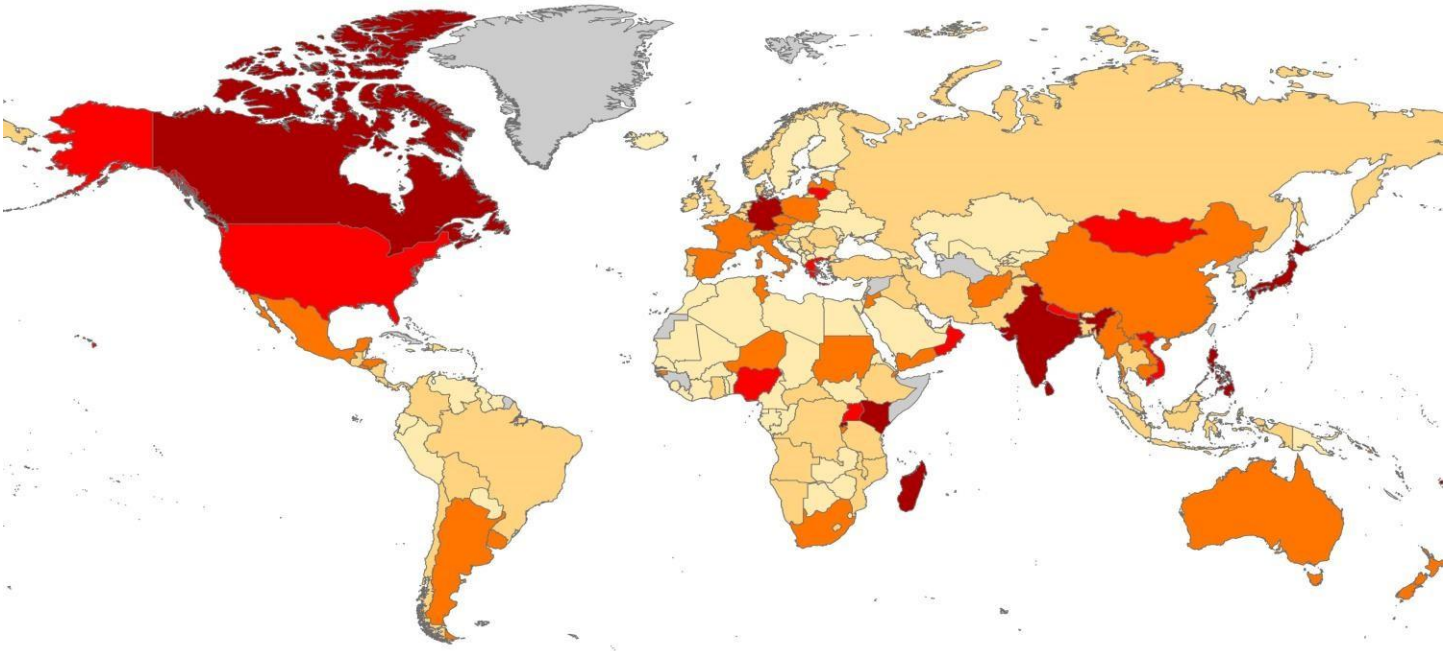

KIRINYAGA COUNTY

PARTICIPATORY CLIMATE RISK ASSESSMENT

REPORT

MAY 2023

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DEFINITION OF TERMS

Climate change refers to a change in the climate system that is caused by significant changes in the concentration of greenhouse gases due to human activities, and which is in addition to the natural climate change that has been observed during a considerable period.

Adaptation means adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

Greenhouse gases (GHGs) are gases that absorb and emit radiant energy within the thermal infrared range. The main GHGs measured in a GHG inventory are, carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), Sulphur hexafluoride (SF6) and nitrogen trifluoride (NF3).

Mitigation refers to human interventions to prevent or slow down atmospheric GHG concentrations by limiting current or future emissions, and/or enhancing potential sinks for greenhouse gases.

Resilience refers to the capacity of social, economic and environmental systems to cope with a hazardous event, trend, or disturbance. It is manifested through responding or reorganizing in ways that assert the essential function, identity, and

structure of the system, while also maintaining the capacity for adaptation, learning and transformation

Vulnerability refers to the propensity or predisposition to be adversely affected. It encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm, and lack of capacity to cope and adapt.

ACRONYMS

CAIP	County Aggregation and Industrial Park
CCAP	County Climate Change Action Plan
CDD	Cool Day Degree
CIDP	County Integrated Development Plan
FLLoCA	Financing Locally Led Climate Action
GHG	Green House Gas
KFS	Kenya Forestry Service
KMD	Kenya Meteorological Department

KNBS Kenya National Bureau of Statistics

LGP Length of the Growing Period

NCCAP National Climate Change Action Plan

NDC Nationally Determined Contributions

NEMA National Environmental Management Authority

PCRA Participatory Climate Risk Assessment

UNCED United Nations Conference on Environment and Development

UNFCC United Nations Framework Convention

VMG Vulnerable and Marginalized Groups

FOREWORD

The Department of Environment, Energy, Climate Change, Natural Resources, Water & Irrigation aims to integrate climate actions into sustainable development and create a low-carbon, climate-resilient economy in Kirinyaga. This report emphasizes the importance of food and nutrition security, income generation, employment creation, savings and investments, and export earnings for the county's development agenda. To achieve the goal of food and nutrition security, the county government is implementing the Financially Locally-led Climate Action

program in collaboration with the National Treasury. The program aims to enhance the resilience of vulnerable and marginalized groups, including youth, women, and people with disabilities across all 47 counties, while also providing immediate and effective responses during crises or emergencies.

Kirinyaga's economy relies heavily on agriculture and is highly susceptible to the impacts of climate change and extreme weather events. The Kenya ClimateSmart Agriculture (CSA) strategy and the country's commitments to the United Nations Framework Convention on Climate Change (UNFCCC) outline responses to cope with these risks. In 2023, the county government developed the Kirinyaga County Climate Change Policy, Climate Change Act, and associated regulations, recognizing the significance of climate change on the county's development. These initiatives aim to incorporate climate change perspectives into county–level programs and development plans, with a participatory approach targeting vulnerable and marginalized groups.

The Department has developed a participatory county climate risk report through consultations with ward representatives, government agencies, civil society groups, community organizations, private sector, academia, and representatives of vulnerable and marginalized groups. This report, supported by the Financially

Locally–led Climate Action program, aims to inform the county government and stakeholders about climate change risks and facilitate their

integration into the county's climate change plan. It provides information on current and potential climate scenarios, vulnerabilities, and risks for key actors, as well as the policy landscape and institutional capacity for delivering adaptation programs.

The report also presents adaptation and risk reduction options to transform and enhance agricultural systems, increase productivity, build resilience among smallholder farmers, and mitigate climate change impacts. The adoption of climate–smart technologies and improved practices is crucial for achieving triple wins: increased productivity, enhanced resilience, and reduced greenhouse gas emissions. It is essential for all stakeholders to cooperate and support these efforts to ensure Kirinyaga becomes a food and nutrition secure county, fostering socio–economic development and improving the livelihoods of its residents.

VERONICA W. WAWERU
COUNTY EXECUTIVE COMMITTEE MEMBER
ENVIRONMENT, ENERGY, CLIMATE CHANGE, NATURAL RESOURCES, WATER & IRRIGATION

ACKNOWLEDGEMENT

We acknowledge the Governor of Kirinyaga County Government H.E. Ann Mumbi Waiguru EGH and her entire County Executive Committee Members for the immense support towards the development of the Kirinyaga County Participatory Climate Risk Assessment report. The collective efforts in the development of this report cannot be underscored as it has pulled the efforts of over 500 consultations including meetings, workshops for capacity building and designing this report.

The department wishes to thank the technical working group led by the Chief officer, Environment, Energy, Climate Change and Natural Resources Ms. Maureen

Muthoni Mwangi that the process of participatory climate risk assessment roadmap was designed, identification of the key stakeholders and representation of the Vulnerable and marginalized groups and ensured the overall coordination in conjunction with the climate change unit of the county government including Kaara Muriithi, Deputy Director Climate Change Adaptation, Dr. Michael Ndwiga, Doreen Mwangi –Director Gender, James Gathura–County Director Meteorology, Economists Naomi Mumbi, George Macharia, Sylvester Njau, Physical Planner Esther Frinah Wambui and Francis Ng'ang'a — Chief Agricultural Officer for the delivery of this report. We would specially thank the department of Agriculture, livestock production and Fisheries for their immense support to the development of this report who through their partnership that we were able to consult with the community driven development committees who represent the agricultural livelihoods in all the wards in the county.

The department would like to thank the members of the society who have been part of this journey. These are the community representatives from all wards who committed their time for the identification of the climate risks and hazards in the community consultations to be part of this report. The civil society organizations, community–based organizations, national and county government departments and

agencies, private sector especially commercial banks, representatives of the vulnerable and marginalized were key actors in the deliberations for this report

Finally, the department wishes to thank the National Treasury for their invaluable guidance and facilitation towards the development of this report. It is through their partnership that the department was able to host participatory processes both at the ward (community) level and at the county level. This ensured citizen centered approach in the development of this report with clear emphasis to the vulnerable and the marginalized groups in our communities.

MAUREEN MUTHONI MWANGI
CHIEF OFFICER – ENVIRONMENT, ENERGY,CLIMATE CHANGE & NATURAL RESOURCES
KIRINYAGA COUNTY

EXECUTIVE SUMMARY

Kirinyaga County is one among the 45 Counties in Kenya that qualified for funding under the Financing Locally Led Climate Action – FLLoCA. It covers a total area of 1478 km^2, of which 308 km^2 is forest cover. The county has a population of 610,411 people. It lies between 1,158 meters and 5,380 meters above the sea level explain the highland, middle land and low land ecological zones. The county has six rivers namely Sagana, Nyamindi, Rupingazi, Thiba, Ragati and Rwamuthambi all channeled to Tana River. The county has five constituencies namely Mwea, Gichugu (Kirinyaga East), Ndia (Kirinyaga West), and Kirinyaga Central.

The County Government of Kirinyaga commits to the global and national climate laws and policies which mainstreamed within the county–based acts of parliament, and policies. A country's readiness to climate financing is often determined by the

potential to establish a stable framework that aligns with the international policy frameworks. Kirinyaga County, having committed and aligned its Climate change Act (2023), Climate Change Framework Policy (2023) and with the Kenya Climate Change Act (2016), the United Nations Framework Convention (UNFCC).

Kirinyaga County is one among the 45 counties that are countries that qualified for the FLLoCA grant. This grant makes it a prerequisite requirement that for the county must engage in a participatory climate risk assessment exercise in a bid to assess and understand the climate stressors, vulnerabilities and risks faced by the community with regards to climate change. It also establishes the resilience and adaptation measures that have been traditionally used and the alternative resilience and adaptation activities that are likely to boost the level of resilience. This report is a product of a 20–ward climate change risk assessment reports.

CONTEXT OF THE PARTICIPATORY CLIMATE RISK ASSESSMENT

1.1 Background

Kirinyaga County is one of the 47 counties in Kenya located between latitudes 001' and 00 40' South and longitudes 37° and 38° East. The county borders Nyeri County to the North West, Murang'a County to the West and Embu County to the East and South and also boarder small part of Machakos County.

Kirinyaga County has four constituencies and twenty elective wards (Figure 1).

