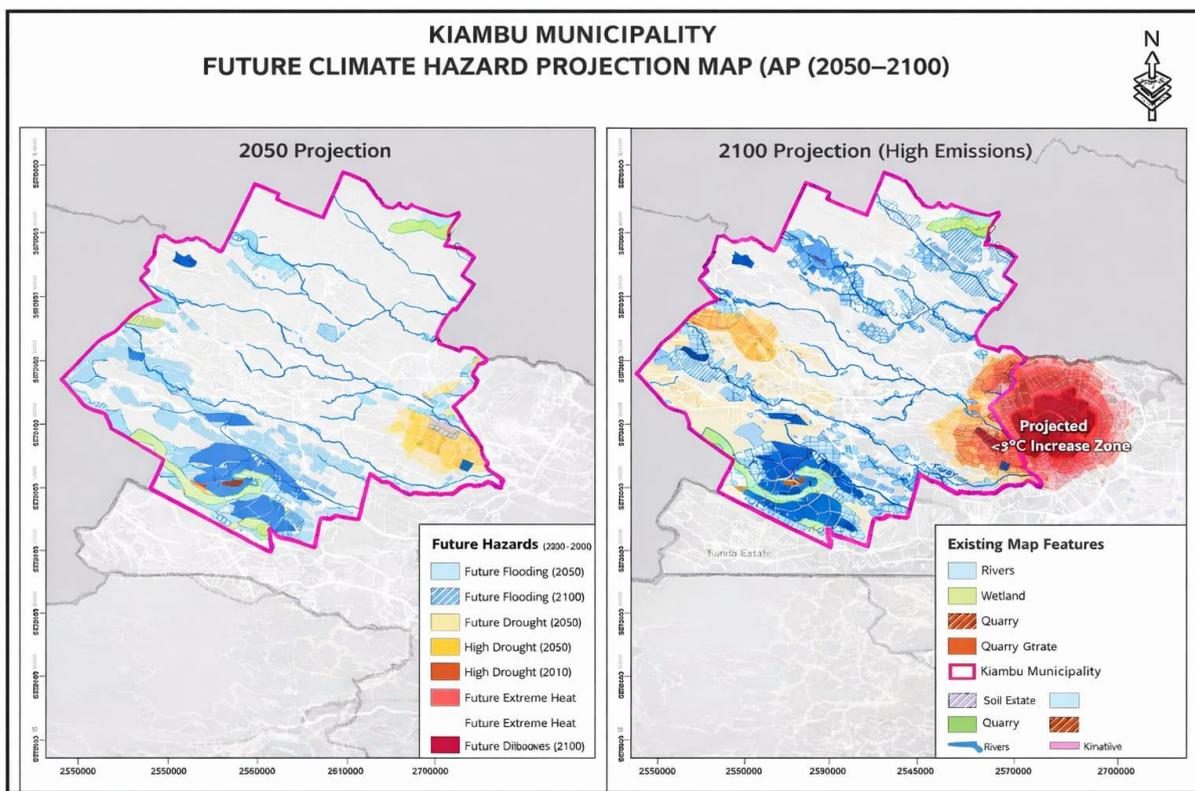


Figure 4: Maps showing the spatial extent, frequency, severity, and overlap of current and future key hazards

3. Exposure & Vulnerability Assessment

Kiambu Municipality’s urban elements — including dense residential estates, informal settlements, commercial zones, road networks, markets, schools, health facilities, and water infrastructure — are increasingly exposed to climate-related hazards, particularly extreme heat, pluvial flooding, and seasonal drought. High levels of built-up surfaces and inadequate stormwater drainage heighten exposure to intense rainfall events, especially in Township and Ndumberi wards, where flooding disrupts transport and business activity. Rapid urbanization, loss of green cover, and limited climate-resilient infrastructure increase vulnerability to heat stress, particularly among low-income households, outdoor workers, and the elderly. Water supply systems and peri-urban agriculture remain sensitive to prolonged dry spells and rising temperatures, which elevate evapotranspiration and water demand. Overall vulnerability is compounded by infrastructure capacity gaps, informal development in hazard-prone areas, and limited adaptive resources among vulnerable populations, indicating a growing need for climate-resilient urban planning and service provision.

