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MUNICIPAL MANAGER**

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**URBAN CLIMATE RISK PROFILE
FOR
JUJA MUNICIPALITY**

October 2025

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Publisher: Kiambu County

Publisher Address:

First Edition: 2025

Printed in Kenya

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The Juja Municipality's Urban Climate Risk Profile (2025) 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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Preface

This Climate Risk Profile for Juja Municipality has been developed to provide a comprehensive assessment of climate-related risks and vulnerabilities affecting the municipality. The report is intended to support informed decision-making, planning, and investment aimed at enhancing climate resilience and sustainable urban development.

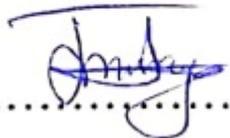
The preparation of this report was guided by a participatory and evidence-based approach, drawing on stakeholder consultations, secondary data sources, and local knowledge. Key thematic areas assessed include climate hazards, exposure, vulnerability, and risk, with a focus on identifying practical and context-specific adaptation measures.

Juja Municipality, like many rapidly urbanizing areas, is increasingly facing the impacts of climate variability, including flooding, water stress, and environmental degradation. These challenges are further compounded by population growth and land-use pressures. This report, therefore, seeks to provide a structured framework for understanding these risks and prioritizing interventions.

It is expected that this Climate Risk Profile will serve as a reference document for the Municipality, Kiambu County Government, development partners, and other stakeholders in integrating climate change considerations into policies, plans, and programs.

Joseph Muraya

Municipal Manager, Juja



Executive Summary

Juja Municipality is increasingly experiencing the impacts of climate variability and change, manifested through recurrent flooding, water stress, rising temperatures, and environmental degradation. Rapid urbanization, population growth, and unplanned developments have further amplified the municipality's exposure and vulnerability to these climate-related risks.

This Climate Risk Profile provides an assessment of key climate hazards, exposure patterns, and vulnerability conditions within Juja Municipality. The analysis identifies flooding and water stress as the most critical risks, with significant impacts on infrastructure, public health, livelihoods, and service delivery. Flood-prone areas such as Gachororo, Kimbo, and sections along the Thika Superhighway—particularly at the Juja underpass—experience frequent disruptions due to inadequate drainage systems and poor solid waste management practices.

Water stress is a municipality-wide **systemic risk**, driven by increasing demand, climate variability, and limited supply. Residents rely heavily on services provided by Ruiru-Juja Water and Sewerage Company and Thika Water and Sewerage Company, where periodic rationing affects households, businesses, and institutions.

A unique and significant local risk identified in Juja is the presence of abandoned and poorly rehabilitated quarry sites. These pose serious safety and environmental hazards, including flooding, drowning risks, and land instability, particularly during heavy rainfall events. Additionally, emerging risks such as heat stress and localized erosion—especially along riverbanks like the Theta River—are expected to intensify over time.

The assessment further highlights that vulnerable groups—including children, the elderly, persons with disabilities, and low-income households—are disproportionately affected by climate impacts due to limited adaptive capacity. Informal settlements and high-density areas face compounded risks due to inadequate infrastructure and limited access to essential services.

In response, this report proposes a set of prioritized climate adaptation measures focusing on flood risk management, improved water supply systems, heat mitigation, quarry rehabilitation, and environmental protection. Key interventions include upgrading drainage infrastructure, promoting rainwater harvesting, enhancing solid waste management, restoring degraded ecosystems, and strengthening regulatory enforcement.

Effective implementation of these measures will require coordinated efforts among the Municipality, Kiambu County Government, utility providers, national agencies, and local communities. Strengthening institutional capacity, improving financing mechanisms, and enhancing stakeholder collaboration will be critical to building long-term climate resilience.

This Climate Risk Profile is intended to guide planning, investment, and policy decisions, and to support Juja Municipality in transitioning towards a more resilient, sustainable, and climate-adaptive urban future.

Acknowledgements

The preparation of the Juja Municipality Climate Risk Profile was made possible through the contributions and support of various institutions, stakeholders, and individuals.

The Municipality acknowledges the leadership and guidance of the Kiambu County Government, as well as the technical input from relevant county departments involved in environment, water, urban planning, and disaster management.

Special recognition is extended to key stakeholders, including Ruiru-Juja Water and Sewerage Company and Thika Water and Sewerage Company, for their valuable insights on water supply challenges and infrastructure. Appreciation is also given to community representatives and local participants whose knowledge and experiences were critical in identifying climate risks and vulnerabilities within the municipality.

The Municipality further acknowledges all institutions and individuals who contributed data, technical expertise, and feedback during the development of this report.

Acronyms and Abbreviations

Acronym	Full Meaning
CECM	County Executive Committee Member
CIDP	County Integrated Development Plan
GIS	Geographic Information System
GHG	Greenhouse Gas
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KMD	Kenya Meteorological Department
M&E	Monitoring and Evaluation
NEMA	National Environment Management Authority
NDMA	National Drought Management Authority
PPP	Public-Private Partnership
RUJUWASCO	Ruiru-Juja Water and Sewerage Company
SWM	Solid Waste Management
THIWASCO	Thika Water and Sewerage Company
UNFCCC	United Nations Framework Convention on Climate Change
WASH	Water, Sanitation and Hygiene

Glossary of Key Terms

Term	Definition
Adaptation	Adjustments in natural or human systems in response to actual or expected climate change, aimed at reducing harm or taking advantage of beneficial opportunities.
Climate Change	Long-term changes in temperature, rainfall patterns, and other climate variables, largely driven by human activities such as greenhouse gas emissions.
Climate Hazard	A climate-related physical event or trend, such as floods, droughts, or heatwaves, that may cause damage or loss.
Climate Risk	The potential for adverse effects resulting from the interaction of climate hazards, exposure, and vulnerability.
Exposure	The presence of people, infrastructure, livelihoods, and ecosystems in areas that could be adversely affected by climate hazards.
Vulnerability	The degree to which a system or population is susceptible to, and unable to cope with, adverse effects of climate change.
Resilience	The ability of a system, community, or society to resist, absorb, adapt to, and recover from climate-related shocks and stresses.
Mitigation	Efforts to reduce or prevent the emission of greenhouse gases, thereby limiting the magnitude of climate change.
Flooding	Overflow of water onto normally dry land, often caused by heavy rainfall, poor drainage, or river overflow.
Drought	A prolonged period of abnormally low rainfall leading to water shortages.
Heat Stress	A condition caused by excessive heat that can negatively affect human health, productivity, and ecosystems.
Urbanization	The process by which an increasing proportion of a population lives in urban areas, often leading to expansion of built environments.
Drainage System	Infrastructure designed to remove excess surface water, especially during rainfall events.
Non-Revenue Water	Water that is produced but lost before it reaches consumers, due to leaks, theft, or inefficiencies in the system.
Riparian Zone	The interface between land and a river or stream, often important for ecosystem stability and flood control.
Ecosystem Degradation	The deterioration of the environment through depletion of resources, destruction of ecosystems, and loss of biodiversity.

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1. Introduction

1.1 Objective of the Urban Climate Risk Profile

The Urban Climate Risk Profile for Juja Municipality aims to identify and assess the key climate hazards, vulnerabilities, and risks affecting the municipality. The profile provides a structured understanding of how climate change may impact urban systems, infrastructure, livelihoods, and ecosystems within the municipality.

This assessment supports evidence-based planning and decision-making for climate resilience by highlighting areas of high exposure and vulnerability to climate hazards such as flooding, drought, landslides, and increasing temperatures. The findings are intended to inform municipal planning processes, infrastructure investments, and climate adaptation strategies.

The Urban Climate Risk Profile also supports the integration of climate risk considerations into urban development planning in Juja Municipality in alignment with national climate policies and county development frameworks. By identifying climate risks and potential adaptation measures, the document contributes to strengthening the municipality's capacity to respond to current and future climate challenges.