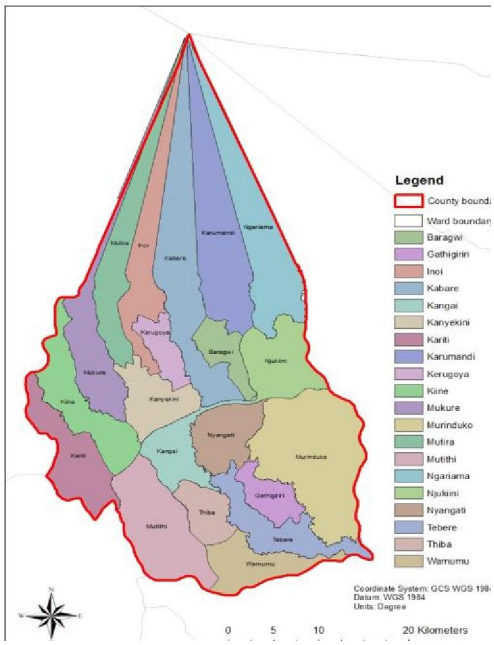


Figure 1: Kirinyaga Wards

The county covers an are kilometers of which 308.2 km^2 are under forest cover and the total land area under agricultural production is 801.7 km^2 (KNBS, 2019). Kirinyaga County is home to 610,411 people. The county has three ecological zones; the lowland areas that fall between 1158 meters to 2000 meters above sea level, the midland areas that lie between 2000 meters to 3400 meters above sea level and the highland comprising areas over 3400m above sea level. The lowland area is characterized by plains that cover most of Mwea constituency. The

midland area includes Ndia, Gichugu and Kirinyaga Central constituencies. The highland area covers the upper areas of Ndia, Gichugu and Central constituencies and the whole of the mountain area. The county has six major rivers namely; Sagana, Nyamindi, Rupingazi, Thiba, Rwamuthambi and Ragati, all of which drain into the Tana River. These rivers are the principal source of water in the county.

The county has a tropical climate and an equatorial rainfall pattern. The climatic condition is influenced by the county position along the equator and its position on the windward side of Mt Kenya. The county has two rainy seasons, the long rains which average 2,146 mm and occur between the months of March to May and the short rains which average 1,212 mm and occur between the months of October to November. The amount of rainfall declines from the high–altitude slopes of Mt. Kenya towards the Semi–arid zones in the eastern part of Mwea constituency. The temperature ranges from a mean of 8.1°C in the upper zones to 30.3°C in the lower zones during the hot season.

Climate change has increased the frequency and magnitude of extreme weather events in Kirinyaga causing

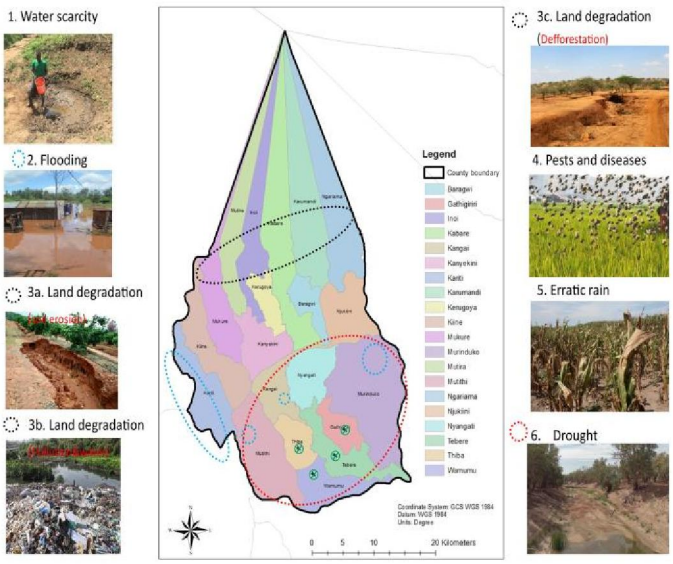


Figure 2: Some Hazards in Kirinyaga

water scarcity, flooding, land degradation (deforestation, pollution, and soil erosion), pest and diseases, erratic rains, drought among other adverse impacts (Figure 2). An example is the torrential rains and severe flooding from

March to May 2018 that devastated communities that were already struggling to recover from a prolonged drought. Climate change is likely to negatively impact Kirinyaga's future development.

The county government has instituted efforts towards mainstreaming climate change in development planning and implementation. The county has developed the third–generation County Integrated Development Plan (CIDP) which has embedded the green economy considerations as outlined in the international climate change treaties and national level laws and policies.

The county government has also gazetted a department and a County executive Member to coordinate climate change matters in the county. To guide planning and implementation of climate action, the county government has adopted the Kirinyaga County Climate Change Policy 2023 and has enacted the Kirinyaga County Climate Change Act 2023 and subsequent regulations to offer the financial resources required to implement climate actions. Earlier, the county government has implemented various projects in Agroforestry (hass avocado and macadamia)

and Sustainable Land Management (SLM) practices to improve the agricultural land resilience to climate change.

1.2 Policy Context

Climate change is a global problem which demands a global solution, and Kenya is an active player in international efforts. The international response to climate change is founded upon the **United Nations Framework Convention on Climate Change** (UNFCCC) which entered into force in 1994. Kenya signed the UNFCCC on 12th June 1992 and ratified the Convention on 30th August 1994. Kenya is a key player in the global climate change governance system and participates in the meetings of the Conference of the Parties (COP) to the UNFCCC, articulating the national interest and the country's position during international negotiations.

The **Kyoto Protocol**, a greenhouse gas emissions reduction treaty linked to the UNFCCC, was adopted by the COP in 1997 and entered into force in 2005. The Kyoto Protocol is an international agreement that commits developed countries and countries in transition to market economics to reduce their overall GHG emissions. The Kyoto Protocol created the Clean Development Mechanism (CDM) under which developing country projects that reduced emissions and contributed to sustainable development earned credits that could be sold to countries or

companies with a commitment to reduce emissions. Kenya ratified the Kyoto Protocol on 25th February 2005.

The **Paris Agreement** entered into force internationally on 4th November 2016, thirty days after 5th October 2016, and the date on which the threshold for entry into force was achieved. The Paris Agreement was ratified by Kenya on 26th December 2016 under section 9(1) of the Treaty Making and Ratification Act, and entered into force for Kenya on 27th January 2017. As set out in Article 2(6), and read with Article 94(5) of the Constitution of Kenya (2010), the Paris Agreement now forms part of the law of Kenya.

At the national level, Kenya has enacted policies and legal frameworks for climate change. For instance, the **Constitution of Kenya (2010)** gives foundation of the institutional and legal framework for climate change action. Article 10 sets out national values and principles of governance, such as sustainable development, devolution of government, and public participation, which are mandatory when making or implementing any law or public policy decisions, including those relating to climate change.

Article 42 provides for the right to a clean and healthy environment for every Kenyan, which includes the right to have the environment protected for the benefit of present and future generations through legislative and other measures.

County Governments have a key delivery role in implementing the Climate Change Act, 2016, having jurisdiction, as set out in the Fourth Schedule (Part 2) of the Constitution, over sectors relevant to climate change action, such as agriculture, soil and water conservation, forestry, water and sanitation, tourism, and health.

The County Government Act of 2012, which has been adapted to the Constitution's state and county structure in relation to devolution, declares the CIDP to be central to the County's administration and prohibits any public spending outside of the plan. The Act clarifies that the CIDP is to be broken down into the economic plan, physical plan, social environmental plan and spatial plan. Kirinyaga County developed a CIDP that runs from 2023–2027.

Kenya Vision 2030 and its Medium-Term Plans is the country's development blueprint, recognized climate change as a risk that could slow the country's development. Climate change actions were identified in the Second Medium Term Plan (MTP) (2013–2017). The Third Medium Term Plan (2018–2022) recognized climate change as a crosscutting thematic area, and mainstreamed climate change actions in sector plans.

Bottom-Up Economic Transformation Agenda (BETA) outlines the government commitments to establish 5 million acres (20,000 km2) agroforestry woodlots in drylands, modernize and commercialize the charcoal value chain, specifically the

adoption of modern kilns; decriminalize the charcoal trade, support scaling up of clean cooking technologies, and promote youth–owned and operated briquette–making enterprises where agricultural waste is available in commercially viable quantities (coffee waste, rice husks, maize cobs and coconut husks).

National Climate Change Response Strategy (2010) was the first national policy document on climate change. It seeks to advance the integration of climate change adaptation and mitigation into all government planning, budgeting, and development objectives. **National Climate Change Action Plan (2018–2022)** is a five–year plan that seeks to further Kenya's development goals in a low carbon climate resilient manner. The plan has set out adaptation, mitigation, and enabling actions. **Kenya's National Adaptation Plan 2015–2030 (NAP)** was submitted to the UNFCCC in 2017. NAP provides a climate hazard and vulnerability assessment, and sets out priority adaptation actions in the 21planning sectors in MTP II.

Nationally Determined Contribution (NDC) (2016) domesticates the Paris Agreement of the UNFCCC and includes mitigation and adaptation contributions. In regard to adaptation, "Kenya will ensure enhanced resilience to climate change towards the attainment of Vision 2030, by mainstreaming climate change into Medium Term Plans (MTPs), and implementing adaptation actions. The mitigation contribution "seeks to abate Kenya's GHG emissions by 30% by 2030."

Achievement of Kenya's NDC is subject to international support in the form of finance, investment, technology development and transfer, and capacity development. The **Climate Change Act (No. 11 of 2016)** is the first comprehensive legal framework for climate change governance in Kenya. The objective of the Act is to "Enhance climate change resilience and low carbon development for sustainable development of Kenya. "The Act establishes the National Climate Change Council (Section 5), Climate Change Directorate (Section 9), and Climate Change Fund (Section 25).

Kenya Climate Smart Agriculture Strategy (KCSAS) (2017–2026) aims at helping Kenya adapt to climate change and build the resilience of agricultural systems, while minimizing GHG emissions. Planned actions will lead to enhanced food and nutritional security, and improved livelihoods. **Climate Risk Management Framework (2017)** integrates disaster risk reduction, climate change adaptation, and sustainable development, so that they are pursued as mutually supportive rather than stand–alone goals. It promotes an integrated climate risk management approach as a central part of policy and planning at National and County levels.

National Climate Change Framework Policy (2008) aims at ensuring the integration of climate change considerations into planning, budgeting, implementation, and decision making at the National and County levels, and across all sectors. **National**

Climate Finance Policy (2018) promotes the establishment of legal, institutional, and reporting frameworks for access to, and management of climate finance. The goal of the policy is to further Kenya's national development goals through enhanced mobilization of climate finance that contributes to low carbon climate resilient development goals.

At the county level, legal and policy frameworks include the **Kirinyaga County Integrated Development Plan (2023 – 2027)** that mainstreams climate change and addresses the impacts of climate change through their development activities. **Kirinyaga County Climate Change Policy** aims at ensuring the integration of climate change considerations into planning, budgeting, implementation, and decision–making by Kirinyaga County government across all sectors. **Kirinyaga County Climate Change Act, 2023** establishes the mechanism for coordination of climate actions by establishing county and ward climate change committees which institutionalizing delivery of climate actions up to the community level. The Act also establishes a county climate change fund to mobilize resources for climate action. This act establishes the requisite resources for delivery of adaptation and mitigation interventions in the county to enhance sustainability.

Kirinyaga County Solid Waste Management Act, 2021 establishes the guidelines towards solid waste management activities in the county to sustainably manage

the projected water streams especially with growing population especially in the urban areas. It bestows responsibilities to all waste management stakeholders including generators, transporters, county government, NEMA and the recyclers. It advocates for development of waste resource recovery facilities to create green jobs and minimize greenhouse gases form waste.

1.3 Purpose of the PCRA Report

The purpose of the Participatory Climate Risk Assessment (PCRA) report is to assess and understand the climate stressors, vulnerabilities, and risks faced by communities and other key actors in relation to climate change. It also informs the County Climate Change Action Plan (CCCAP). The report aims to achieve the following specific objectives:

a) Identify Climate Stressors

The PCRA process helps to identify and understand the climate stressors experienced by the community, such as changes in rainfall patterns or temperature. It highlights the specific hazards that the ward is facing and contributes to the understanding of vulnerability.

b) Assess Vulnerability and Risk

The report assesses who or what is vulnerable or at risk within the ward in relation to climate-related hazards. This includes identifying vulnerable aspects such as

agricultural investments, livelihoods, or infrastructure, and understanding the specific vulnerabilities they face.

c) Determine Location and Timing of Vulnerability

The PCRA report identifies where vulnerable people, ecosystems, infrastructure, and resources are located within the ward. It also examines when these vulnerabilities occur or are likely to occur, such as during dry periods or specific seasons.

d) Identify Factors Contributing to Vulnerability

The report explores the internal and external factors that contribute to the vulnerability of specific groups of people or resources. This may include factors like poor community cohesion or specific social and economic conditions that exacerbate vulnerability.

e) Assess Existing Actions and Their Effectiveness

The PCRA process examines the actions that people and communities are already taking to reduce their vulnerabilities to climate change. It evaluates the effectiveness of these actions in building resilience and reducing risks.

f) Evaluate Climate Stressors in the Context of Development

The report assesses the extent to which climate stressors, such as sea-level rise, act as barriers to development compared to non-climate stressors like population growth. This understanding helps prioritize interventions and resource allocation.

g) Prioritize Adaptation Options

Based on the findings of the PCRA, the report helps prioritize options for adaptation to the effects of climate variability and change. It identifies interventions and strategies that can enhance resilience and reduce vulnerability within the ward.