3.1 Urban Elements

Table 3. Urban elements inventory

Category	Subcategory	Included in RCRA (Y/N)	Available in GIS (Y/N)	Description
Infrastructure & Services				
Stormwater Drainage	Stormwater conveyance network	Y	N (partial)	Open drains, culverts along main roads; mostly absent in informal areas.
	Stormwater storage	N	N	No storage
Water & Wastewater Mgmt	Pumping stations	N	N	Only 4 water kiosks available
	Groundwater abstraction	Y	N (partial)	Private boreholes and Kiambu Water boreholes (available in GIS)
	Water treatment facilities	Y	Y	2 Kiambu Water Treatment Plants

	Water supply networks	Y	Y	Piped system coverage ~98%; intermittent supply.
	Sewer networks	Y	Y	Only in Kiambu Town, Thindigua, parts of Kirigiti centre and Kiamumbi; 65% use septic tanks.
	Wastewater treatment facilities	Y	Y	Kiambu WWTP (trickling filters).
Solid Waste Management	Transfer facilities	Y	N	
	Landfills and dump sites	Y	N	Closed dumpsite awaiting decommissioning
	Recycling centers	Y	N	Informal sector; no formal facility.
	Collection fleet	Y	Y	1 Tipper truck, 1 Compactor truck, 1 Skip loader and 1 backhoe
Transport and Mobility	Road networks	Y	Y	Tarmac and murrum roads; some roads in poor condition.
	Bridges	N	N	
	Public transport networks	Y	N	Matatu routes
	Transportation terminals	Y	Y	Kiambu Town bus park
	Non-motorised transport	Y	N	Within Kiambu Town, Riabai Centre

Energy	Poles and power lines	Y	Y	Kenya Power network; frequent outages during storms.
	Transformers and substations	Y	Y	Kiu River Sub Station and several transformers
	Streetlighting	Y	Y	Solar and grid-powered; mostly in town centres.
Economic Infrastructure	Markets	Y	Y	Under construction Kiambu and Ting'ang'a Market
	Businesses and commercial hubs	Y	N	>3000 formal SMEs, many informal traders.
	Industrial zones	Y	Y	
Social Infrastructure	Government buildings	Y	Y	Kiambu County Headquarters, Red Nova Offices, Community Offices
	Education facilities	Y	Y	25 ECDE, 25 primary, 21 secondary, 2 vocational centre, KINAP
	Healthcare facilities	Y	Y	Kiambu Referral Hospital, Ndumberi Level 3 (Under Construction) 4 dispensaries operational, 1 under construction
	Public spaces	Y	Y	Kirigiti Stadium (currently still under construction), Kiambu Communtiy Hall
	Faith-based buildings	N	N	Numerous churches.

Emergency Services	Fire stations	Y	Y	1 fire station (Indian Bazaar)
	Police stations	Y	Y	6 police stations, 15 posts
	Early warning systems	N	N	None.
	Disaster management centers	N	N	None; rely on Kiambu County.
Populations				
Urban Residents	Population	Y	Y	145,903 (2019 census)
	Households	Y	Y	39,190 households; average size 3.4.
Informal Settlement Residents	Population in informal settlements	Y	N	Ruturu - 2500
	Households lacking land tenure	Y	N	>500 households.
	Households lacking basic services	Y	N	Limited water, sewer, waste collection.
Vulnerable & Marginalized	Low-income households	Y	N	~30% of households below poverty line.
	Women-headed households	Y	N	33% of households.
	Children and youth	Y	Y	<18 years: 45% of population.
	Elderly persons	Y	N	>65 years: 5% of population.

	People with disabilities (PWD)	Y	N	~5% of population (estimated).
	Unemployed youth	Y	N	30% unemployment rate.
	Seasonal workers	Y	N	Construction labour
Natural Assets				
Urban Green Infrastructure	Urban parks and gardens	Y	Y	Kiambu Hospital Green Park, several private gardens
	Green corridors	N	N	None formalised.
	Urban forests	Y	N	No forests
Urban Blue Infrastructure	Natural wetlands	Y	N	
	Rivers	Y	Y	Riara, Kamiti
	Riparian zones	Y	N	Encroached, poorly mapped.
	Lakes/ponds	Y	Y	Small farm dams.
Peri-urban & Agricultural Systems	Peri-urban agriculture	Y	N	Vegetables, dairy, poultry.
	Agroforestry	Y	N	Scattered on farms.
	Forests and reserves	Y	N	

3.2 Exposure, Vulnerability, and Impacts of Climate Hazards on Urban Elements

For this Urban Climate Risk Profile, exposure and vulnerability levels should be interpreted in accordance with the table below.