1.2 Urban Context

1.2.1 Geographic Area

Juja Municipality is located within Kiambu County in the central region of Kenya, approximately 30 kilometres north of Nairobi along the Nairobi–Thika Superhighway. The municipality lies between Ruiru and Thika towns and forms part of the rapidly expanding Nairobi Metropolitan Area.

The municipality serves as an important urban centre supporting residential development, industrial activity, higher education, and commercial services. Juja is widely recognized as an educational and innovation methodohub due to the presence of Jomo Kenyatta University of Agriculture and Technology (JKUAT), which has significantly influenced the town's growth and demographic structure.

Juja Municipality covers an area of approximately **342 km²** and has an estimated population of **about 300,000 people based on the 2019 population census**. Rapid population growth has

been driven by the municipality's strategic location along the Thika Superhighway and its proximity to Nairobi.

Administratively, Juja Municipality consists of five wards:

- Juja Ward
- Murera Ward
- Theta Ward
- Kalimoni Ward
- Witeithie Ward

These wards form the core administrative and service delivery units within the municipality.

The municipality is accessible through the **A2 Nairobi–Thika Superhighway** as well as the **Nairobi–Nanyuki railway line**, both of which play a significant role in supporting mobility, economic activities, and commuter flows between Juja and Nairobi.

Several important natural features define the municipality's physical environment. These include:

- **Komu River** forming part of the northern boundary
- **Theta and Thiririka Rivers** along the southern boundary
- Parts of the **Nairobi–Athi river system** to the east

These river systems play an important ecological and hydrological role but may also increase exposure to flooding risks in some areas.

Rapid urban expansion, increasing built-up areas, and conversion of agricultural land into residential developments have significantly transformed the land-use patterns within Juja Municipality in recent years.

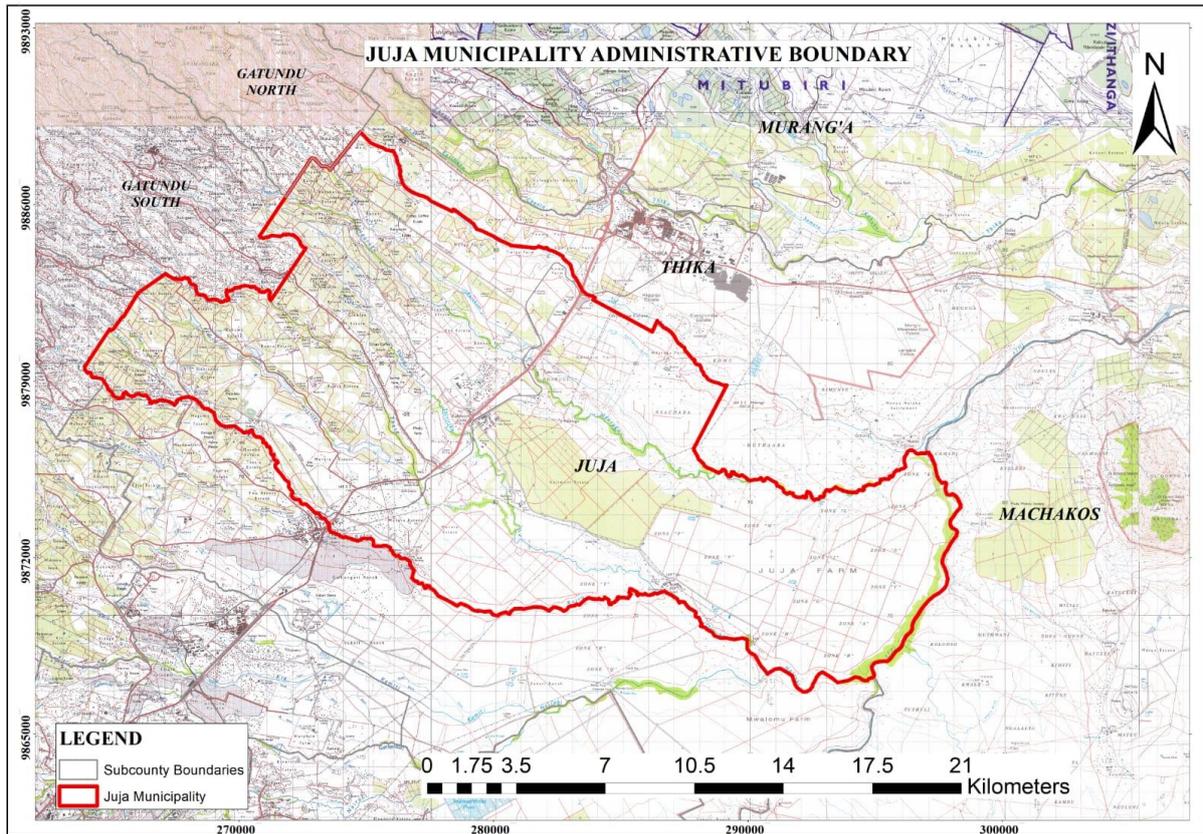


Figure 1: *Administrative Boundary of Juja Municipality*

Source: Kiambu County Department of Municipal Administration and Urban Development (MAUD)

1.2.2 Governance Structure

Juja Municipality is administered under the Government of Kiambu County in accordance with the Urban Areas and Cities Act. The municipality is governed by a Municipal Board responsible for overseeing urban management, development planning, and service delivery within the municipal area.

The Municipal Board works closely with various Kiambu County Government departments responsible for sectors such as:

- Environment and natural resource management
- Infrastructure development
- Land use planning and urban development
- Water and sanitation services
- Public health and social services

These departments are responsible for implementing policies and programs related to climate resilience, environmental management, and sustainable urban development.

The municipality also collaborates with national government agencies, development partners, and community stakeholders to support inclusive urban governance and climate-resilient development.

1.2.3 Socio-Economic Context

Juja Municipality has experienced rapid population growth over the past two decades, driven largely by its proximity to Nairobi and the presence of major educational institutions and industries.

A significant proportion of the population consists of university students and young professionals associated with the nearby Jomo Kenyatta University of Agriculture and Technology, which has contributed to the development of student hostels, retail businesses, restaurants, and service enterprises within the municipality.

The municipality's population includes:

- Long-term residents
- Students and university staff
- Migrants seeking employment opportunities
- Peri-urban farming communities

Economic activities in Juja Municipality are diverse and include retail trade, education services, small-scale manufacturing, real estate development, and agriculture in surrounding peri-urban areas.

Informal economic activities such as street vending, small retail shops, and transport services also play an important role in supporting livelihoods for a large portion of residents.

Rapid urban growth has placed increasing pressure on infrastructure and municipal services including water supply, drainage systems, transportation networks, and solid waste management. These pressures may increase vulnerability to climate hazards, particularly in densely populated or underserved areas.

1.2.4 Economic Context

Juja Municipality has developed into an important **industrial and educational hub within Kiambu County**.

The presence of major industries such as:

- Pulp and Paper manufacturing
- Star Plastics manufacturing
- Safari Stationers
- Hydro Aluminium

has contributed to employment creation and economic growth within the municipality.

In addition to industrial activity, Juja hosts a range of commercial centres including markets, retail businesses, restaurants, and transport services serving both residents and commuters travelling along the Thika Superhighway.

Education is also a major economic driver. The presence of Jomo Kenyatta University of Agriculture and Technology attracts a large student population, which has stimulated growth in the housing sector, retail trade, hospitality services, and transport businesses.

Agriculture remains important in peri-urban areas surrounding Juja Municipality where smallholder farming contributes to food production and household income. However, agricultural productivity is sensitive to climate variability including drought conditions and changes in rainfall patterns.

Sustaining economic growth in Juja Municipality will depend on strengthening climate-resilient infrastructure and protecting natural resources that support livelihoods and economic activities.

1.2.5 Land-Use Context

Land use within Juja Municipality consists of a mixture of:

- Residential developments
- Commercial centres
- Industrial zones

- Educational institutions
- Agricultural land
- Natural ecosystems including rivers and wetlands

Rapid urbanization has led to significant conversion of agricultural land into residential estates, student hostels, and commercial developments.