For purposes of ensuring robust understanding of the climate resilience, adaptation and mitigation measures at the local level the PCRA process was the preferred method of climate assessment because it allows those affected by climate hazards to understand their challenges and assess their own needs. It encourages stakeholders involved in climate issues within the ward to propose actions that can make them more resilient and seek external assistance from partners, government, and other stakeholders. The PCRA process helps generate ward-level climate actions that can inform the County Climate Change Action Plan (CCAP) and contribute to more effective and targeted climate change adaptation and mitigation efforts.

1.4 Key Steps in the County's PCRA Process

The PCRA process has a component of stakeholder analysis, public participation on emphasis for inclusion of the vulnerable groups (women, youth and PWDs) in the community who are adversely affected by climate change and are traditionally left out in development planning. The PCRA process is guided by the following principles:

The following are key aspects of the PCRA process; robust understanding of climate risk and uncertainty, collaborative action and resilience, investing in local capabilities, flexible programming and learning, addressing structural inequalities faced by women, youth, disabled and displaced people, marginalized people, appropriate subsidiarity, accountability and transparency, principle of reality– this is to lead the community to identify the issues that affect them at their community level and patient and predictable, climate funding for local action.

The PCRA process has two key phases as outlined:

Phase 1: Participatory Climate Change Risk Assessment

This is the first phase of the PCRA process and results in the development of a county climate risk assessment report, which identifies the key climate risks for the county as well as strategic investment areas for climate resilience, the process also support county sectorial or planning processes such as the County integrated

development plan. The process comprises of six steps which include constituting a team to lead the participatory process, the objective involves the formation of the cross-sectorial county technical working group. The cross sectorial included technical officers from climate change directorate, county finance and planning department, key department such as Agriculture, Environment, gender and the county directorate of meteorology (Figure 3). In addition, the team engaged interns mentored in different sectors. A wider consultative group was used to provide advice throughout the process.

Figure 3: Training of the Technical Working Group (TWG)

The second step the team undertook was a stakeholder analysis process/ mapping stakeholder, the objective was to identify all key stakeholders at county, sub-

county and ward levels who can contribute and should participate in the PCRA process, they include representatives of groups traditionally marginalized and vulnerable to the impacts of climate change, additionally, the step develops a stakeholder engagement strategy/ process for the key stakeholders identified.

At the ward level, Kirinyaga County established Community Development Committees in each ward under the Kirinyaga Wezesha structure. The committee comprises of representatives of community common interest groups involved in the main economic activities in each community which largely cover agricultural activities. These representatives were elected at the ward level which was drawn from four zones within the ward. The committees comprise of 13 members as follows; (a)12 members elected from the four zones within the ward (b)1 member representing the Vulnerable and Marginalized Groups (VMG) elected by VMG Common Interest groups in the ward and (c) Ward administrator as ex–officio to the committee.

The member elected to represent the VMG common interest groups may fall under the category of; a widow if a woman, a person living with disability, a person living with HIV and a youth. The election of these ward committee followed the two third gender rule. No ward committee has more than two–thirds of its membership is of the same gender.

The team also engaged the stakeholders at all levels, this is the third step with the objective to ensure that all stakeholders identified (communities and other key local actors), contribute to the PCRA process. At the ward level, the team organized and facilitated meeting to identify local climate risks and vulnerabilities and community priorities for climate action investments.

On the other hand, the team engaged the stakeholders in a workshop to collect data, the stakeholders were organized into table groups and presentations on the PCRA tools were presented. The team also consulted and reviewed the relevant national development, sectorial plans and climate resilience and adaptation documents. Other documents reviewed included the Kirinyaga CIDP 2023–2027, National climate change Action Plan 2018–2022, the Kenya climate smart Agriculture strategy 2017–2026 and the Kirinyaga County Risk profile.

A county multi– stakeholder climate risk assessment was held whose objective was to conduct a participatory and cross–sectorial holistic assessment of the current and likely future climate risks facing the county, the exposure, vulnerability, and adaptive capacity and to identify robust broad thematic adaptation investment areas that can address the current and future climate vulnerabilities of different vulnerable groups. The participants were derived from different sectors, they include; 10 county directors from relevant departments,

NEMA, KFS, WARA, CSOB, Kenya national chamber of commerce, banks, Managing directors from water service providers.

Figure 4: Tebere Ward Participants Identifying the Risks

The outcome of the PCRA process culminates to development of a participatory climate risk assessment report. The objective of the six and the last step is to outline the broad strategic adaptation planning priorities for the county over a five-year time frame. The substantive Climate Change Unit (CCU) which is a team nominated with suitable skills on report writing, analyzed and summarized information collected during the multi-stakeholder consultations.

Figure 5: Kirinyaga County Multi- Stakeholder Workshop

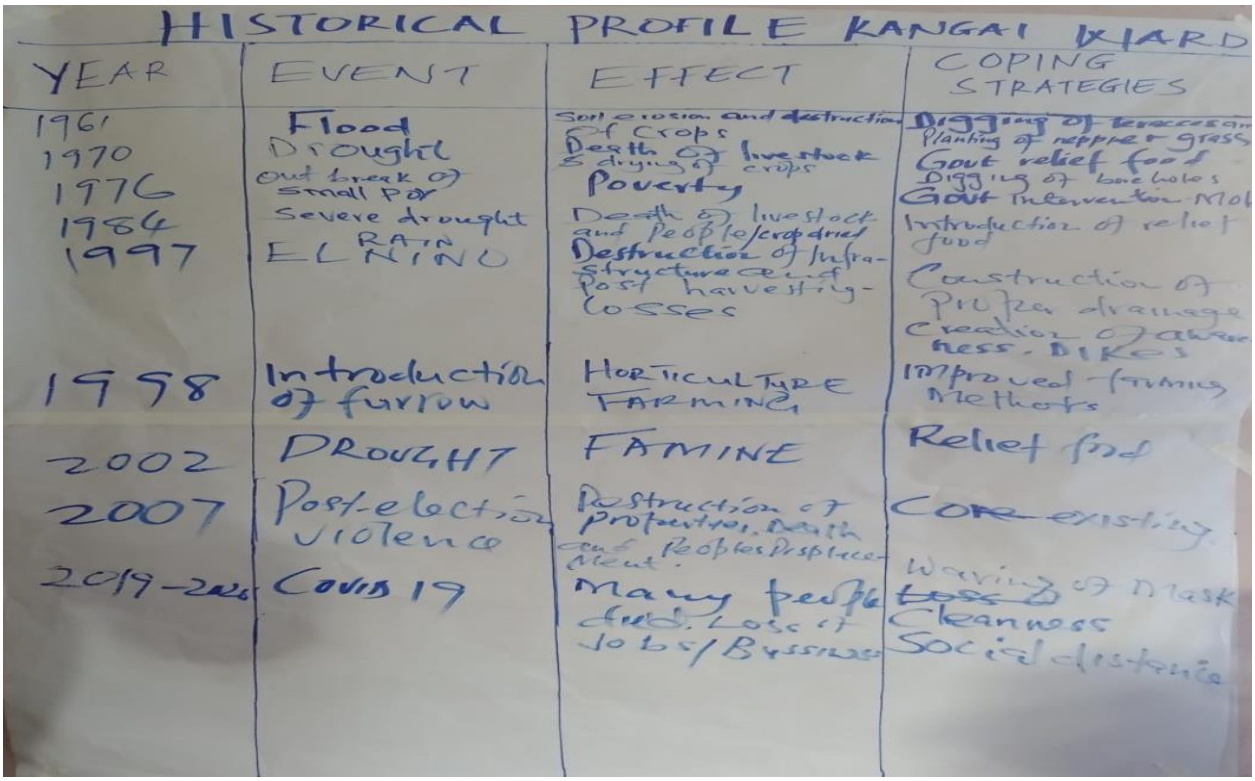
Phase 2: County Climate change Action plan

This phase focuses on the development of the participatory CCCAP and its adoption by the county Assembly. The CCCAP is a five-year action plan, which will identify specific county and ward-level investments for building resilience to climate change. The five-year action also includes annual investment plans which will be funded by the county climate change fund.

2.1 Current and Historical Climate Hazards and Trends

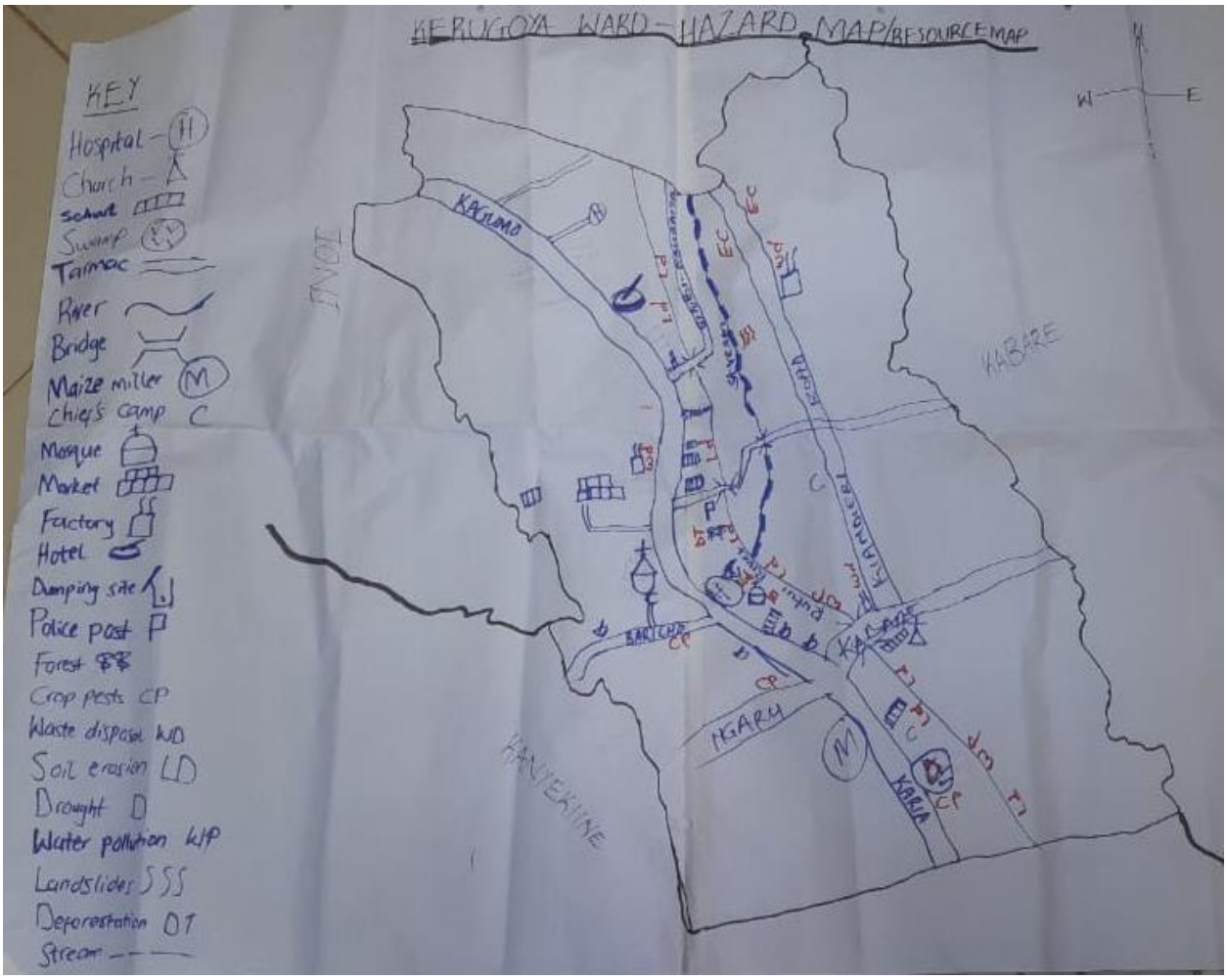
Kirinyaga county is profiled as one of the counties with a diverse ecological definition. During the community engagement process, the participants played an instrumental role in outlining the key climate hazards and risks that faced the communities. A clearer definition of hazards was established and later qualified with regards to whether the impacts were direct or indirect impacts on the productive systems, as well as, the livelihoods of the people. The conversation with the community members was guided through reflecting on the past trends and future projection with regards to main aspects such as temperature and precipitation. Responses drawn from the ward level communities and committees and data shared by the meteorological department confirmed the historical and current climate hazards.