Table 4. Interpretation of exposure and vulnerability levels

Level	Exposure Level Interpretation	Vulnerability Level Interpretation
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High	A large number and high-value urban elements are located within the hazard footprint.	The urban element is vulnerable to the hazard due to high sensitivity and limited adaptive capacity.
Medium	A moderate number or mix of low- and medium-value elements are located within the hazard footprint.	The element is somewhat vulnerable due to moderate sensitivity and adaptive capacity
Low	Few or no critical urban elements lie within the hazard footprint.	The element is minimally vulnerable due to limited sensitivity and/or high adaptive capacity.

For this Urban Climate Risk Profile, the following matrix summarizes likely impacts on each urban element by combining the assigned exposure and vulnerability levels.

Table 5. Impact Matrix

		Vulnerability Level		
		Low	Medium	High
Exposure Level	High	Moderate	Major	Catastrophic
	Medium	Minor	Moderate	Major
	Low	Insignificant	Minor	Moderate

Table 6. Exposure, Vulnerability, and Impacts of Pluvial Flooding on Urban Elements

Hazard: Pluvial Flooding

Category	Exposure (Description)	Exposure Level	Vulnerability (Sensitivity / Adaptive Capacity)	Vulnerability Level	Impact Level
Infrastructure & Services					
Stormwater Drainage		High	Sensitivity: Frequent clogging during rains, Flash flooding along streets Adaptive Capacity: Limited routine clearing, Insufficient budget for upgrades, limited maintenance budget.	High	Catastrophic
Water & Wastewater Management	Sewage lines in older town areas, Treatment facilities near low-lying spots	High	Sensitivity: Inflow & sewer backup during heavy rain • Lack of separation of storm & sewer pipes Adaptive Capacity: • Limited redundancy • Outdated infrastructure.	Medium	Major
Solid Waste Management	Informal dumps in roadside gullies	High	Sensitivity: Unlined dumpsites; Waste blocks drains increasing runoff;	High	Catastrophic

			hazardous leachate. Adaptive Capacity: Low – no flood-proofing, irregular collection.		
Transport and Mobility	Flooding along Biashara Street	High	Sensitivity: Siltation of culverts, slowed traffic Adaptive Capacity: Few alternative routes, Low – reactive maintenance, no climate-proof design standards	High	Catastrophic
Energy	Transformer stations at ground level in estates, Pole infrastructure exposed; overhead lines vulnerable to falling trees during storms.	Medium	Sensitivity: Poles not flood-resistant; undergrounding absent. Adaptive Capacity: Medium – Kenya Power replaces poles after events.	Medium	Moderate
Economic Infrastructure	Businesses in Kiambu CBD hail from low-lying blocks	High	Sensitivity: Market drainage poor; goods stored at floor level, Damage to goods & stock, Lost income during closures Adaptive Capacity: No insurance, Limited business continuity planning	High	Catastrophic

Social Infrastructure	Access roads to some dispensaries floods, and flooding in some schools	High	Sensitivity: Interruption of services Adaptive Capacity: Low – no flood retrofitting.	High	Catastrophic
Emergency Services	Fire/ ambulance access may be cut off. No dedicated disaster centre.	Medium	Sensitivity: Single access route; no backup generator at fire station, slower response times Adaptive Capacity: Low – no early warning, emergency protocols exist, resource constraints	High	Major
Populations					
Urban Residents	Residential zones in Kiambu Township near poor drainage	High	Sensitivity: Low awareness; children play in floodwater. Adaptive Capacity: Low – few households have flood insurance; no relocation assistance, uneven coping resources	High	Catastrophic
Informal Settlement Residents	Residents of Ruturo and GG town; homes built with mud/wattle, no drainage.	High	Sensitivity: Extreme poverty; poor housing; Limited sanitation. Adaptive Capacity: Very low – no tenure security, no access to credit.	High	Catastrophic

Vulnerable & Marginalized Groups	Elderly, PWDs, and children disproportionately affected; mobility constraints, low income households	High	Sensitivity: Reduced mobility; chronic illnesses worsened by damp. Adaptive Capacity: Low – limited social protection.	High	Catastrophic
Natural Assets					
Urban Green Infrastructure	The Parks and gardens may experience waterlogging; trees uprooted	Medium	Sensitivity: Shallow-rooted exotic species, Soil compaction reduces absorption Adaptive Capacity: Replanting or maintenance after events	Medium	Moderate
Urban Blue Infrastructure	Streams like Kamiti River tributaries	High	Sensitivity: Wetland already degraded; invasive species. Adaptive Capacity: Low – no active restoration programme, some natural retention	High	Catastrophic
Peri-urban & Agricultural Systems	Smallholder farms along lower slopes	High	Sensitivity: Tea intolerant to waterlogging; soil erosion. Adaptive Capacity: Medium – farmers use cut-off drains but lack capital.	Medium	Major