Major transport corridors such as the Nairobi–Thika Superhighway have further accelerated urban expansion and commercial development within the municipality.

However, unplanned development, increased impervious surfaces, and inadequate waste management can contribute to environmental degradation and increased flood risks. Encroachment on riparian areas and natural drainage corridors may also reduce the municipality’s natural capacity to regulate stormwater flows.

Effective land-use planning and enforcement of development regulations are therefore critical for ensuring that urban growth occurs in a manner that minimizes climate risks and protects important ecological resources.

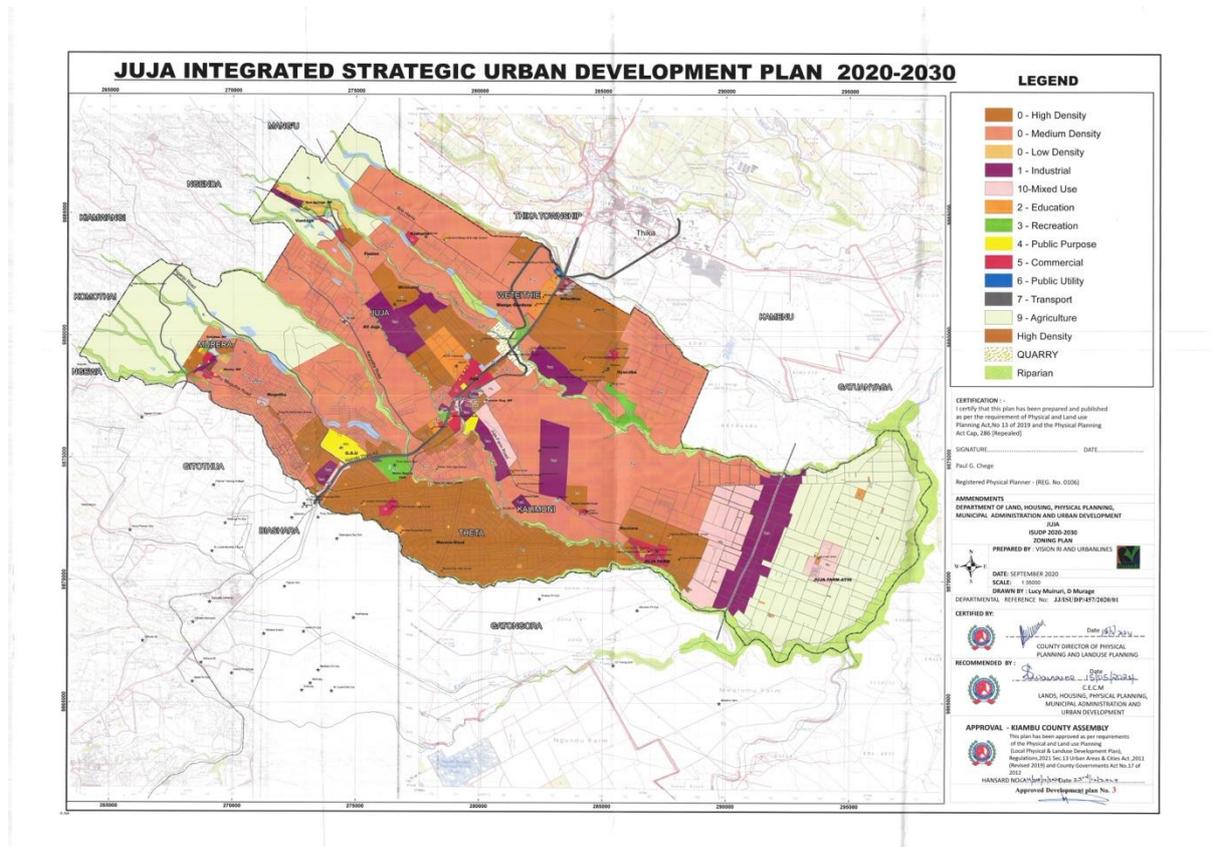


Figure 2: *Juja Municipality Land Use Map*

Source: Kiambu County Physical Planning Department

1.3 Key Stakeholders and Inclusiveness

Addressing climate risks in Juja Municipality requires collaboration among a wide range of stakeholders including government institutions, local communities, academic institutions, private sector actors, and development partners.

Key stakeholders involved in climate resilience and urban development within Juja Municipality include the Kiambu County Government, the Juja Municipal Board, national government agencies responsible for environmental management and climate policy, academic institutions such as Jomo Kenyatta University of Agriculture and Technology, utility providers such as Ruiru-Juja Water and Sewerage Company (RUJUWASCO), local community organizations, and private sector actors operating within the municipality.

The involvement of these stakeholders is essential for identifying local climate risks, implementing adaptation strategies, and supporting sustainable urban development.

Academic institutions such as JKUAT play a particularly important role in Juja Municipality through research, innovation, and technical expertise that can support climate monitoring, environmental management, and sustainable infrastructure planning.

Table 1: *Stakeholder Mapping (Influence–Interest Matrix)*

	Low Interest	High Interest
High Influence	National government agencies (NEMA, KFS, KMD)	Kiambu County Executive Juja Municipal Board RUJUWASCO Jomo Kenyatta University of Agriculture and Technology
Low Influence	Private developers Transport operators Industrial businesses	Residents of Juja Municipality Community Based Organisations (CBOs) Youth groups and student associations Farmers' groups

Private sector actors, including industries and commercial enterprises located within the municipality, also influence urban development patterns and resource use. Their participation

is therefore important in promoting climate-resilient investments and sustainable business practices.

Inclusive engagement of vulnerable groups such as women, youth, informal settlement residents, and small-scale farmers is critical for ensuring that climate adaptation initiatives address the needs of those most affected by climate impacts. Community-based organizations, youth groups, and local associations can support public awareness, community mobilization, and grassroots climate resilience initiatives.

The stakeholder mapping for Juja Municipality categorizes key actors based on their level of influence and interest in municipal climate resilience and urban development initiatives. Stakeholders with high influence and high interest, such as the Kiambu County Executive, Juja Municipal Board, and RUJUWASCO, play a critical role in decision-making and implementation and therefore require close engagement. National government agencies including KFS, KEFRI, and KMD possess significant influence but relatively lower direct interest at the municipal level and should be kept satisfied through coordination and consultation. Community groups, residents, and local associations demonstrate high interest in municipal development but have relatively lower influence and should be actively informed and involved in participatory processes.

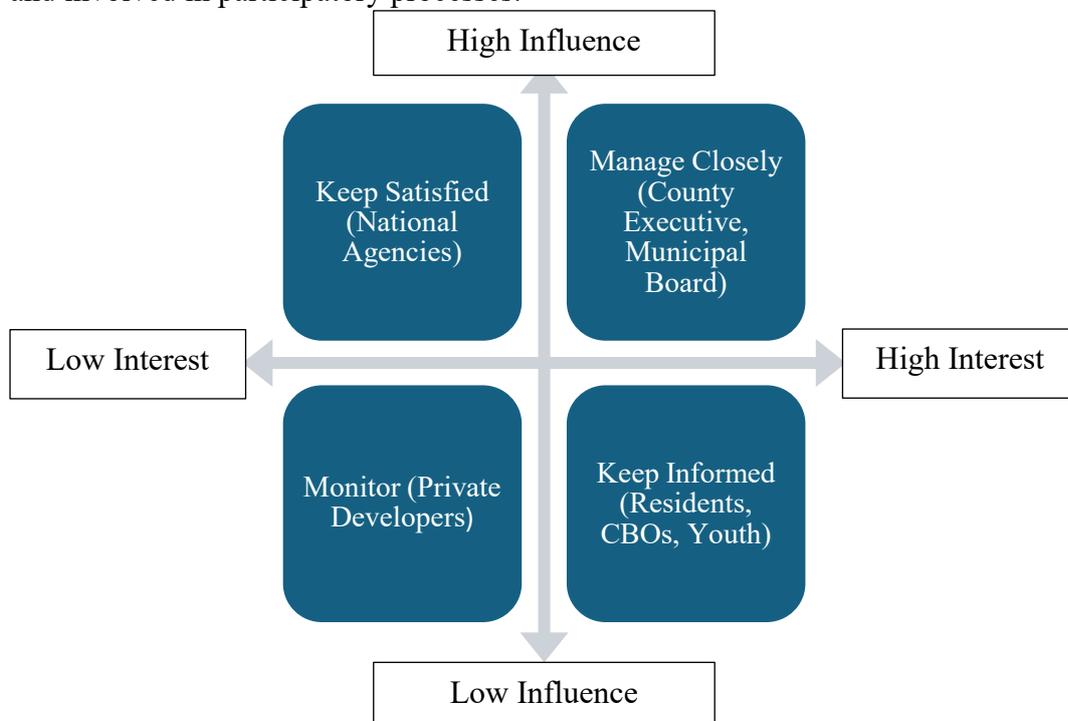


Figure 3: Stakeholder Mapping (Influence–Interest Matrix)