Figure 6: Historical Profiling by Participants of Kangai Ward



Kirinyaga County is zoned into two distinct climatic zones where there is a highland and Arid and Semi-Arid Lands (ASAL) area. The average precipitation in Kirinyaga falls between 700—1400 mm implying that the higher the altitude, the higher the amount of rainfall. According to the participants and reports from the meteorological department, there is a directional spatial trend where the peak values are perceived to appear in the northern part of the county (Kirinyaga East, Kirinyaga Central and some parts of Kirinyaga West). This explains that there is a significant element of elevation in the county. On the other side, there is a significantly higher temperature in the lower sides of the County as compared to the northern parts.

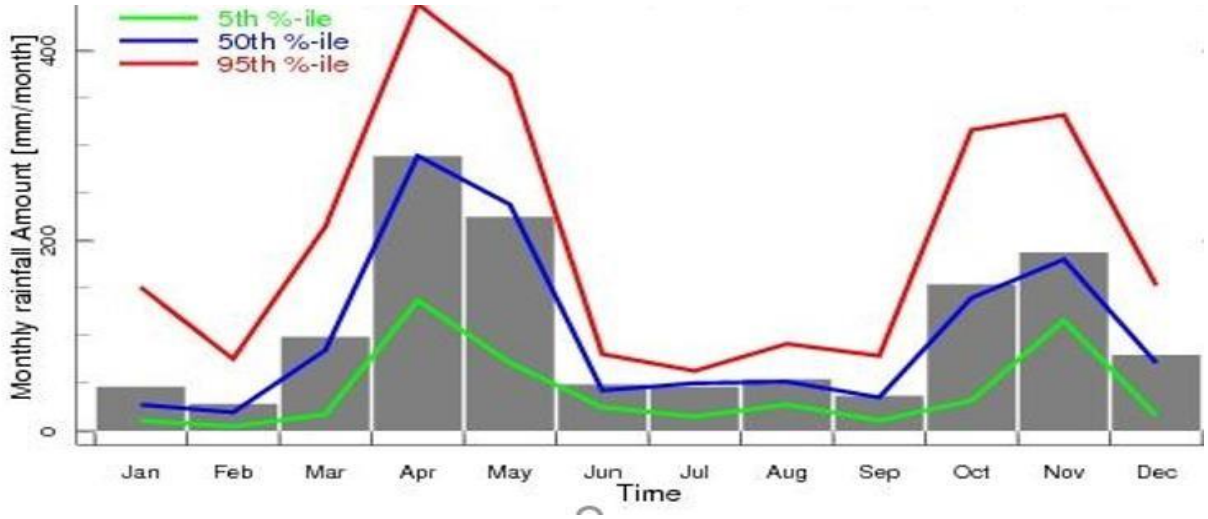
Figure 7: Hazard Map of Kerugoya Ward as Drawn by Community



In the county, the long rains season between March and May is considered to be wetter than the short rain season in October to December. There are seasons of dry spells which are stipulated at approximately 50mm of rainfall. These trends indicate that there has been a level of deviation with regards to the past. Since the year 1985, the rainfalls have gradually decreased, especially with regards to the long rains. It is projected that the trends of decreased precipitation may persist up to 2040 after which interventions may provoke gradually increase in rainfall. On the

other side the short rains have been increasing significantly towards the future. This has potential hazardous outcome in terms of increased drought periods, reduced crop yield and floods.

Figure 8: Monthly Rainfall Climatology 1983–2018



As a result of the changes in the Cool Day Degree CDD, the county is likely to experience low precipitation, and seasonal droughts. Hence, the unprecedented increased in precipitation in the county both in the past and the current period, the drought is likely to appear more commonly. In the past, the 95th percentile in terms of the daily precipitation was an indicator that there was heavy rainfall as a result of the wet days. One of the impacts has been increased soil erosion, degradation of soil quality due to erosion and increased instances of flooding in the lower regions of the county.

The county has also experienced gradually increasing instances of temperature to the extents of NT35, a clear indicator of heat stress. This is consistent in the lower or southern regions of the county, mainly constituting Mwea West and Mwea East (Mwea Sub–County). These heat stress moments are likely to take up to 2–3 weeks. According to the participants, the growing seasons in Kirinyaga have varied greatly, especially in the months of March and April. The growing seasons in the north have moved earlier by approximately one month whereas the growing seasons in the south have shifted to one month late. This has resulted in farmers opting to shift to the new trends in a bid to avoid crop loss.

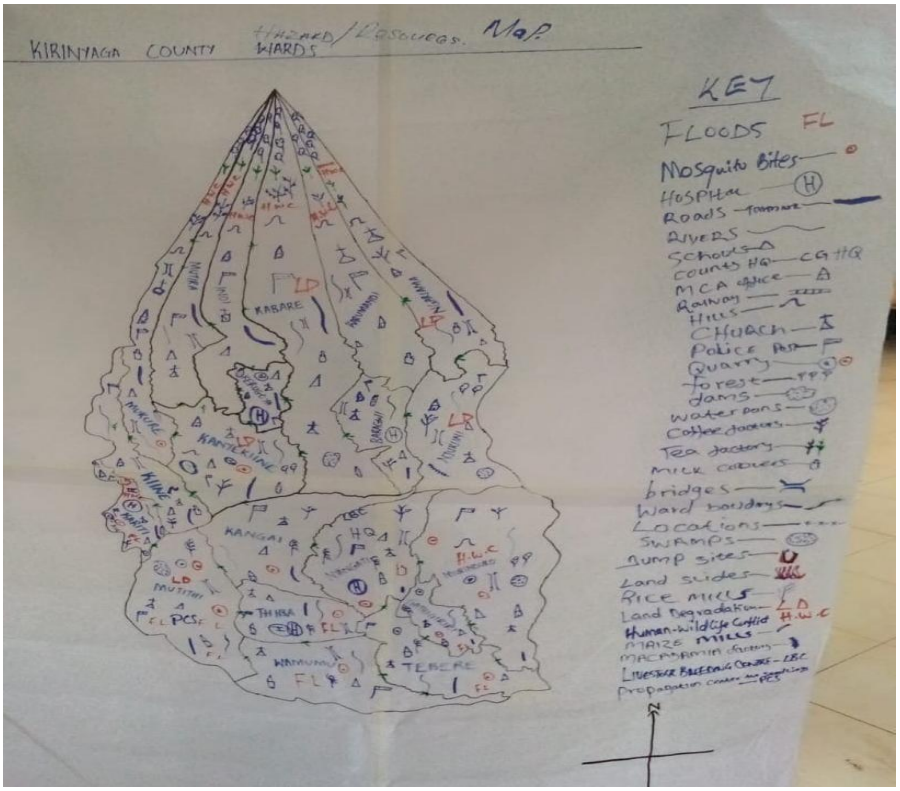


Figure 9: Hazard Map of Kirinyaga County as Drawn by Community

This map attempts to provide an overview of the extent to which the county is exposed

to climate hazards. The community was tasked with the role of identifying the county assets, identifying and zoning the hazard areas and outlining the socio–economic hazards and sources.

The participants further explained the climatic hazards and the extent in which they have impacted their lives, details that are well elaborated in the exposure and vulnerability profiles in the County.

2.2 Exposure and Vulnerability Profiles of the County

Vulnerability profiles are established to take into consideration the sources of social, economic and environmental marginality. The conversation in this context revolves around considerations regarding the link between the community, the specific environmental elements and the vulnerability and exposure by the ecosystem components. The data gathered to inform the exposure and vulnerability was acquired from the various tools. The discussion reflected on the integration of the underlying causes of vulnerability of assets, and ranking the assets in terms of the magnitude of vulnerability. A specific concept and concern on the socio–ecological perspective. Table 1 shows the results of the engagements regarding the exposures and vulnerabilities.

Table 1: Exposure and Vulnerability Profiles

Tool	Hazard	Vulnerability	Capacities identified
Hazzard Mapping	Drought	• Loss of life • Soil erosion, • Inaccessibility to clean and safe water • Food shortages • Human and animal death • Gender based violence (political and civil conflicts)	• Investing in watersaving Irrigation technologies • Training and building capacity in conservation farming • Planting drought resistant crops • Construction of water pans
	Land degradation (deforestation, soil erosion, landslides) and floods, pollution).	• Extinction of indigenous crop/tree varieties • Air and water pollution • Exposure to illness and disease • Destruction of property	• Water tower/catchment, and River conservation • Installation of dykes • Agro–forestry • Waste material recovery facility
	Floods	• Destruction of property and livelihood.	• Development of dykes • Conservation of rivers through planting of bamboos trees.

Tool	Hazard	Vulnerability	Capacities identified
	Land degradation (Pollution)	• Illnesses from disease–causing	• Waste material recovery facility

		Microorganisms	
Historical Timeline	Excess Precipitation, Flooding & Drought	• Food and water shortages, soil erosion • Loss of livelihood	• Post–harvest technologies (use of hematic bags) • Irrigation projects • Training in conservation farming
	Human–wildlife conflict (Birds and Monkeys)	• Injuries and loss of property (crops)	• Birds and monkey control mechanisms
Seasonal Calendar	Crop, livestock and human disease diseases and drought	• Loss of livestock/Loss of crop	• Climate smart farming • Use of indigenous knowledge to manage diseases • Training on the value chains
	Scarcity of water	• Inadequate water storage • Low water access	• Bulk water storage tanks at Sagana (Kariti and Kiine wards), • Investment in community water projects, • Invest in domestic water harvesting technologies

	Drought	• Poor crop yield	• Diversification of livelihood enterprises • Capacity and training
	Pests and diseases	• Reduced crop yield • Poor quality of yield • Diminished livelihoods.	• Integrated pest management system and Good Agricultural Practices (GAP)
Daily Clock	Drought	• Food insecurity, • Crop failure	• Diversification of livelihood enterprises • Capacity and training
Tool	**Hazard**	**Vulnerability**	**Capacities identified**
	Water crisis	• Inadequate water storage • Low water connectivity	• Establishment of bulk water storage facilities • Investment in community water projects, • Invest in domestic water harvesting

			technologies
	Human–wildlife conflicts	• Injuries and loss of property (crops)	• Birds and monkey control mechanisms

2.3 Differentiated Impacts of Climate Trends and Risks

The contemporary and historical climate trends that have resulted in specific risks affecting the community tend to have both direct and indirect impacts on the community. The hazards identified in order of intensity include water scarcity, flooding, land degradation (deforestation, pollution and soil erosion), pollution, erratic rains, drought and human–wildlife conflict. Table 2 presents different hazards and the direct, and indirect impacts of the hazards.