Table 7. Exposure, Vulnerability, and Impacts of Drought on Urban Elements

Hazard: Droughts

Category	Exposure (Description)	Exposure Level	Vulnerability (Sensitivity / Adaptive Capacity)	Vulnerability Level	Impact Level
Infrastructure & Services					
Water & Wastewater Management	Water supply rationed during dry spells	High	Sensitivity: Reduced water levels in boreholes, high non-revenue water Adaptive Capacity: Low – few storage tanks; no desalination, increasing in private water vendors	High	Catastrophic
Solid Waste Management	Reduced waste generation; but increased fire risk at dumpsites.	Low	Sensitivity: Gioto Dumpsite combustible. Adaptive Capacity: Low – no firefighting equipment on site.	Medium	Moderate
Energy	Hydro-power from Thika basin indirectly affected; local solar irrigation used, Increased electricity demand for pumping water	Low	Sensitivity: Not directly exposed. Adaptive Capacity: High – grid power stable, Shift to solar energy	Low	Insignificant
Economic Infrastructure	Coffee farming affected, Markets: reduced vegetable supply, higher prices.	High	Sensitivity: Reduced agricultural yields, Increased irrigation costs	High	Catastrophic

			Adaptive Capacity: Low – no crop insurance, no irrigation for coffee		
Social Infrastructure	Schools: absenteeism due to hunger; boreholes dry. Health facilities: water shortages.	Medium	Sensitivity: Children malnutrition; hospital water tanks insufficient. Adaptive Capacity: Low – emergency water trucking is costly.	High	Major
Emergency Services	Increased fire calls; water for firefighting limited.	Medium	Sensitivity: Fire outbreaks at Gioto dumpsite Adaptive Capacity: County disaster units active	High	Major
Populations					
Urban Residents	All residents face water rationing	High	Sensitivity: Low per-capita storage; poor households buy expensive water. Adaptive Capacity: Low – rainwater harvesting uncommon.	High	Catastrophic
Informal Settlement Residents	No piped water; rely on water kiosks and private vendors who hike prices during drought.	High	Sensitivity: Extreme water poverty. Adaptive Capacity: Very low – no savings.	High	Catastrophic
Vulnerable & Marginalized Groups	Low income households, Elderly and HIV+ need clean water for medication.	High	Sensitivity: Income loss; health vulnerability.	High	Catastrophic

			Adaptive Capacity: Low – no alternative livelihoods.		
Natural Assets					
Urban Green Infrastructure	Trees and lawns wilt; increased pest attacks.	Medium	Sensitivity: Exotic species not drought-tolerant. Adaptive Capacity: Low – no irrigation.	High	Major
Urban Blue Infrastructure	River flow reduces	High	Sensitivity: Wetland ecology stressed. Adaptive Capacity: Low – no environmental flow allocation.	High	Catastrophic
Peri-urban & Agricultural Systems	Rain-fed maize and beans fail; dairy farmers buy costly hay.	High	Sensitivity: Shallow soils; no irrigation. Adaptive Capacity: Low – few make silage; limited drought-tolerant breeds.	High	Catastrophic

Table 8. Exposure, Vulnerability, and Impacts of Extreme heat on Urban Elements

Hazard: Extreme Heat

Category	Exposure (Description)	Exposure Level	Vulnerability (Sensitivity / Adaptive Capacity)	Vulnerability Level	Impact Level
Infrastructure & Services					

Water & Wastewater Management	Increased water demand when hot	High	Sensitivity: Reduced water availability, Increased pipe bursts due to pressure changes Adaptive Capacity: Some storage tanks exist, Limited demand-management systems	High	Catastrophic
Solid Waste Management	Open dump exposed to high temperatures (Gioto)	Medium	Sensitivity: Increased decomposition, Fire outbreaks Adaptive Capacity: Fire response available	Medium	Moderate
Transport and Mobility	Asphalt roads in Kiambu CBD and other areas	High	Sensitivity: Softening of asphalt, Expansion joints stress, Worker heat stress Adaptive Capacity: Road design not heat-adapted, Limited shading	High	Moderate
Energy	Increased electricity demand (AC for cooling, refrigeration)	High	Sensitivity: Grid overload risk Occasional. Adaptive Capacity: More dependency on solar power	Medium	Major
Social Infrastructure	ECDE classrooms hot; children absent.	High	Sensitivity: Adaptive Capacity: Low – no warm-clothing programme.	High	Major