1.4 Methodology

This Urban Climate Risk Profile for Juja Municipality was developed using a qualitative assessment approach that combines climate data analysis, literature review, and urban risk assessment methods. The methodology draws on guidance from urban climate risk assessment frameworks developed by international organizations and development partners.

The assessment involved reviewing available climate information, municipal planning documents, and relevant national and county-level policies related to climate change and urban development. Climate trends and hazard information were informed by publicly available datasets, including climate projections and indicators from the World Bank Climate Change Knowledge Portal and national climate monitoring institutions.

The analysis focused on identifying key climate hazards affecting the municipality and assessing their potential impacts on urban systems such as housing, infrastructure, economic activities, and natural ecosystems. Exposure and vulnerability were evaluated based on known environmental conditions, patterns of urban development, and the sensitivity of different sectors to climate variability.

Based on this information, a climate risk assessment was conducted by examining the interaction between hazards, exposure, and vulnerability. The assessment helped identify priority climate risks and potential adaptation opportunities that could support resilience-building efforts within Juja Municipality.

Key components of the assessment included:

- Identification of major climate hazards affecting the municipality
- Analysis of exposure of urban systems and infrastructure
- Assessment of vulnerability across key sectors
- Development of a climate risk matrix
- Identification of potential adaptation and resilience measures

This approach provides a structured basis for understanding climate risks and informing future climate-resilient urban planning and investment decisions. The methodology adopts a risk-based approach consistent with global urban climate risk assessment practices.

2. Hazard Assessment

2.1 Key Climate Hazards

Juja Municipality is exposed to several climate-related hazards that are influenced by both natural environmental conditions and rapid urbanization. Climate change is expected to increase the frequency and intensity of certain hazards, with significant implications for infrastructure, livelihoods, and environmental systems.

Based on available data, stakeholder insights, and local observations, the key climate hazards affecting Juja Municipality include:

- Flooding and waterlogging
- Drought and water stress
- Heat stress and rising temperatures
- Localized erosion and minor landslide risks
- Environmental risks associated with abandoned and filled quarries

Table 2: *Hazard Screening for Juja Municipality*

Hazard	Hazard Likely	Significant Impact	High Priority	Key Hazard
Average surface temperature increase	Y	Y	Y	Y
Extreme heat	Y	Y	Y	Y
Changes in precipitation patterns	Y	Y	Y	Y
Pluvial flooding	Y	Y	Y	Y
Fluvial flooding	Y	Y	Y	Y
Waterlogging	Y	Y	Y	Y
Drought	Y	Y	Y	Y
Landslides	Y	N	N	N
Gully erosion	Y	Y	Y	N
Extreme wind	Y	N	N	N
Hailstorms	Y	N	N	N
Earthquakes	Y	N	N	N
Quarry-related hazards (flooding, collapse, drowning risk)	Y	Y	Y	Y

2.1.1 Flooding and Waterlogging

Flooding is one of the most significant climate hazards affecting Juja Municipality. It is primarily driven by intense rainfall events, inadequate drainage systems, rapid urbanization, and increased impervious surfaces.

The following areas are particularly prone to flooding:

- Gachororo
- Juja Farm
- Kimbo (junction area)
- Mugutha
- Ngoma Tupu
- Rioriro
- One-Four
- Mung'etho
- Sewage area
- High Point
- Along the Thika Superhighway at the Juja underpass

Flooding in these areas is often exacerbated by blocked drainage channels, poor stormwater management, and encroachment on natural drainage pathways. The underpass along the Thika Superhighway is especially vulnerable due to its low elevation and accumulation of runoff during heavy rainfall events.

2.1.2 Drought and Water Stress

Water stress is a major and widespread issue affecting all wards within Juja Municipality. This is largely driven by increasing population demand, limited water supply infrastructure, and periodic dry spells.

Water supply within the municipality is managed by two service providers:

- Ruiru-Juja Water and Sewerage Company – serving most parts of Juja
- Thika Water and Sewerage Company (THIWASCO) – serving Witeithie

Frequent water rationing affects households, businesses, and institutions across the municipality, making the entire urban system highly vulnerable to drought conditions and climate variability.

Peri-urban agricultural areas are particularly affected, as reduced water availability leads to:

- Declining crop productivity
- Increased cost of irrigation
- Reduced household incomes

2.1.3 Heat Stress and Rising Temperatures

Juja Municipality is increasingly experiencing rising temperatures associated with climate change and urbanization. Built-up areas with limited vegetation cover are particularly affected by the urban heat island effect.

Areas with high building density such as:

- Juja Town
- Gachororo
- Witeithie
- Kimbo

experience elevated temperatures due to:

- Reduced green cover
- Increased paved surfaces
- High population density

Heat stress affects human health, increases water demand, and reduces productivity, particularly among outdoor workers and vulnerable populations.

2.1.4 Erosion and Minor Landslide Risks

While large-scale landslides are not common in Juja Municipality, localized soil erosion and minor slope instability may occur in areas affected by:

- Encroachment along riverbanks

- Poor land management practices
- Increased surface runoff during heavy rainfall

In particular, areas along the Theta River have shown signs of:

- Riverbank erosion
- Minor slope instability
- Land degradation due to human activities

Although currently limited in scale, these risks may increase over time if land-use practices and environmental management are not improved.

2.1.5 Quarry-Related Environmental Risks

Juja Municipality has several abandoned and filled quarry sites, which present a unique and significant environmental and safety risk.

These quarries pose multiple hazards, including:

- Flooding due to water accumulation during rainfall
- Risk of drowning, especially for children and residents
- Ground instability and potential collapse
- Environmental degradation and poor land rehabilitation

Many of these sites are located within or near residential areas, increasing the exposure of communities to these risks.

Quarry-related hazards are particularly concerning because they:

- Are often unmanaged
- Lack proper fencing or safety measures
- Can worsen during extreme rainfall events

Addressing these risks will require targeted interventions including mapping, rehabilitation, and enforcement of land restoration regulations.

2.2 Climate Indicators and Hazard Thresholds

Climate hazards in Juja Municipality can be monitored using key indicators based on meteorological and environmental data.