Table 2: Differentiated Impacts of Climate Trends and Risks

Hazard	Direct effects	Indirect effects
Water scarcity	• Inadequate water storage	• Poor sanitation and likelihood of suffering from water borne diseases
	• Low water connectivity	• Reduced quality of water • Increase in the cost of acquiring the water resource • Internal conflicts during the scramble for the

		water resource
Human wildlife conflict	• Interruption of human life/ livelihood – birds, hippos, monkeys, & wild snakes	• Economic distress (costs of treatment of the affected persons) • Unprecedented permanent disabilities • Loss of life • Reduction of household income
	• Damage of plants on farms	• Unprecedented instances of food shortage from reduced harvest • Increase in food price because of the reduced harvest • Loss of livelihood/ farmer income

Hazard	Direct effects	Indirect effects
	• Harm on livestock (chicken, goats etc)	• Reduction/Loss of income • Reduced/Loss of livestock
Pest and diseases (livestock and crops)	• Infestation on crops and livestock (affect the health of the crop)	• Reduced crop yield • Food insecurity • Loss of livelihood for the farmers and traders who rely on farm and animal products for business.
	• High cost of invasive control	• Reduced household income
	• Affect the health of the livestock	• Loss of livestock (death) • Reduced household income/ loss of livelihood

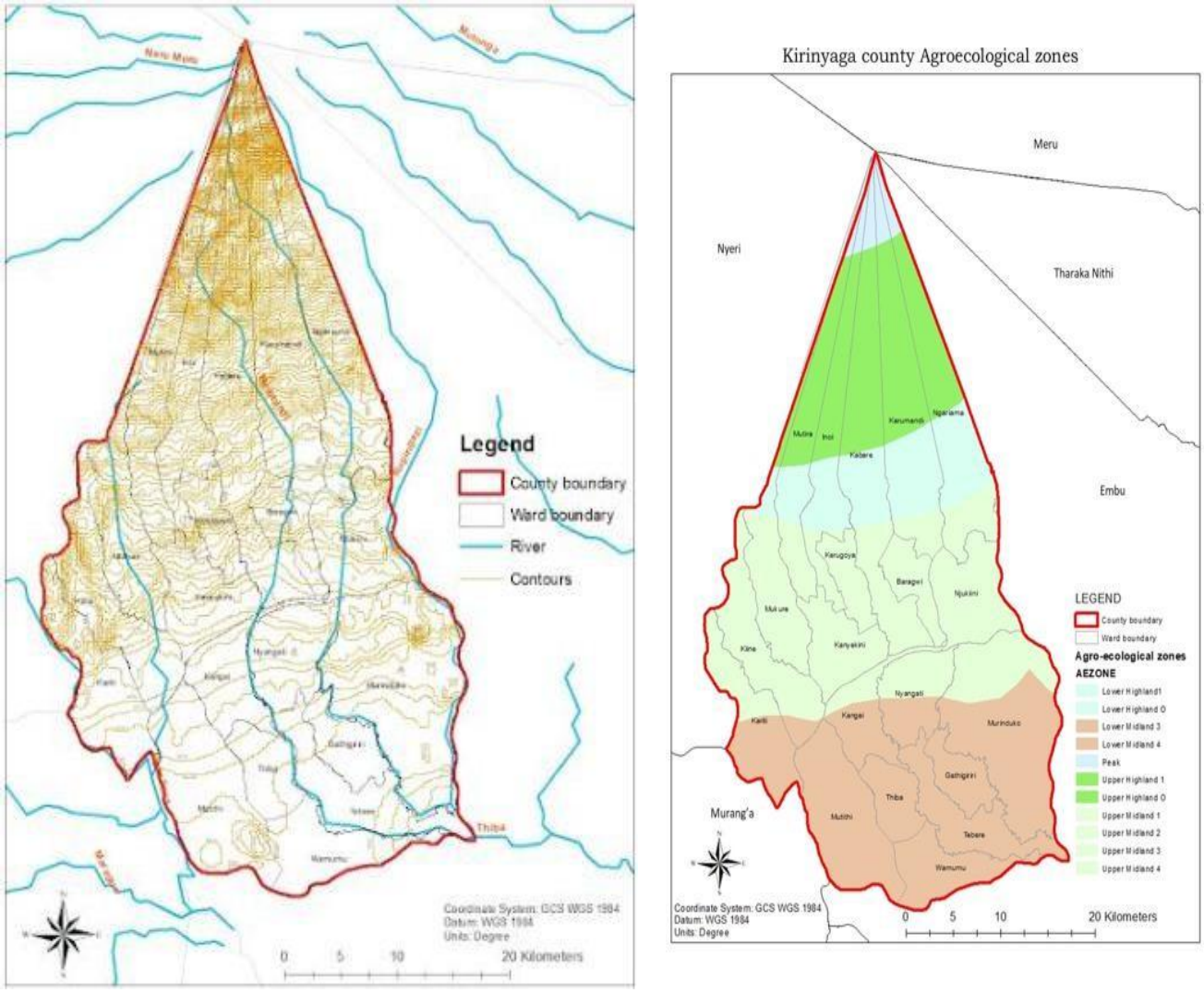
		• Reduced productivity of the livestock • Low market price for the animals
Erratic rains	• Loss/crop failure	• Reduced yield resulting in food/fodder shortage. • Reduced household income
	• Missed planting seasons	• Reduced productivity
Floods	• Loss of crops and livestock	• Reduced productivity/ reduced household income
	• Water scarcity	• Water rationing
	• Accelerated riverbank erosion	• Busting of riverbanks and flooding of riverbanks
Land degradation (pollution, deforestation, soil erosion)	• Public nuisance, • Air population, water pollution • Bleeding site for invasive insects, depleted quality of soils	• Contraction of vector–instigated infectious illness. • Impoverishment of the quality of air, water and land resources
Drought	• Retarded growth of crops/ Loss of crop	• Reduced harvest • Increase in food price • Loss of household income • Increased instances of mental instability as a result of losing crops or livestock (economic losses) • Increased immorality and early pregnancies

	• Loss of fodder crops	• Deterioration of animal health • Low market prices for livestock • Deaths of livestock • Loss of livelihood and reduction of household income • Low birth rates for livestock
Hazard	**Direct effects**	**Indirect effects**
		• Reduced milk production

2.4 Spatial Distribution Risks

The County government of Kirinyaga is defined into an average of three distinct Agro–ecological zones namely the Upper land, the mid–land and the low land. The county comprises of four sub–counties and twenty wards. It is important to point out that the spatial distribution of risk is easier reviewed from a ward level.

Figure 10: Spatial Distribution of Risk



First, the upper land constitutes of wards that are intensively covered by forests are have proximity to Mt. Kenya Forest. This is a tea growing zone, but also practice Agro–forestry where fruit trees such as avocado. The Agro–ecological zone is prone to hazards such as erratic rainfall, land degradation (soil erosion, deforestation, pollution) pest and diseases, and human–wildlife conflicts. A majority of these risks are high level risks since they expose the community to extreme vulnerabilities. The mid–land constitutes an averagely topographical and ecological zone. It is mainly coffee growing, but can still support mixed farming.

The key hazards facing the communities in this region include erratic rains, pest and Diseases (Livestock and plants), human–wildlife conflicts, water scarcity and land degradation (pollution, land degradation and deforestation). The lowland constitutes of wards in the low side of the county (Mwea Sub–County). The zone comprises of land used for mixed farming and an extensive irrigation land comprising of the designated Mwea–Tebere irrigation scheme and the Jua–Kali irrigation land (Figure 11 and table 3).

Figure 11: Map of Spatial Distribution of Risk

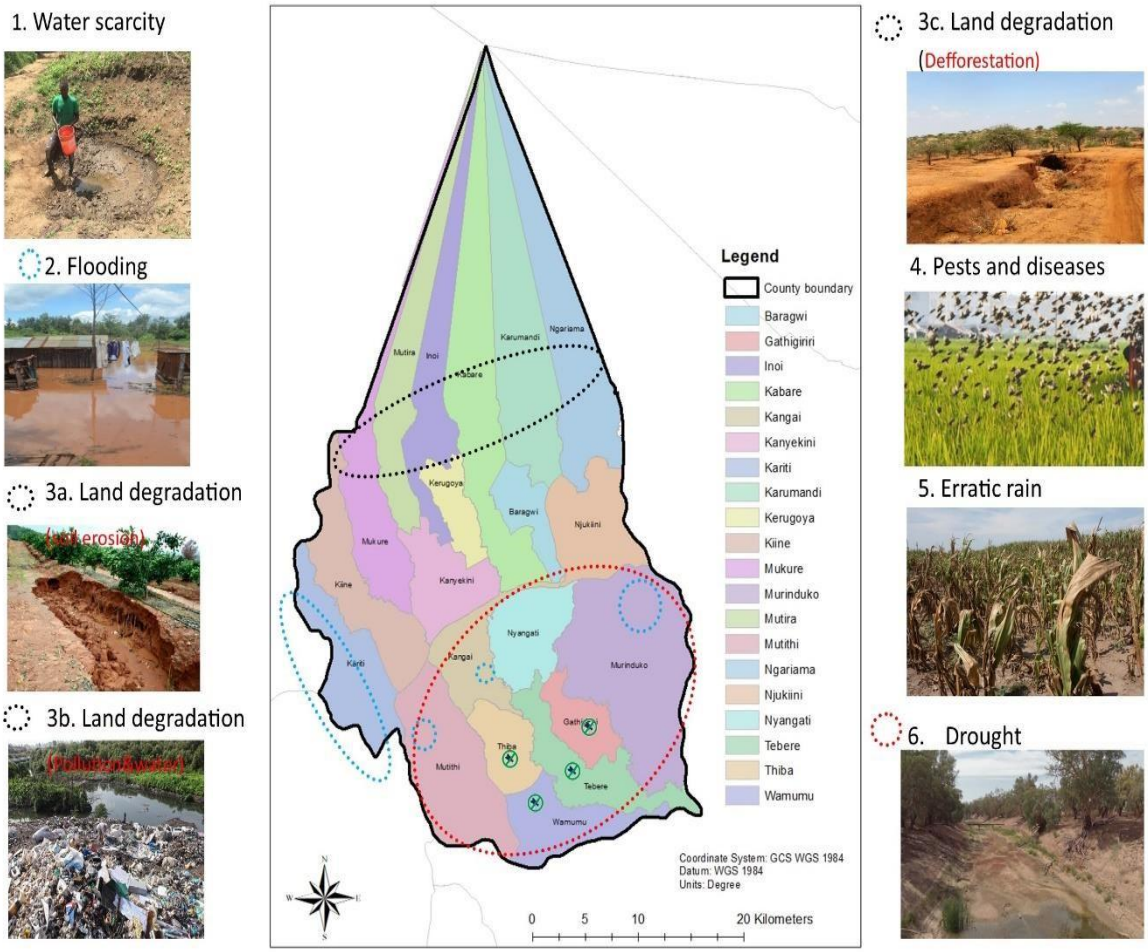


Table 3: Spatial Distribution of Risks

Ecological zones	Wards	Risks /Hazards

Upper–land	Kabare, Njukiini, Ngariama, Karumandi, Mutira, Inoi.	• Solid–Waste • Erratic rains • Pest and Diseases (Livestock and plants) • Human–Wildlife conflicts • Land degradation (soil erosion, deforestation, and pollution (solid waste)
Midland	Kiine, Mukure, Kanyekiine, Kerugoya, Baragwi, Njukiini	• Pollution • Erratic rains • Pest and Diseases (Livestock and plants) • Human–Wildlife conflicts • Water scarcity • Land degradation (pollution, land degradation, and deforestation)
Low–land	Tebere, Wamumu, Thiba, Nyangati, Kangai, Murinduko, Gathigiriri. Mutithi	• Floods • Pollution • Erratic rainfall • Land degradation (Pollution and soil erosion) • Human–wildlife conflicts • Drought • Pests and diseases

FUTURE CLIMATE SCENARIOS FOR THE COUNTY

3.1 National Downscaled Climate Change Projections

3.1.1 Temperature

In Kenya, air temperature is projected to rise by 1.2 to 3.2 degrees Celsius very likely range by 2080 relative to year 1876, depending on the future Green House Gas (GHG) emissions scenario. Compared to preindustrial levels, median climate model temperature increases over Kenya amount to approximately 1.4 degree Celsius in 2030 and 1.7 degree Celsius in both 2050 and 2080 under the low emissions scenario Representative Concentration Pathway (RCP) – RCP2.6. under the medium/ high emissions scenario RCP6.0, median climate model temperature

increases amount to 1.3 degree Celsius in 2030,1.6 degree Celsius in 2050 and 2.2 degree Celsius in 2080.