Emergency Services	Increased heat related illnesses	Low	Sensitivity: Strain on health services Adaptive Capacity: Limited heat early-warning systems, Health staff trained but resources limited	High	Major
Populations					
Urban Residents	Dense housing in Kiambu Town & peri-urban estates	Medium	Sensitivity: Increased water demand Adaptive Capacity: Low – few can afford AC, Limited green shading	High	Major
Informal Settlement Residents	Makeshift houses offer no protection; children and elderly suffer most.	High	Sensitivity: Poor ventilation, Limited water access Adaptive Capacity: Low buffers	High	Catastrophic
Vulnerable & Marginalized Groups	Elderly, children, outdoor workers	High	Sensitivity: Dehydration, Heat stroke Adaptive Capacity: Very low.	High	Major
Natural Assets					
Urban Green Infrastructure	Tree cover in estates and road corridors	Low	Sensitivity: Tree stress Adaptive Capacity: Protective covers	High	Major
Peri-urban & Agricultural Systems	Tea leaves damaged; reduced plucking.	High	Sensitivity: Reduced crop yields, Heat stress in livestock Adaptive Capacity: Limited shade structures, early warning.	High	Major

4. Climate Risk Assessment

For this Urban Climate Risk Profile, the following matrix summarizes overall risk for each urban element by combining the assessed hazard level and the estimated impact level.

Table 9. Risk matrix

		Hazard Level		
		Low	Medium	High
Impact Level	Catastrophic	High	Very High	Very High
	Major	Medium	High	Very High
	Moderate	Low	Medium	High
	Minor	Low	Low	Medium
	Insignificant	Very Low	Low	Low

For this Urban Climate Risk Profile, risk levels should be interpreted based on the table below.

Table 10. Interpretation of risk levels

Level	Interpretation
Very High	Very high risks are unacceptable. Risk should be avoided, reduced or transferred. Immediate planning and implementation of risk reduction measures is required. Allocate resources and coordinate interventions to prevent or minimize impact.
High	High risks should be actively addressed. Develop and implement mitigation actions promptly. Monitor environmental indicators and ensure readiness of emergency or adaptation measures.
Medium	Medium risks should be managed. Plan and implement mitigation activities to reduce them to acceptable levels. Regularly review climate data and risk levels.
Low	Low risks are acceptable under current conditions. Minimal control or monitoring is needed, provided they remain stable and do not escalate.
Very Low	Very low risks are negligible in terms of likelihood and consequences. No immediate action is required beyond routine monitoring and periodic review.

4.1 Current and Future Climate Risks on Urban Elements

Table 11. Summary of Flooding risks for Kiambu Municipality

Category	Impact Level	Current Risk	2050	2050	2100	2100
			SSP2-4.5	SSP5-8.5	SSP2-4.5	SSP5-8.5
Hazard Level		High	High	Very High	High	Very High
Infrastructure & Services						

Stormwater Drainage	Catastrophic	Very High				
Water & Wastewater Mgmt	Major	High	High	Very High	High	Very High
Solid Waste Management	Catastrophic	Very High				
Transport and Mobility	Catastrophic	Very High				
Energy	Moderate	Medium	High	High	High	Very High
Economic Infrastructure	Catastrophic	Very High				
Social Infrastructure	Catastrophic	Very High				
Emergency Services	Major	High	High	Very High	High	Very High
Populations						
Urban Residents	Catastrophic	Very High				
Informal Settlement Residents	Catastrophic	Very High				
Vulnerable & Marginalized Groups	Catastrophic	Very High				
Natural Assets						
Urban Green Infrastructure	Moderate	Medium	High	High	High	Very High
Urban Blue Infrastructure	Catastrophic	Very High				

Peri-urban & Agricultural Systems	Major	High	High	Very High	High	Very High
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Table 12. Summary of Drought risks for Kiambu Municipality

Category	Impact Level	Current Risk	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Hazard Level		Medium	High	Very High	High	Very High
Infrastructure & Services						
Water & Wastewater Mgmt	Catastrophic	High	Very High	Very High	Very High	Very High
Solid Waste Management	Minor	Low	Medium	Medium	Medium	High
Energy	Insignificant	Very Low	Low	Low	Low	Medium
Economic Infrastructure	Catastrophic	High	Very High	Very High	Very High	Very High
Social Infrastructure	Major	Medium	High	Very High	High	Very High
Emergency Services	Major	Medium	High	Very High	High	Very High
Populations						
Urban Residents	Catastrophic	High	Very High	Very High	Very High	Very High
Informal Settlement Residents	Catastrophic	High	Very High	Very High	Very High	Very High