Table 3: *Climate Indicators and Hazard Thresholds*

Key Hazard	Climate Indicator	Data Source	Low	Medium	High
Flooding (Pluvial & Fluvial)	Maximum 1-day precipitation (mm/day)	Kenya Meteorological Department (KMD); World Bank Climate Change Knowledge Portal	< 20 mm/day	20–50 mm/day	> 50 mm/day
Heat Stress	Number of hot days (Temperature >30 °C) per year	Kenya Meteorological Department; World Bank Climate Change Knowledge Portal	< 10 days	10–30 days	> 30 days
Drought / Water Stress	Consecutive dry days (CDD)	ICPAC; Kenya Meteorological Department; World Bank Climate Change Knowledge Portal	< 10 days	10–20 days	> 20 days
Landslides	3–5 day cumulative rainfall on slopes (mm)	Kenya Meteorological Department; Geological Survey of Kenya	< 50 mm	50–100 mm	> 100 mm
Rainfall Variability / Waterlogging	Number of heavy rainfall events (>30 mm/day) per season	Kenya Meteorological Department; World Bank Climate Change Knowledge Portal	0–2 events	3–5 events	> 5 events

2.3 Current Hazard Levels and Climate Projections

Climate trends observed across Kenya indicate increasing variability in rainfall patterns and rising temperatures. Juja Municipality is already experiencing these changes through:

- More frequent intense rainfall events
- Periods of prolonged dry conditions
- Increasing average temperatures

These trends are consistent with broader projections for central Kenya and are expected to intensify over time.

Table 4: *Current and Future Hazard Levels for Juja Municipality*

Hazard	Current	2050 SSP2-4.5	2050 SSP5-8.5	2100 SSP2-4.5	2100 SSP5-8.5
Flooding	Medium	Medium	High	High	High
Heat Stress	Medium	High	High	High	Very High
Drought	Medium	Medium	High	High	High
Landslides/Erosion	Low-Medium	Medium	Medium	Medium	High
Quarry Risks	Medium	Medium	High	High	High

The projections presented in Table 4 indicate a clear increase in the intensity and frequency of key climate hazards over time, particularly under high-emission scenarios. Flooding, heat stress, and drought are expected to become more severe, posing significant risks to infrastructure, public health, water resources, and economic activities within Juja Municipality.

The increase in flood risk is closely linked to projected changes in rainfall intensity, which, when combined with existing challenges such as inadequate drainage systems and unplanned urban development, is likely to worsen the impacts in already flood-prone areas such as Gachororo, Kimbo, and the Thika Superhighway underpass.

Similarly, rising temperatures are expected to intensify heat stress, particularly in densely built-up areas with limited green spaces. This may lead to increased demand for water and energy, as well as heightened health risks for vulnerable populations.

Water stress is also projected to worsen due to the combined effects of climate variability and growing demand, placing additional pressure on existing supply systems managed by RUJUWASCO and THIWASCO.

In addition, quarry-related risks are likely to increase as extreme rainfall events become more frequent, leading to greater water accumulation, instability, and safety concerns in and around these sites.

These projections underscore the urgent need for integrated climate adaptation measures, improved urban planning, and strengthened infrastructure systems to enhance resilience within the municipality.

The current spatial distribution of climate-related hazards in Juja Municipality is illustrated in Figure 4. The map highlights existing hazard hotspots based on observed climate patterns, environmental conditions, and urban development characteristics.

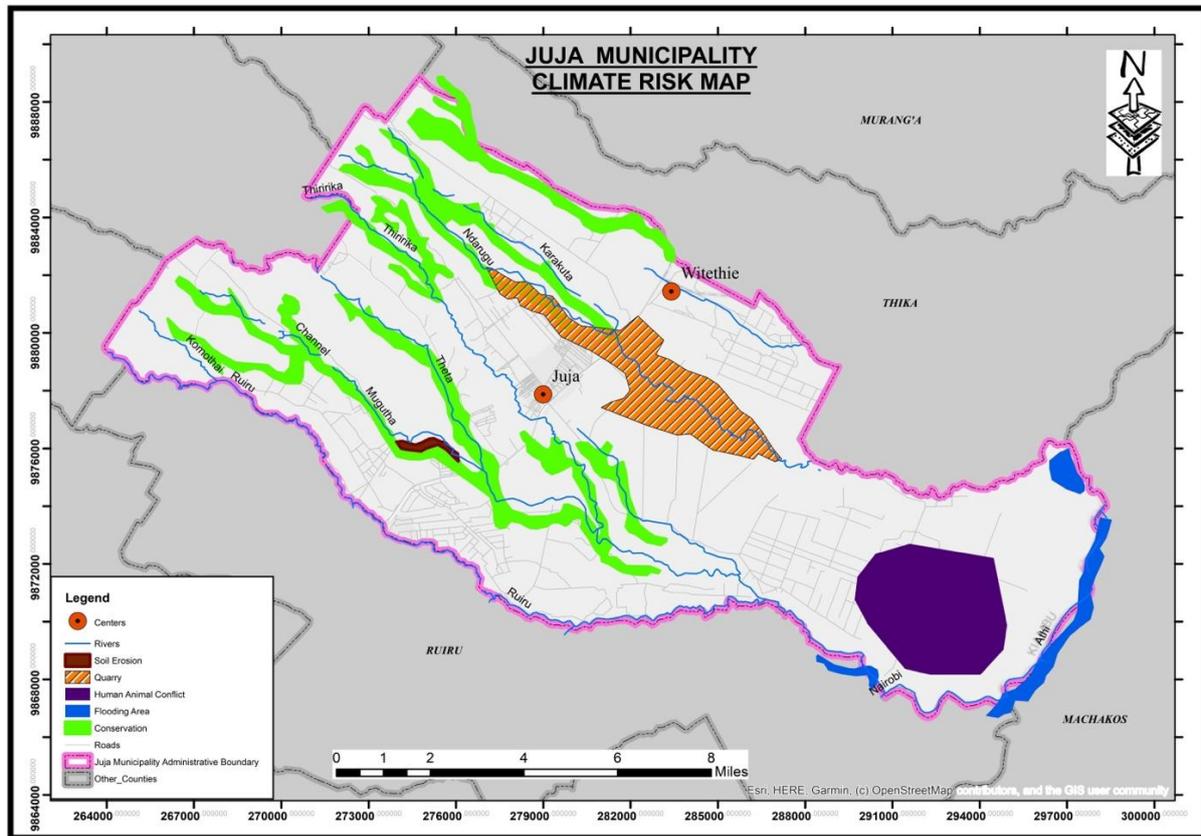


Figure 4: Climate Hazard Map of Juja Municipality (Current Hazard Conditions)

Source: GIS analysis based on observed hazard datas

The hazard map indicates that flooding, waterlogging, and environmental risks are concentrated in areas such as Gachororo, Kimbo, and along the Thika Superhighway, particularly at the Juja underpass. Quarry-prone zones and areas with poor drainage infrastructure also exhibit elevated hazard levels. These patterns reflect the current exposure of the municipality to climate-related events.

2.3.1 Historical Climate Hazard Events

Juja Municipality has experienced a range of climate-related hazard events over the past decade, reflecting broader climatic trends observed across central Kenya. These events provide important insights into the municipality’s exposure and vulnerability to climate variability and extremes.

Historical occurrences of flooding, drought, and extreme rainfall have resulted in disruptions to transport systems, damage to infrastructure, reduced water availability, and impacts on livelihoods. In particular, recurrent flooding in low-lying and poorly drained areas, as well as persistent water shortages due to rationing by service providers such as RUJUWASCO and THIWASCO, highlight the municipality’s sensitivity to both extreme rainfall and prolonged dry conditions.

The table below summarizes selected historical climate hazard events and their observed impacts within Juja Municipality.

Table 5: Historical Climate Hazard Events

Year	Hazard Event	Observed Impacts
2016–2017	Drought and water shortages	Water rationing across Juja; reduced agricultural productivity
2018	Heavy rainfall and flooding	Flooding in Gachororo, Kimbo, and Juja town; disruption of transport
2020	Intense long rains	Flooding in underpass and low-lying areas
2022	Below-average rainfall	Water stress across all wards
2024	Heavy rainfall and flooding	Flooding along Thika Superhighway underpass and residential zones

2.3.2 Future Climate Projections

Climate projections for Kenya indicate a continued increase in temperature and greater variability in rainfall patterns over the coming decades. According to projections from the World Bank Climate Change Knowledge Portal, mean annual temperatures in Kenya are expected to increase by approximately 1.5–2.5°C by the 2050s under intermediate emissions scenarios. In addition, rainfall patterns are expected to become more erratic, with an increase in the intensity of extreme rainfall events. These changes are likely to increase the risk of flooding, landslides, and water stress in rapidly urbanizing municipalities such as Juja Municipality.