Figure 12: Global IPCC Representative Concentration Pathways for Global and Kenya

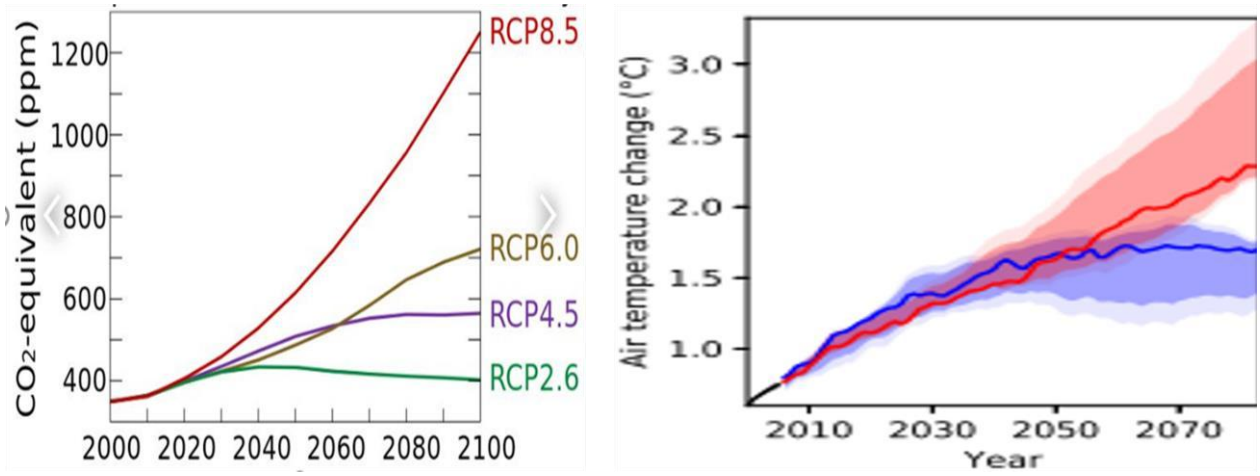
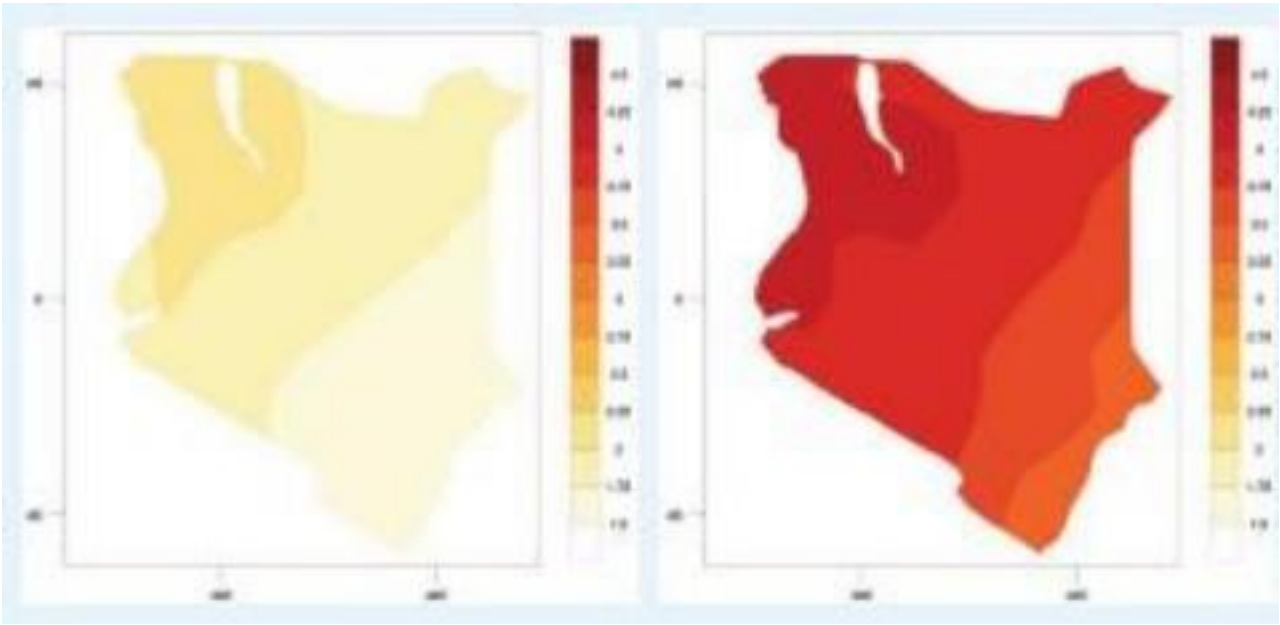


Figure 13: Air Temperature Projections for Kenya



3.1.2 Precipitation

The future projections of precipitations are less certain than projections of temperature change due to high natural year–to year variability. There are 3 climate models analysed, one model project no change to a slight decrease in mean annual precipitation over Kenya under RCP6.0, the other two models project an increase under the same scenario. Under RCP2.6, median model projections indicate a slight increase towards the year 2030 but an overall decrease towards the end of the century. Under RCP6.0, the projected precipitation increase is likely to intensify after 2050, reaching 53mm per year at the end of the century compared to year 2000. Higher concentration pathways suggest an overall wetter future for Kenya.

Figure 14: Precipitation Projections for Kenya

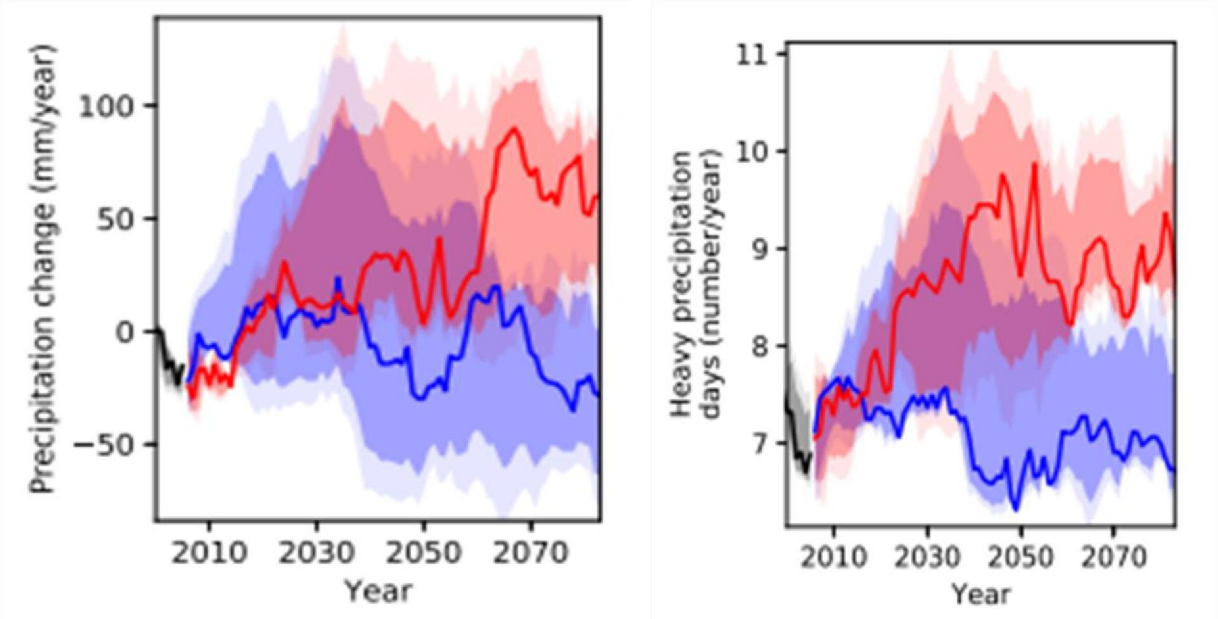
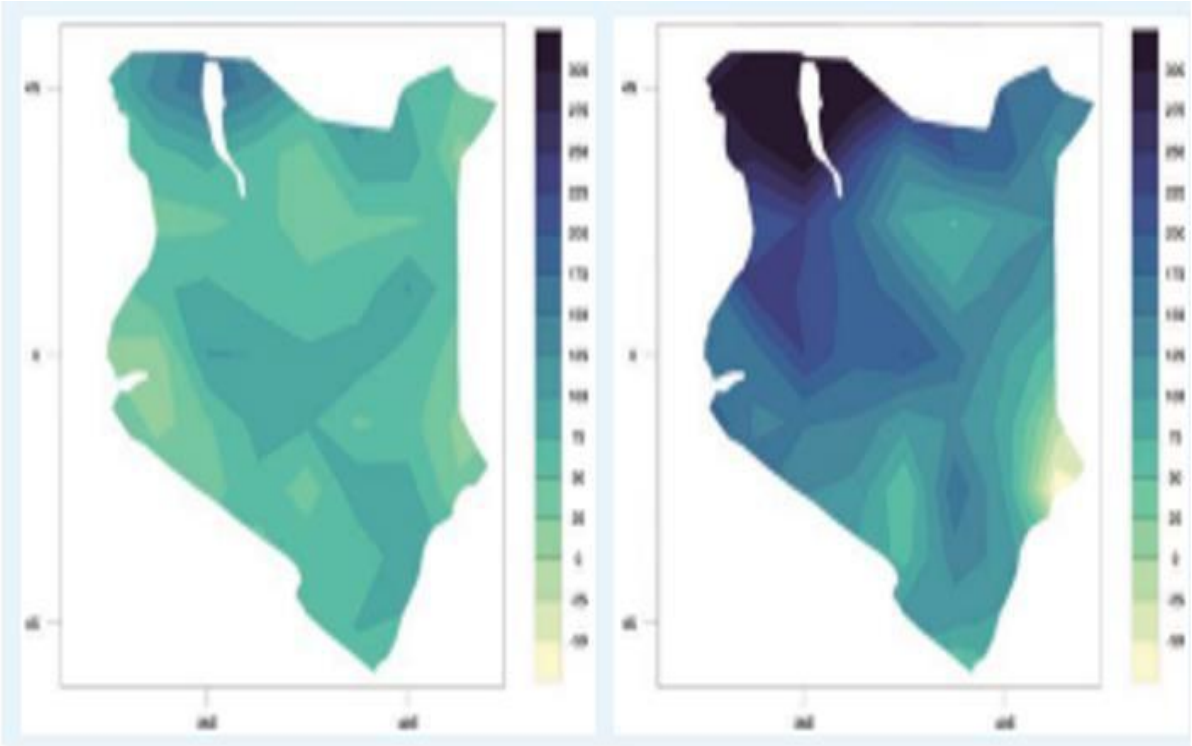