Vulnerable & Marginalized Groups	Catastrophic	Very High				
Natural Assets						
Urban Green Infrastructure	Major	Medium	High	Very High	High	Very High
Urban Blue Infrastructure	Catastrophic	High	High	Very High	Very High	Very High
Peri-urban & Agricultural Systems	Catastrophic	Very High				

Table 13. Summary of Extreme Heat risks for Kiambu Municipality

Category	Impact Level	Current Risk	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Hazard Level		Medium	Medium	Low	Medium	Low
Infrastructure & Services						
Transport and Mobility	Minor	Low	Low	Low	Low	Low
Energy	Minor	Low	Low	Low	Low	Low
Social Infrastructure	Major	High	High	Medium	High	Medium
Emergency Services	Minor	Low	Low	Low	Low	Low
Populations						
Urban Residents	Major	High	High	Medium	High	Medium
Informal Settlement Residents	Catastrophic	Very High	Very High	High	Very High	High

Vulnerable & Marginalized Groups	Catastrophic	Very High	Very High	High	Very High	High
Natural Assets						
Urban Green Infrastructure	Minor	Low	Low	Very Low	Low	Very Low
Peri-urban & Agricultural Systems	Major	High	High	Medium	High	Medium

4.2. Climate Risk Hotspots

Climate risks are not evenly distributed across Kiambu Municipality. The following wards face the highest multi-hazard risk:

1. Township Ward

- High concentration of informal and semi-formal settlements
- Poor drainage → frequent flash flooding
- Iron-sheet roofing → severe indoor heat stress
- Heavy reliance on communal/borehole water → drought vulnerability

Overall Risk: Very High (Flood + Heat), High (Drought)

2. Ting'ang'a Ward

- Dense residential development
- High impervious surface coverage → surface runoff
- Urban heat island effect
- High water demand during dry periods

Overall Risk: Very High (Flood + Heat), High (Drought)

3. Riabai Ward

- Drainage congestion and localized flooding
- Open market exposure to extreme heat
- Moderate water stress during dry spells

Overall Risk: Very High (Flood + Heat), Medium–High (Drought)

5. What's Next?

5.1 Key Findings

- a) **Flooding** is the most pervasive and severe hazard, with **very high** risks already affecting stormwater drainage, transport, solid waste, economic and social infrastructure, and all population groups. These risks will become **very high to catastrophic** under all future scenarios.
- b) **Drought** poses **very high** risks to water supply, agriculture, and vulnerable livelihoods, particularly. Risks will escalate to **very high** by 2050 under RCP8.5.
- c) **Extreme heat** currently causes **high** risks for informal settlement residents and coffee estates, but these may slightly increase under high-emission scenarios.

Most at-risk groups:

- Residents of informal settlements (Ruturu)
- Elderly persons and children
- Construction workers
- Boda boda operators
- Smallholder farmers in Ting'ang'a and Riabai

Trends intensifying future risks:

- Rapid urbanisation reducing pervious surfaces and increasing runoff.
- Continued encroachment on riparian reserves and wetlands.
- Increasing water demand from population growth.
- Limited municipal budget for maintenance and new infrastructure.

Table 14. Summary of climate risks affecting urban elements for

Kiambu Municipality

Category	Current	Mid-term (2050)	Long-term (2100)
Infrastructure & Services			
Storm Water Drainage	Flooding (Very High)	Flooding (Very High)	Flooding (Very High)
Water & Wastewater Management	Drought (High), Flooding (High), Heat (Medium)	Drought (Very High), Flooding (Very High), Heat (High)	Drought (Very High), Flooding (Very High), Heat (Very High)
Solid Waste Management	Flooding (High), Heat (Medium)	Flooding (Very High), Heat (High)	Flooding (Very High)