In addition to current hazard conditions, projected climate risks have been spatially analyzed to identify areas that are likely to experience increased vulnerability in the future.

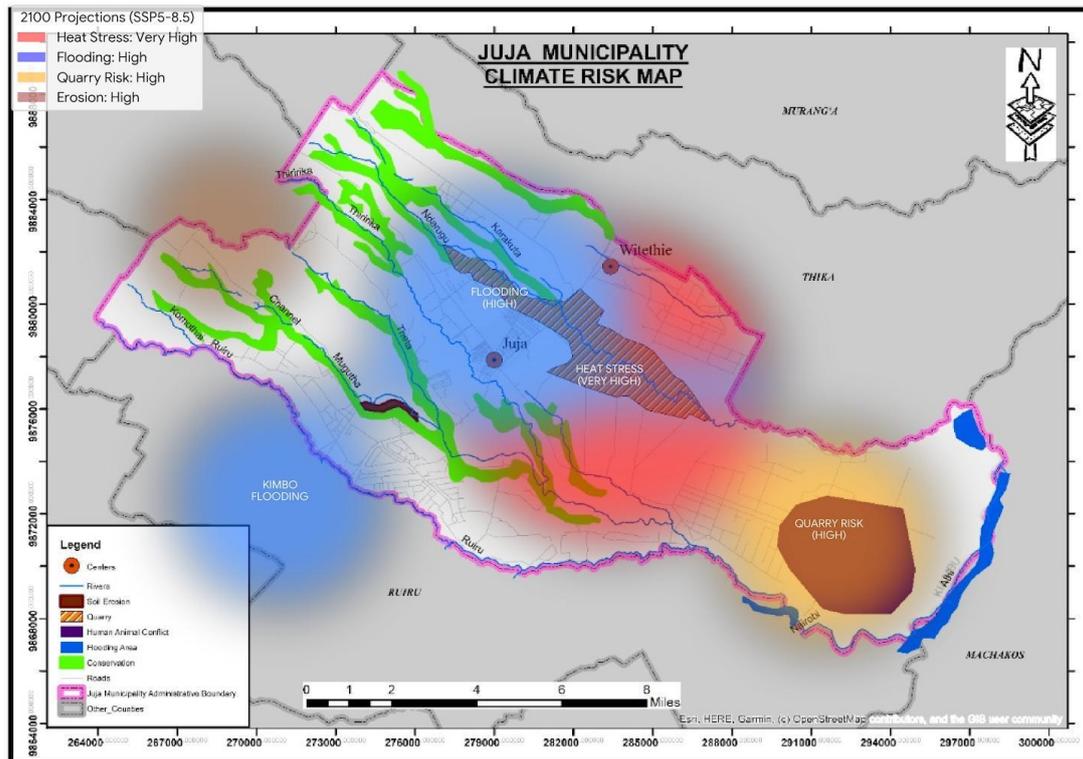


Figure 5: Climate Risk Profile Map of Juja Municipality (Projected Risk Distribution)

Source: GIS-based analysis integrating hazard projections, exposure, and vulnerability

The Climate Risk Profile Map presents the projected spatial distribution of climate risk within Juja Municipality by combining future hazard trends with existing exposure and vulnerability factors. The map indicates an expansion and intensification of high-risk zones, particularly in densely populated areas such as Witeithie, Gachororo, and parts of Juja Farm. These findings suggest that without targeted adaptation measures, climate impacts are likely to become more severe over time.

3. Exposure and Vulnerability Assessment

3.1 Overview

Exposure and vulnerability assessment examines the extent to which people, infrastructure, and economic activities within Juja Municipality are susceptible to climate-related hazards. While hazards describe potential climate events, exposure refers to the presence of people and assets in hazard-prone areas, and vulnerability reflects their capacity to anticipate, cope with, and recover from these impacts.

In Juja Municipality, rapid urbanization, population growth, and unplanned development have increased both exposure and vulnerability to climate risks. Informal settlements, inadequate infrastructure, and environmental degradation further exacerbate these risks.

3.2 Population and Settlement Patterns

Juja Municipality has experienced rapid population growth driven by its proximity to Nairobi and the presence of major institutions such as Jomo Kenyatta University of Agriculture and Technology.

Settlement patterns are characterized by a mix of planned residential areas, peri-urban developments, and informal settlements. High-density areas often experience inadequate infrastructure and limited access to basic services, increasing their vulnerability to climate hazards.

Key informal and high-density settlement areas include:

- Witeithie
- Gachororo
- Parts of Juja Farm
- Kimbo

These areas are particularly vulnerable due to:

- Poor drainage systems
- High population density
- Limited access to clean water and sanitation
- Proximity to flood-prone zones

Population growth continues to place pressure on land, housing, and service delivery, increasing exposure to flooding, heat stress, and water shortages.

3.3 Infrastructure and Services

Infrastructure systems in Juja Municipality play a critical role in determining resilience to climate risks. However, many systems are currently under strain due to rapid urban expansion and limited investment.

3.3.1 Transport Infrastructure

Juja is a key transport corridor along the Nairobi–Thika axis, with the Thika Superhighway serving as the main transport route.

Flooding at critical points, particularly the Juja underpass, disrupts mobility and economic activities. Poor drainage in feeder roads within residential areas further exacerbates access challenges during heavy rainfall.

3.3.2 Water Supply and Sanitation

Water supply is a major vulnerability across the municipality. Services are provided by:

- RUJUWASCO
- THIWASCO (serving Witeithie)

Frequent rationing limits access to reliable water supply, increasing vulnerability during drought periods.

Sanitation infrastructure is also inadequate in some areas, particularly informal settlements, leading to:

- Increased risk of waterborne diseases during flooding
- Environmental contamination
- Public health challenges

3.3.3 Solid Waste Management

Solid waste management remains a significant challenge within Juja Municipality.

Key issues include:

- Illegal dumping in open spaces and along roads
- Waste blocking drainage systems
- Limited waste collection coverage

Poor waste management contributes directly to flooding by clogging drainage channels, especially in high-density areas such as Gachororo and Witeithie.

Table 6: Key Infrastructure and Services in Juja Municipality

Sector	Key Elements	Climate Sensitivity
Transport	Thika Superhighway, feeder roads	Flooding disrupts movement
Water	RUJUWASCO, THIWASCO systems	Highly sensitive to drought
Sanitation	Sewer systems, pit latrines	Flood contamination risk
Solid Waste	Collection systems, informal dumping	Blocks drainage, worsens floods
Energy	Electricity grid	Storm damage, outages
Health	Hospitals, clinics	Increased disease burden
Education	Schools, JKUAT	Disruption during extreme events

3.4 Economic Activities and Livelihoods

The economy of Juja Municipality is diverse, comprising:

- Small-scale businesses
- Industrial activities
- Agriculture in peri-urban areas
- Informal sector activities

Climate hazards affect these sectors in different ways:

- Flooding disrupts businesses and transport
- Drought reduces agricultural productivity
- Heat stress lowers labor productivity
- Water shortages increase operational costs

Informal sector workers are particularly vulnerable due to limited financial resilience and lack of social protection.

3.5 Environmental Sensitivity

Environmental systems within Juja Municipality play a key role in regulating climate impacts but are increasingly under pressure.

Sensitive environmental areas include:

- River systems such as Theta River
- Riparian zones affected by encroachment
- Open spaces and wetlands
- Abandoned quarry sites

Encroachment along riverbanks has increased exposure to flooding and erosion, while degradation of natural systems reduces their ability to buffer climate impacts.

Quarry sites present an additional environmental risk due to poor rehabilitation and increased hazard exposure during rainfall events.