Figure 15: Precipitation Projections for Kenya 1986–2005 Baseline



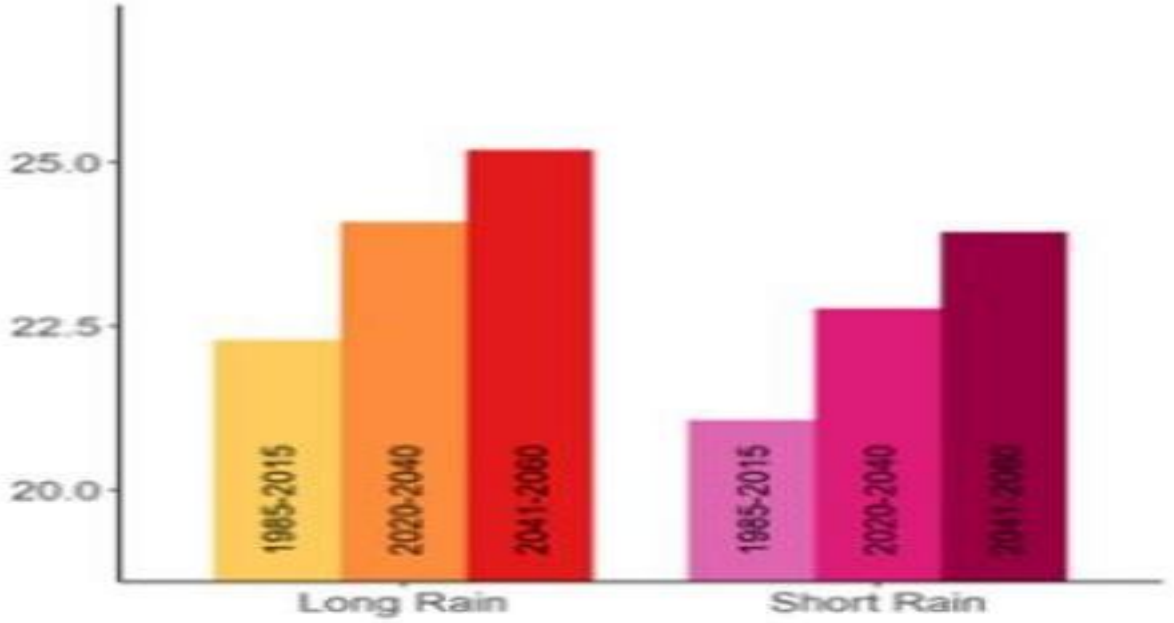
3.2 County Future Climate Scenarios

3.2.1 Temperature

Kirinyaga county future climate projections suggest that the growing season in the northern regions will face delays of up to 10 days. The above Climate Information Services (CIS) is given through Participatory Scenario Planning (PSP), where we involve all the members of the society, women, men, youths, PWDs and marginalized groups. This information is provided by Kenya Meteorological Department (KMD) and will be disseminated to all groups of the society, women, men, youths, PWDs and marginalized groups to help them allocate duties appropriately before the period. Therefore, the climate advisory services will become critical to inform farmers about the optimum planting window and avoid crop loss.

Additionally, the projections will help advise women, youth and men of the county on the length of the Growing Period (LGP) that will decrease throughout by 4 to 16 days. The Length of the growing season is based on the period when the climatic conditions are suitable for crop growth. Farmers in the county will adapt to these changes by shorter– duration crop varieties. The county also advises on the need to have more youths employed in the meteorological department to help them learn so that they can disseminate information to other members of the society.

Figure 16: Temperature Projections for Kirinyaga



3.2.2 Precipitation

Figure 17: Rainfall Trends Projections for Kirinyaga

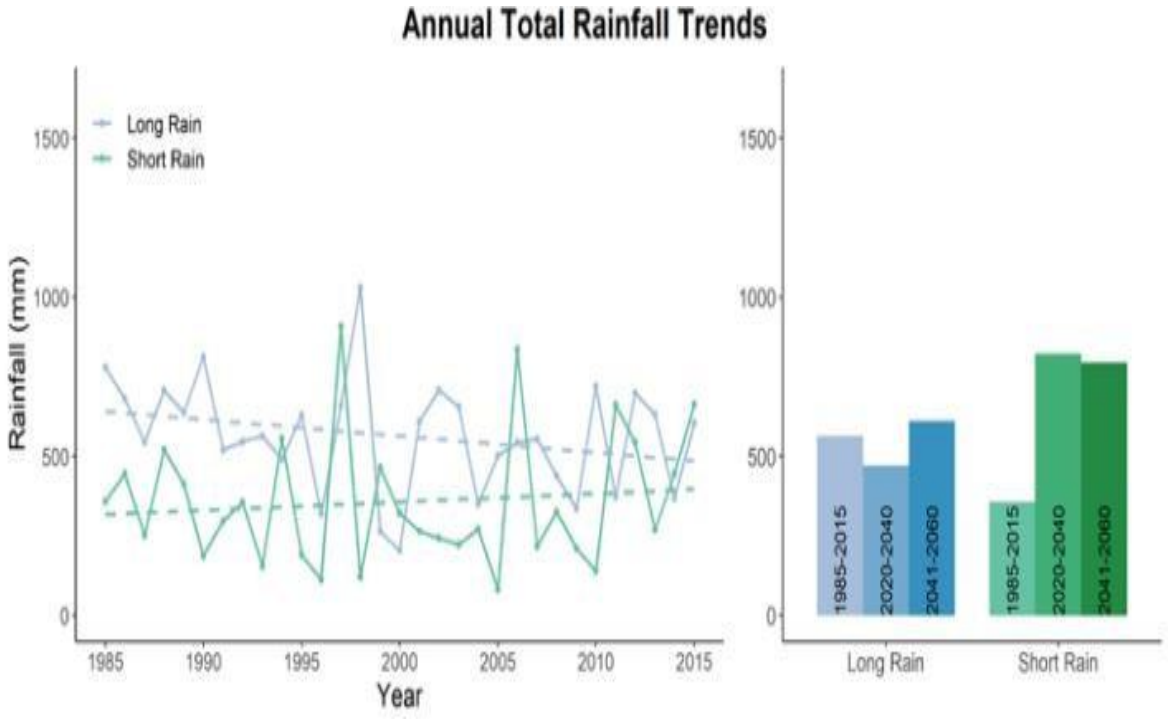
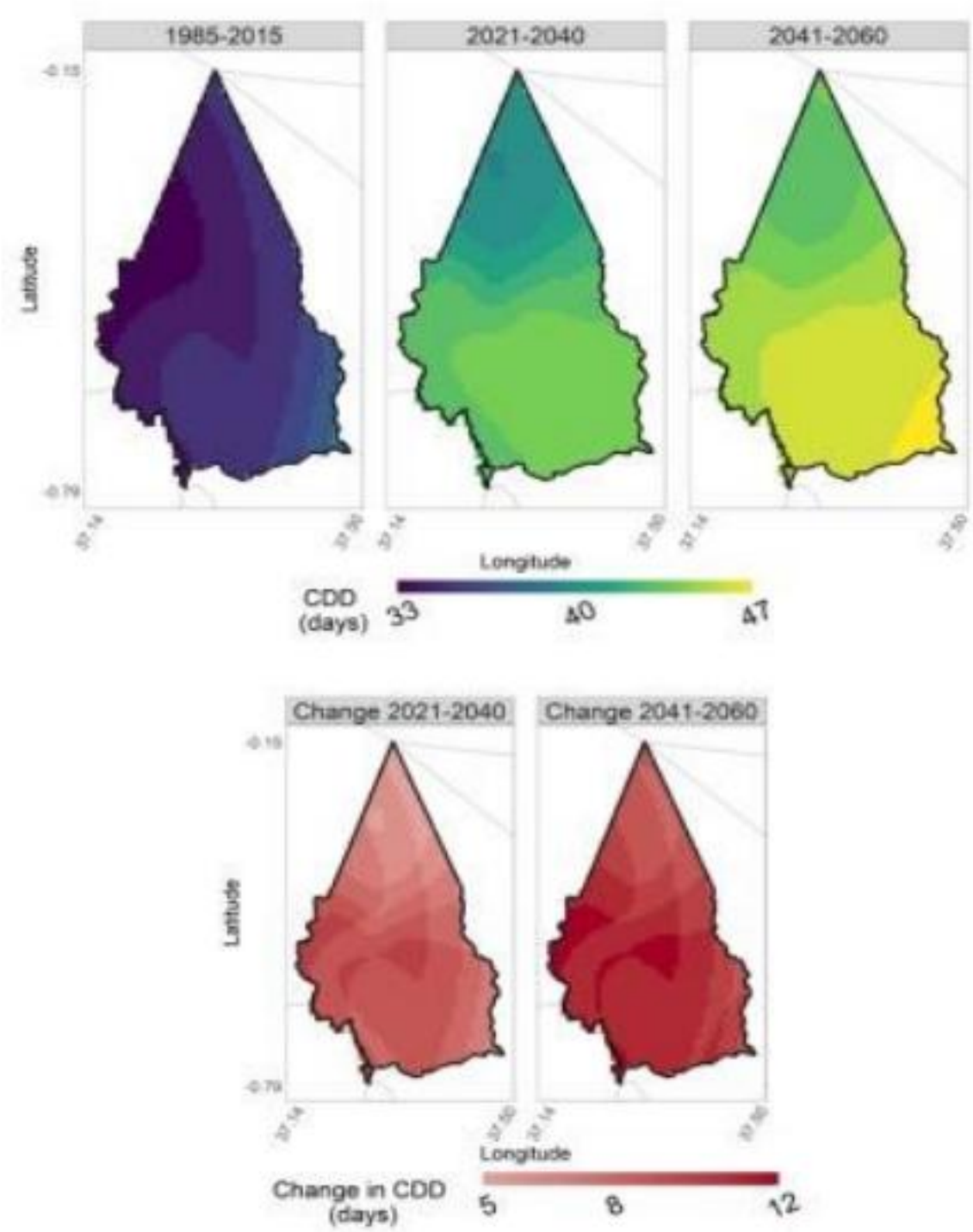


Figure 18: Rainfall Trends Projections for Kirinyaga using Consecutive Dry Day



ANALYSIS OF EXISTING RESILIENCE / ADAPTATION STRATEGIES TO CURRENT AND FUTURE CLIMATE RISKS

4.1 Overview of Existing Adaptations/Resilience Strategies and Their Effectiveness to Current Climate Risks

The engagement with the community representative provided a clear reflection of the already existing adaptation and resilience strategies. This section of the report provides a synthesized overview of the reported existing resilience strategies, differentiated by the livelihoods and the producer systems, the stakeholder groups, the economic and social sectors. In the report, the vulnerable groups constitute the women, youth and persons living with disabilities among other marginalized groups.

At the ward level, we were able to identify the vulnerabilities affecting women, men, youths and PWDs and differentiate them at the four major sectors of the economy that is agriculture, energy, infrastructure and trade. The community helped us to understand their existing adaptations / resilience strategies for each vulnerability. All groups in the community included women, men, youth, PWDs and marginalized groups. The needs of women, youth, men and PWDs were well differentiated. In the agriculture sector, drought and pests and diseases were the major hazards. The community suffered from food insecurity, crop failure and diminished livelihoods.

As a result, they used traditional farming conservation methods to try kill the pests. Some of the interventions we recommend are integrated pest management and GAP and growing drought resistant crops.

In the energy, climate change and environment sector, the major hazards are deforestation, land degradation, water shortage and erratic rains. Some of the vulnerabilities associated with these hazards are inadequate water storage, low water connectivity, breeding sites for disease vector, emission of GHG, air and water pollution, public nuisance, soil erosion, food insecurity, diminished livelihoods, reduced crop productivity, loss of pasture, post-harvest loss and crop failure. The strategic interventions for these vulnerabilities are building bulk water storage tanks, community water projects, investing in water harvesting facilities such as tanks and dams, agro-forestry (growing avocado, mango, macadamia and orange fruit trees), building waste recovery facilities, establishing sewer lines, sustainable land management practices, provision of Climate Information Services (CIS) and installing automatic weather stations in all sub counties.

In the transport, public works and infrastructure sector, the major hazard is flooding. The vulnerabilities associated with flooding are urban flooding or poor drainage and destruction of infrastructure and livelihoods. The interventions to tackle these vulnerabilities are cabro installation in urban centres, building dykes

along Ragati, Sagana and Thiba rivers, conservation of riparian using bamboos and restoration of wet lands.