			High), Heat (High)
Transport and Mobility	Flooding (Very High), Heat (High)	Flooding (Very High), Heat (Very High)	Flooding (Very High), Heat (Very High)
Economic Infrastructure	Flooding (Very High), Drought (High), Heat (High)	Flooding (Very High), Drought (Very High), Heat (Very High)	Flooding (Very High), Drought (Very High), Heat (Very High)
Social Infrastructure	Flooding (High), Heat (High), Drought (Medium)	Flooding (Very High), Heat (Very High), Drought (High)	Flooding (Very High), Heat (Very High), Drought (High)
Emergency Services	Flooding (High), Heat (Medium), Drought (Medium)	Flooding (Very High), Heat (High), Drought (High)	Flooding (Very High), Heat (High), Drought (High)
Populations			
Urban Residents	Flooding (Very High), Heat (High), Drought (High)	Flooding (Very High), Heat (Very High), Drought (Very High)	Flooding (Very High), Heat (Very High), Drought (Very High)
Informal Settlement Residents	Flooding (Very High), Heat (Very High), Drought (Very High)	All three hazards (Very High)	All three hazards (Very High)
Vulnerable & Marginalized Groups	Flooding (Very High), Heat (Very High), Drought (High)	All three hazards (Very High)	All three hazards (Very High)

Natural Assets			
Urban Blue Infrastructure	Flooding (Very High), Drought (High), Heat (Medium)	Flooding (Very High), Drought (Very High), Heat (High)	Flooding (Very High), Drought (Very High), Heat (High)
Urban Green Infrastructure	Heat (High), Drought (High), Flooding (Medium)	Heat (Very High), Drought (Very High), Flooding (High)	Heat (Very High), Drought (Very High), Flooding (High)
Peri-urban & Agricultural Systems	Drought (Very High), Heat (High), Flooding (High)	Drought (Very High), Heat (Very High), Flooding (Very High)	Drought (Very High), Heat (Very High), Flooding (Very High)

5.2 Climate Adaptation and Resilience Solutions

The following solutions are drawn from community consultations and the Kiambu County PCRA adaptation strategies. They are prioritised as immediate (0-2 years), mid-term (3-7 years), and long-term (8-15 years).

Table 15. Climate adaptation and resilience solutions recommended for Kiambu Municipality

Category	Immediate (0-2 years)	Mid-term (3-7 years)	Long-term (8-15 years)
Infrastructure & Services			
Stormwater Drainage	<ul style="list-style-type: none"> • Desilt and unblock drains in Kiambu Town CBD, Kirigiti, Kiamumbi, Ndumberi • Install trash screens along Riabai & Ngegu streams • Map entire municipal drainage network in GIS 	<ul style="list-style-type: none"> • Construct lined drains in flood hotspots (Kirigiti, Kiamumbi, Ting'ang'a) • Rehabilitate Riabai wetland/lowlands as retention basin 	<ul style="list-style-type: none"> • Implement Sustainable Urban Drainage Systems (SUDS) for all new developments • Restore riparian zones along Riabai, Ngegu and Kamiti tributaries
Water & Wastewater Mgmt	<ul style="list-style-type: none"> • Distribute 500 domestic rainwater tanks (Kiambu Town, Ndumberi, Ting'ang'a) • Repair non-revenue water leaks (Kiambu Water network) • Solarise 3 municipal boreholes (Riabai & Kiamumbi) 	<ul style="list-style-type: none"> • Expand piped water supply from Karimenu II Dam to underserved areas (Ting'ang'a, Kanunga) • Construct 2 community water pans in Riabai ward 	<ul style="list-style-type: none"> • Build climate-resilient centralised water treatment plant • Recycle treated effluent for urban agriculture
Solid Waste Management	<ul style="list-style-type: none"> • Provide 100 waste bins in flood-prone areas. 	<ul style="list-style-type: none"> • Establish material recovery facility (MRF). 	<ul style="list-style-type: none"> • Develop circular economy plan; zero waste to landfill.