3.6 Vulnerable Groups

Certain population groups within Juja Municipality are disproportionately affected by climate-related hazards due to socio-economic, physical, and environmental factors. Findings from the Kiambu County participatory climate risk assessment highlight the following groups as particularly vulnerable:

Children are highly exposed to flood risks, especially in areas with poor drainage and open, unprotected quarry sites. Flooded and impassable roads limit access to schools and essential services. In addition, dust pollution—particularly during dry periods—contributes to respiratory illnesses such as asthma, leading to increased school absenteeism.

Persons with Disabilities (PWDs) face heightened vulnerability during both floods and droughts. Limited mobility makes evacuation and access to services difficult during flooding events, while low and unstable incomes increase their risk of food insecurity during drought periods.

The elderly are particularly susceptible to climate-related health risks due to weakened immune systems. Dust pollution associated with dry and windy conditions increases the incidence of respiratory illnesses. Additionally, drought conditions limit access to food and essential resources, further increasing their vulnerability.

Farmer households in peri-urban areas are vulnerable to climate variability, particularly drought and extreme heat. These conditions often lead to crop failure, reduced agricultural productivity, and loss of household income.

Youth engaged in quarrying activities face occupational health risks due to prolonged exposure to dust, which can lead to respiratory illnesses. Their vulnerability is compounded by the informal nature of quarrying activities and limited access to protective equipment and healthcare.

These vulnerabilities highlight the need for targeted, inclusive climate adaptation strategies that address the specific needs of at-risk populations within Juja Municipality.

3.7 Exposure and Vulnerability Summary

Table 7: Summary of Exposure and Vulnerability by Sector

Sector	Exposure Level	Vulnerability Level	Key Issues
Population	High	High	Informal settlements in risk areas
Infrastructure	High	Medium-High	Poor drainage, weak systems
Water	High	High	Rationing, limited supply
Economy	Medium-High	High	Informal sector sensitivity
Environment	High	High	Degradation, encroachment
Quarry Areas	High	High	Safety and flooding risks

The analysis of exposure and vulnerability across key sectors in Juja Municipality indicates that a significant proportion of the population, infrastructure, and economic activities are at high risk from climate-related hazards.

As shown in Table 7, population exposure is particularly high due to the concentration of residents in informal and high-density settlements such as Witeithie, Gachororo, and parts of Juja Farm, many of which are located in flood-prone areas with limited infrastructure. These conditions increase susceptibility to flooding, water contamination, and health risks.

Critical infrastructure systems—including transport, water supply, and sanitation—also exhibit high levels of exposure and vulnerability. Inadequate drainage, frequent water rationing by service providers such as RUJUWASCO and THIWASCO, and insufficient waste management systems further compound these challenges.

Economic activities, particularly in the informal sector and peri-urban agriculture, are highly sensitive to climate variability. Flooding disrupts business operations and transport, while drought and extreme heat reduce agricultural productivity and increase the cost of living.

Environmental systems, including riverbanks and quarry sites, are under increasing pressure due to encroachment and poor land management practices. These conditions not only heighten exposure to hazards such as flooding and erosion but also reduce the natural capacity of ecosystems to buffer climate impacts.

Overall, the findings highlight a pattern of high exposure combined with high vulnerability across multiple sectors, underscoring the need for integrated and targeted climate adaptation measures to enhance resilience within Juja Municipality.

4. Climate Risk Assessment

4.1 Overview

Climate risk in Juja Municipality arises from the interaction between climate hazards, exposure of people and assets, and the vulnerability of affected systems. This section combines the findings from the hazard assessment (Section 2) and the exposure and vulnerability analysis (Section 3) to identify and prioritize key climate risks.

The assessment focuses on the potential impacts of major hazards—including flooding, drought, heat stress, and quarry-related risks—on critical sectors such as infrastructure, water supply, public health, livelihoods, and the environment.

4.2 Risk Assessment Approach

The climate risk assessment is based on a qualitative approach that evaluates risk as a function of:

- Likelihood of occurrence of a hazard
- Consequence/Impact on exposed systems

Each identified risk is assessed and categorized as:

- Low
- Medium
- High
- Very High

This approach allows for prioritization of risks to inform planning, investment, and climate adaptation strategies within Juja Municipality.

4.3 Climate Risk Matrix

The Climate Risk Matrix provides a summary of the key climate risks affecting Juja Municipality based on the interaction between identified hazards, levels of exposure, and vulnerability of affected systems. The matrix evaluates each risk in terms of its likelihood of occurrence and potential impact, allowing for prioritization of risks across different sectors.

This assessment highlights the most critical climate risks requiring urgent attention, particularly those with high likelihood and severe consequences for infrastructure, livelihoods, public health, and environmental systems.

Table 8: *Climate Risk Matrix for Juja Municipality*

Hazard	Exposure	Vulnerability	Likelihood	Impact	Risk Level
Flooding (Gachororo, Kimbo, underpass etc.)	High	High	High	High	Very High
Water Stress / Drought	High	High	High	High	Very High
Heat Stress	High	Medium-High	High	Medium-High	High
Quarry-related Risks	High	High	Medium-High	High	High
Erosion (Theta River areas)	Medium	Medium	Medium	Medium	Medium

The Climate Risk Matrix indicates that flooding and water stress are the most critical risks facing Juja Municipality, both classified as **very high risk** due to their widespread impacts and high frequency of occurrence. These risks affect multiple sectors simultaneously, including transport, water supply, public health, and economic activities.

Heat stress and quarry-related hazards are also identified as **high-risk**, with significant implications for human health, safety, and environmental sustainability. While erosion presents a comparatively lower risk, it remains an important concern in specific areas, particularly along riverbanks such as the Theta River, where ongoing land degradation may increase future vulnerability.

Overall, the matrix underscores the need for targeted and integrated adaptation measures, with priority given to high and very high-risk areas and sectors. These findings form the basis for the adaptation strategies outlined in the subsequent section.

4.4 Key Climate Risks

4.4.1 Flooding Risk

Flooding represents one of the most critical climate risks in Juja Municipality, particularly in densely populated and low-lying areas such as Gachororo, Kimbo, and sections along the Thika Superhighway.

The combination of high rainfall intensity, inadequate drainage infrastructure, and poor solid waste management significantly increases flood risk. Blocked drainage systems—often due to unmanaged waste—further exacerbate water accumulation during storm events.

Flood impacts include:

- Damage to roads and infrastructure
- Disruption of transport and economic activities
- Increased risk of waterborne diseases
- Safety risks, particularly in areas near open quarries

4.4.2 Water Stress and Drought Risk

Water stress is a municipality-wide systemic risk, affecting all wards within Juja.

Dependence on piped water systems managed by RUJUWASCO and THIWASCO, combined with increasing demand and climate variability, has resulted in frequent water rationing.

Key impacts include:

- Reduced access to safe water
- Increased cost of water for households and businesses
- Reduced agricultural productivity
- Heightened public health risks

4.4.3 Heat Stress Risk

Rising temperatures and urban heat effects pose a growing risk, particularly in densely built areas such as Juja Town, Witeithie, and Gachororo.

Heat stress affects:

- Human health (especially children and the elderly)
- Labor productivity
- Water demand

Although not as immediately visible as flooding, heat stress represents a slow-onset but significant risk that will intensify over time.

4.4.4 Quarry-Related Risks

Quarry-related hazards are a distinct and locally significant risk in Juja Municipality.

Abandoned and poorly rehabilitated quarry sites present multiple dangers:

- Water accumulation leading to drowning risks
- Ground instability and potential collapse
- Increased hazard during heavy rainfall events

These risks disproportionately affect:

- Children
- Youth engaged in quarrying
- Nearby residential communities

The lack of regulation, fencing, and rehabilitation makes this a high-priority safety and environmental concern.

4.4.5 Erosion and Environmental Degradation

Encroachment along riverbanks, particularly near the Theta River, has increased exposure to erosion and localized land degradation.