	<ul style="list-style-type: none"> • Conduct monthly clean-ups (river banks, drains). • Formalise waste pickers cooperative. 	<ul style="list-style-type: none"> • Decommission and rehabilitate Gioto dumpsite. • Introduce separate waste collection. 	<ul style="list-style-type: none"> • Construct sanitary landfill for residual waste.
Transport and Mobility	<ul style="list-style-type: none"> • Repair flood-damaged culverts (Kirigiti–Riabai road) • Install flood warning signage at low points • Grade 50 km of murrum roads (Ting’ang’a, Kanunga) 	<ul style="list-style-type: none"> • Climate-proof 20 km of roads (raised embankments, culverts). • Pave high-traffic murrum roads. 	<ul style="list-style-type: none"> • Integrate climate resilience into all municipal road standards • Develop non-motorised transport network.
Energy	<ul style="list-style-type: none"> - Trim trees near power lines. - Install 100 solar streetlights in dark spots. 	<ul style="list-style-type: none"> - Underground power lines in flood zones. - Promote solar water heating by-law. 	<ul style="list-style-type: none"> • Develop decentralised solar mini-grids for peri-urban Ting’ang’a & Riabai
Economic Infrastructure	<ul style="list-style-type: none"> • Provide raised stalls at Kiambu & Kirigiti Markets • Train 200 farmers (Ndumberi, Ting’ang’a) on drought-tolerant crops 	<ul style="list-style-type: none"> - Build cold storage facility at Kiambu Market. - Support tea cooperatives with weather index insurance. 	<ul style="list-style-type: none"> - Establish climate-smart agriculture demonstration centre.
Social Infrastructure	<ul style="list-style-type: none"> - Retrofit 10 ECDE centres with insulation and warm floors. - Install water tanks in 15 schools. 	<ul style="list-style-type: none"> - Climate-proof 5 health dispensaries. 	<ul style="list-style-type: none"> - Build model climate-resilient school.

Emergency Services	<ul style="list-style-type: none"> - Develop ward-level contingency plans. - Train 50 Community Emergency Response Teams (CERT). 	<ul style="list-style-type: none"> - Equip fire station with flood rescue boat. - Install 3 automated weather stations for early warning. 	<ul style="list-style-type: none"> - Establish municipal disaster operations centre.
Populations			
Urban Residents	<ul style="list-style-type: none"> - Awareness campaign on flood safety and rainwater harvesting. - Distribute mosquito nets in flood zones. 	<ul style="list-style-type: none"> - Subsidise household rainwater tanks. - Expand health insurance coverage for vulnerable groups. 	<ul style="list-style-type: none"> - Incorporate climate resilience into housing bylaws.
Informal Settlement Residents	<ul style="list-style-type: none"> - Relocate 50 most at-risk households to safer land. - Provide basic sanitation facilities (temporary). 	<ul style="list-style-type: none"> - Develop participatory slum upgrading plan - Secure land tenure for residents. 	<ul style="list-style-type: none"> - In-situ upgrading with flood-proof housing and services.
Vulnerable & Marginalized Groups	<ul style="list-style-type: none"> - Register elderly/PWDs for social protection cash transfers. 	<ul style="list-style-type: none"> - Establish livelihoods diversification programme - Provide grants for youth agribusiness. 	<ul style="list-style-type: none"> - Fully inclusive climate action plan with reserved budgets.
Natural Assets			
Urban Green Infrastructure	<ul style="list-style-type: none"> - Plant 5,000 indigenous trees (riparian, schools). - Protect remnant urban forests. 	<ul style="list-style-type: none"> - Develop green corridor from Thindigua to Ndumberi - Establish community tree nurseries. 	<ul style="list-style-type: none"> - Increase tree cover to 20% of municipal area.

Urban Blue Infrastructure	<ul style="list-style-type: none"> - Demarcate and peg riparian reserves. - Remove encroachers along Kamiti and Riara River. 	<ul style="list-style-type: none"> - Restore 5 km of riparian zone with bamboo. 	<ul style="list-style-type: none"> - Fully rehabilitated riparian areas
Peri-urban & Agricultural Systems	<ul style="list-style-type: none"> - Train 500 farmers on hay-making and silage. - Distribute drought-tolerant maize seed. 	<ul style="list-style-type: none"> - Promote agroforestry on Coffee buffer zones. 	<ul style="list-style-type: none"> - Transform agricultural lands into climate-smart agriculture hub.

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Annex N1. Data Sources

Page	Data	Data Source
9	Population figures, ward-wise	KNBS 2019, Kiambu CIDP 2023-2027
11	Hazard screening	PCRA Kiambu Sub-County consultations, 2023
12	Climate indicators, thresholds	KMD, CHIRPS, CORDEX-Africa, ERA5-Land, World Climate Knowledge Portal
13	Current hazard levels	Kiambu County PCRA (Chapter 3)
13	Future hazard projections	Kiambu County PCRA (Chapter 4) – downscaled CMIP5
16	Urban elements inventory – infrastructure	Kiambu Municipal Board asset register (2024)
17	Informal settlement data	Ward administrators, PCRA community mapping
19–33	Exposure, vulnerability, impacts	PCRA community workshops, 2023; expert judgment
34–37	Risk levels	Derived using IPCC AR5 risk framework
38	Climate risk hotspots	PCRA hazard maps, municipal physical planning
40	Adaptation solutions	PCRA adaptation strategies (Table 4,15,16)