While currently a moderate risk, continued environmental degradation could:

- Increase flood intensity
- Reduce natural drainage capacity
- Lead to long-term land instability

4.5 Priority Climate Risks

Based on the assessment, the following risks are identified as priority areas for intervention:

1. Flooding and drainage failure
2. Water stress and unreliable supply
3. Quarry-related safety and environmental risks
4. Heat stress in high-density urban areas

These risks require urgent and coordinated action due to their high likelihood and significant impact on the municipality.

4.6 Risk Interactions and Compounding Effects

Climate risks in Juja Municipality are interconnected and often reinforce one another.

For example:

- Poor solid waste management contributes to blocked drainage, worsening flooding
- Flooding increases contamination of water sources, compounding public health risks
- Drought increases pressure on water systems, which are already strained by population growth
- Quarry sites amplify flood risks through water accumulation

Understanding these interactions is essential for designing integrated and effective climate resilience strategies.

5. Climate Adaptation Measures and Action Plan

5.1 Overview

This section outlines priority climate adaptation measures aimed at reducing vulnerability and enhancing resilience in Juja Municipality. The proposed actions are based on the key risks identified in Section 4, including flooding, water stress, heat stress, and quarry-related hazards.

The measures focus on strengthening infrastructure, improving environmental management, enhancing service delivery, and promoting community-based resilience. Implementation will require coordinated efforts among the County Government, the Municipal Board, utility

providers such as RUJUWASCO and THIWASCO, and other stakeholders including communities and the private sector.

5.2 Adaptation Strategies by Risk Area

5.2.1 Flood Risk Management

To address flooding in hotspots such as Gachororo, Kimbo, and the Juja underpass, the following measures are proposed:

- Rehabilitation and expansion of stormwater drainage systems
- Regular desilting and maintenance of drainage channels
- Enforcement of solid waste management regulations to prevent blockage
- Protection and restoration of natural drainage pathways
- Installation of early warning systems in flood-prone areas

5.2.2 Water Supply and Drought Management

To reduce water stress across all wards:

- Expansion of water supply infrastructure and storage capacity
- Promotion of rainwater harvesting at household and institutional levels
- Reduction of non-revenue water (leakages and illegal connections)
- Strengthening coordination with RUJUWASCO and THIWASCO
- Promotion of water conservation practices

5.2.3 Heat Stress Mitigation

To address rising temperatures and urban heat effects:

- Increase urban tree planting and green spaces
- Promote green infrastructure in new developments
- Encourage use of reflective and climate-sensitive building materials
- Protect existing open spaces

5.2.4 Quarry Risk Management

Given the significant risks posed by abandoned and filled quarries:

- Mapping and inventory of all quarry sites
- Fencing and securing hazardous sites
- Rehabilitation and restoration of abandoned quarries
- Enforcement of environmental regulations for quarry operators
- Public awareness campaigns on quarry safety

5.2.5 Environmental Management and Erosion Control

- Protection of riparian zones along rivers such as Theta River
- Enforcement against encroachment on environmentally sensitive areas
- Promotion of soil conservation practices
- Restoration of degraded ecosystems

5.3 Climate Adaptation Action Plan

The Climate Adaptation Action Plan for Juja Municipality outlines a set of prioritized interventions designed to address the key climate risks identified in this assessment. The plan translates risk analysis into practical actions that can be implemented over the short, medium, and long term to enhance resilience across sectors.

The proposed actions focus on critical areas including flood risk management, water supply improvement, heat stress mitigation, quarry safety, environmental protection, and solid waste management. These interventions are aligned with existing institutional mandates and are intended to strengthen ongoing efforts by the Municipality and Kiambu County Government.

Implementation of the action plan will require coordinated efforts among multiple stakeholders, including municipal departments, county agencies, utility providers such as RUJUWASCO and THIWASCO, national regulatory bodies, and local communities. Each action has been assigned a responsible entity and indicative timeframe to support planning, accountability, and effective execution.

The action plan is intended to serve as a flexible and evolving framework that can be updated over time in response to emerging climate risks, new data, and changing development priorities within Juja Municipality.

Table 9: Climate Adaptation Action Plan for Juja Municipality

Goal Area	Objective	Key Actions	Timeframe	Responsible Entity
Flood Management	Reduce flood risk in hotspots	Upgrade drainage, desilt channels, enforce waste control	Short–Medium Term	Municipality, County Govt
Water Supply	Improve water reliability	Expand supply, promote rainwater harvesting, reduce losses	Short–Long Term	RUJUWASCO, THIWASCO, County Govt
Heat Mitigation	Reduce urban heat effects	Tree planting, green spaces, climate-sensitive planning	Medium–Long Term	Municipality, County Govt
Quarry Safety	Reduce risks from quarries	Mapping, fencing, rehabilitation, enforcement	Short–Medium Term	County Govt, NEMA
Environmental Protection	Protect ecosystems	Riparian restoration, erosion control	Medium–Long Term	Municipality, County Govt
Solid Waste Management	Improve drainage and sanitation	Strengthen waste collection, reduce illegal dumping	Short Term	Municipality

5.4 Implementation Considerations

Effective implementation of the proposed adaptation measures will depend on several key factors:

- **Institutional coordination:** Collaboration between municipal, county, and national agencies is essential
- **Financing:** Adequate budget allocation and access to climate financing mechanisms
- **Community engagement:** Active involvement of local communities in planning and implementation

- **Enforcement:** Strengthening compliance with environmental and land-use regulations
- **Capacity building:** Enhancing technical and institutional capacity for climate planning

5.5 Monitoring and Evaluation

To ensure the effectiveness of adaptation measures, a monitoring and evaluation (M&E) framework should be established. This should include:

- Clear indicators for each intervention
- Regular progress reviews
- Data collection on climate impacts and response outcomes
- Reporting mechanisms to relevant authorities

6. Conclusion

Juja Municipality is increasingly exposed to a range of climate-related risks, particularly flooding, water stress, heat stress, and quarry-related hazards. These risks are driven by a combination of climate variability and rapid urbanization, which has placed significant pressure on infrastructure, environmental systems, and service delivery.

The assessment highlights that high exposure and vulnerability across key sectors—including population, infrastructure, water supply, and the environment—are likely to intensify the impacts of climate hazards if no action is taken. Informal settlements, inadequate drainage systems, water supply constraints, and environmental degradation further compound these risks.

However, the analysis also identifies clear opportunities for strengthening resilience through targeted and integrated adaptation measures. Improving drainage infrastructure, enhancing water supply systems, promoting sustainable land-use planning, rehabilitating quarry sites, and strengthening environmental management can significantly reduce climate risks.

Effective implementation of the proposed Climate Adaptation Action Plan will require strong coordination among the Kiambu County Government, Juja Municipal Board, utility providers, national agencies, and local communities. Inclusive participation, adequate financing, and continuous monitoring will be essential to ensure long-term sustainability and impact.

By integrating climate risk considerations into urban planning and development, Juja Municipality can enhance its resilience, protect livelihoods, and support sustainable and inclusive growth in the face of a changing climate.

References

- World Bank Group. (n.d.). *Climate Change Knowledge Portal*. Retrieved from <https://climateknowledgeportal.worldbank.org/>
- Kenya Meteorological Department. (n.d.). *Climate Data and Weather Information*. Nairobi, Kenya.
- Intergovernmental Authority on Development Climate Prediction and Applications Centre (ICPAC). (n.d.). *Climate Monitoring and Forecasting Products*. Retrieved from <https://www.icpac.net/>
- Kiambu County Government. (2023). *Kiambu County Integrated Development Plan (CIDP)*.
- Kiambu County Government. (n.d.). *Participatory Climate Risk Assessment Report*.
- National Environment Management Authority. (n.d.). *Environmental Guidelines and Regulations*. Nairobi, Kenya.
- United Nations Framework Convention on Climate Change. (n.d.). *Climate Change Resources*. Retrieved from <https://unfccc.int/>
- Ruiru-Juja Water and Sewerage Company. (n.d.). *Water Supply and Service Information*.
- Thika Water and Sewerage Company. (n.d.). *Water Supply and Service Information*.