Table 4: Existing Adaptations/Resilience Strategies

Sectors	Existing Adaptation/ Current Strategies	Vulnerability	Alternative Interventions/ Resilience Strategies
Agriculture, Livestock, Veterinary and Fisheries sector	• Traditional conservational farming – use of Terraces, mulching, organic manure use	• Cut off drains – resulting in soil erosion • Crop Failure • Food insecurity • Diminished livelihoods	• Upscale climate smart agriculture – use of contours • Embrace use of compost manure • Drought resistant crops • Fodder banks • Integrated Pest management and G.A.P
	• Selected Small-scale water harvesting and storage • Water abstraction in the southern ecological zone	• Few community members have adopted the culture to harvest and store water.	• Building capacity community members on upscaling on-farm water harvesting technologies.
	• Minimal adoption of drought tolerant crops and early maturing crop	• Unregulated high cost of crop seed and planting materials • Lack of awareness among the	• Upscaling the early maturing and drought tolerant varieties • Invest in a seedpropagation

		farmers/ minimal advocacy measures on the need to embrace drought tolerant crop • Minimal regulation on water abstraction.	technology for drought tolerance variety of crops • Revitalization of Kamweti ATC to facilitate farm demos on drought resistant crops — (demonstrations of the new crop and livestock
			technologies, innovations, and management practices Increasing the productivity, commercialization, and competitiveness of the rice and cotton sectors through knowledge and technology promotion)
	• Use of Sprinkler irrigation during dry seasons • Use of earth–canals to distribute water in the irrigation schemes	• Use of excess water, hence impacting the ground water levels/ drying up of rivers • Reducing the amount of water in the ecosystem • Percolation of water meant for	• Adoption of water saving irrigation technology — drip • irrigation technology Advocacy and investment in expanded coverage of area under water saving irrigation infrastructure

		irrigation to the ground canals	• Construction of concrete canals with a regulated gradient.
	• Household level forage conservation	• Unsustainable forage conservation practices which deplete quality of feedstores, and overreliance on vegetation cover for feeds	• Investing in Silage technology, hay bailing, pasture reseeding and bulking, • Investing in controlled community feed stores
	• Use of uncontrolled pesticides in the farms	• Exposure of farmers to harmful inputs • Degradation of the quality of soil	• Use of organic and ratified farm inputs to promote sustainable food production. • Possession of an integrated pest management system.

Environment, Energy, Climate Change, Water and Irrigation Sector	• Hand pump boreholes • Construction of water intakes	• The infrastructure proves strenuous and time wastage (hence impacting the daily clock) Emission of GHG • Air and water pollution • Public nuisance • Breeding sites for disease vector • Food insecurity Diminished livelihoods Inadequate water storage Low water connectivity	• Installation of green energy to pump water for domestic use from boreholes • Bulk water storage tanks at Sagana (Kiine and Kariti) • Community water projects • connectivity Water harvesting (dams and tanks) • Increase water connectivity to the households – investing in infrastructure and completing the water supply system. • Sustainable land management practices • Establish sewer lines • Build waste material recovery facilities

			• Provision of climate information services • Installing automatic weather stations in all sub counties
	• Low–capacity dams (earth, sand and pans) Siltation of dams	• Insufficient water, evaporative loss, deep percolation	• Frequent desilting and rehabilitation of earth • dams, Construction of earth dams, sand dams and water pans, use of liners and green surface cover, • Promotion of farm pods
	• Small scale irrigation schemes	• Low coverage	• Extension of existing pipeline
	• Utilization of Existing natural springs	• Utilization of Existing natural springs	• spring protection (fencing)
	• Existing rock outcrops	• Not harnessed	• Rock catchment
	• Use of unsustainable water harvesting at some optimal levels	• Low adoption of water harvesting technologies • Soil erosion from surface runoff • Loss of pasture • Reduced crop productivity	• water tanks, run off water harvesting • Improvement of ground vegetation

	• Deforestation	• Reduced tree cover • Reduced precipitation	• Invest in agroforestry fruit trees (mango, macadamia, oranges and avocados Afforestation, • Riverine tree planting, commercial nursery establishment, • Investing in bamboo propagation technology, agroforestry, • Initiate school greening programs, climate smart markets, Material Recovery Facility, water reuse and recycling, promotion of renewable energy for Agro-based industry, provision of climate services, mainstreaming ICT use, woodlot establishment, promotion of commercial forestry, Energy saving jikos, biogas production

			technologies, solar energy mechanisms

	• Use of skips and skip loaders, and open dumping & pit latrines and unsustainable septic tank.	• Uncontrolled dumping • Uncontrolled dumpsite 'scavengers' • Lack of segregating organic from non–organic waste • Uncontrolled environmental degradation (air pollution, water pollution)	• Investment in waste material recovery facility Increasing the • number of skips in the county • Invest in a liquid waste management system within the industrial and commercial sections in the country
Transport, Public Works and Infrastructure (Disaster Risk Management)	• Routine Grading of access roads	• Poor drainage establishment • Urban flooding • Destruction of infrastructure and livelihoods	• Opening of new access roads for market access, road bridges and drifts for climate proofing actions • Cabro installation in urban areas • Buildings dykes along Ragati, Sagana and Thiba • Conservation of riparian using bamboo • Restoration of wet lands establishment of new market centres
	• Fire station and firefighting machines	• Lack of hydrants, • Advocacy on how best to access the	• Strategic location of Hydrants

		services	
	• Construction of dykes to prevent floods and flash floods from affecting the community	• Uncontrolled flooding	• Conservation of the riparian land/ riverine (planting of trees)
Department of Trade. Cooperatives,	• Construction of aggregation centres across the county	• Insufficient lighting to facilitate night processes	• Securing and dedicating a plan for CAIP — County Aggregation and Industrial
Tourism, Industrialization and Enterprise Development		• Insufficient water harvesting systems • Minimal greening around the centres	Park (formalized to handle and promote food security, export income) Climate smart industrial parks • Installation of solar lighting across the infrastructures • Expand the water harvesting systems

4.2 Effectiveness of Adaptation/ Resilience Strategies to Future Climate Risks

The community identified several hazards such as water scarcity, flooding in areas of Sagana (Thigirici) and Mwea areas, land degradation in various ways such as pollution both water and land, soil erosion and deforestation, pests and diseases, erratic rains that disrupts the planting season and spoils the harvests and drought. Some of the priorities identified at the ward and county workshop included; building of bulk water storage tanks to mitigate the risk of water scarcity to farmers both crops and animals. The table also identifies land degradation adaptation resilience strategies which are waste material recovery facility which include the sanitary landfill, composting, and the storage for non– organic waste. Kirinyaga county urban centres has been experiencing pollution in terms of solid waste dumping, the acquisition of additional skips to cover all urban centers is a priority. To mitigate the risk of losing the riparian land the strategy of conservation of the areas using the Bamboo, Agro–forestry/ growing of avocado, Mango, Macadamia, and oranges /fruit trees was identified as a critical adaptation .

To mitigate flooding, erratic rains ,pest and diseases and drought, it is important to invest in the county information system in all the sub–counties. This will enable famers and other livelihoods to plan in terms of investing in integrated pest

management and GAP using the drought tolerant seeds and investing in building of dykes in the flooding areas. The climate information services give advisory on weather forecast and adaptation methods in Agriculture, water and environment through Participatory Scenario planning (PSP).

The adaptation resilience strategies has considered the gender and social inclusion information, climate change is a cross-cutting issue and the sustainable development goal has clearly stated that for effective climate change related planning and management, the focus should be on women, youth and marginalized communities.

Table 5: Adaptations/Resilience Strategies to Future Climate Risks

Risk/Hazard	Livelihood/Economic System	Climate Resilience Strategies	Stakeholder Group Applying the Strategy	Gender and Social Inclusion information
Water scarcity	Farmers	• Bulk water storage tanks • Laying of pipes to connect households to water	• Farmers • Livelihoods	• Mobilize VMGs to join community water projects • Encourage youths to get actively involved in community water projects to help in laying of pipes • Empower women groups by giving them water tanks that will help in reserving water

Flooding	Livestock and Crop farming Natural resources Infrastructure Education and health Traders	• Conservation of riparian land/ conservation of the river–line (Ragati, Sagana and Thiba) • Growing of avocado, Macadamia oranges • Building of dykes along the river	• Farmers • Traders • The government	• Provide bamboos to the youths so that they can plant along the rivers • Sensitize on the importance of conserving wet lands to men, women, youths and pwds
Land degradation a) Soil erosion b) Pollution c) Deforestation	Trade Farming	• Waste material recovery facilities for sustainable solid waste management	• Development partners • Traders • Farmers	• Training the youth in waste recovery • Encourage youth innovation and ideas on waste management

Risk/Hazard	**Livelihood/Economic System**	**Climate Resilience Strategies**	**Stakeholder Group Applying the Strategy**	**Gender and Social Inclusion information**

		• Employ extended producer responsibilities best practices • Acquisition of Skips in urban centers		• Ensure gender balance and inclusion of youths, PWDs and marginalized groups in employment
Pests and diseases	Livestock and Crop farming	• Integrated pest management practices	• Farmers	• Mobilize, and sensitize the youth, women, PWDs and the elderly on climate change and climate smart agricultural technologies
Erratic rains	Livestock and Crop farming	• Water harvesting technologies e.g., water pans • Spreading the coverage of water access e.g. the southern ecological zones • Provision of the climate information	• Farmers • Traders	• Empowering women with sustainable water harvesting system • Training farmers on how best to establish microwater pans for farming practices

		services		
Drought	Livestock and crop farming Trade and Agroprocessing	• Concrete lining of irrigation canals to improve efficiency • Development of fodder bags • crop insurance	• Farmers, Traders • Government and development partners	• Sensitize the youth, women, PWDs and the elderly on climate change and climate smart agricultural technologies/practices best.
Risk/Hazard	**Livelihood/Economic System**	**Climate Resilience Strategies**	**Stakeholder Group Applying the Strategy**	**Gender and Social Inclusion information**

		• Rainwater harvesting and irrigation • Planting drought–tolerant varieties and rearing drought tolerant animals		• Fund innovative activities initiated by the youth to curb drought

Table 6: Adaptation Investment/Action

Proposed intervention	Activity	Indicator	Target	Means of Verification	Responsibility	Cost (M)	Time frame
Department of Agriculture, Livestock Production and Fisheries							
Establish a framework to coordinate and implement climate smart agricultural activities in the county.	Develop a framework for climate smart activities. Development of a climate smart agriculture technologies center at Kirinyaga Agriculture Training Center at Kamweti	A legal framework is developed. Climate smart agriculture technologies center established.	1	Climate smart agriculture policy	CGK– DoALPF.	35	2022–2027

Integrate pest management and good Agriculture Practices	Develop a framework for identification and Implementation of appropriate Pest Management and GAP	IPM & GAP recommended and implemented	20	IPM report GAP report	CGK ALVF	30	2023–2027
Promote SLM practices	Promote SLM practices including installation of cutoff drains, Retention ditches,	No of SLM interventions implemented	1	Physical verification	CGK ALVF	50	2023–2027

Proposed intervention	**Activity**	**Indicator**	**Target**	**Means of Verification**	**Responsibility**	**Cost (M)**	**Time frame**
	Use of cover crops and Gabions						
Agro forestation	Planting of fruit trees including Avocado, Mangoes,	No of fruit seedlings acquired and distributed	6,000,000	Procurement of seedling	CGK – ALVF	900	2023–2027

	Macadamia and Oranges			Distribution list			
Promote use of drought resistant crops/ seedlings	Acquire drought resistant seedling and crop varieties to prevent crop failure due to prolonged drought	No of drought resistant seedling acquired and distributed to farmers	Mwea East and Mwea west	Seedling distribution list	CGK ALVF	200	2023–2027
Public Works							
Protection of Infrastructure form effects of flooding	Development/ Installation of dykes along Sagana, Ragati and Thiba Rivers	Dykes constructed and operationalized	2	Dykes in place	CGK – Public Works	50	2023–2027
Department of Trade. Cooperatives, Tourism, Industrialization and Enterprise Development							

Development of CAIP	Construction of industrial parks and corresponding utility infrastructure to enhance agroprocessing, value addition, food conservation through reduced post–harvest loss.	Number of agro–processing industries established	Sagana Climate smart Agro processi ng park	Completion certificates	CGK– trade, tourism, industrialization and enterprise development, Partners	500	2022–2027

Proposed intervention	Activity	Indicator	Target	Means of Verification	Responsibility	Cost (M)	Time frame
Promotion and diversification of tourism activities/ conservation of natural resources	Mainstream conservation and protection of natural resources within the county	Number of sites conserved and protected		Completion certificates Progress reports	CGK– trade, tourism, industrialization and enterprise development, Partners	20	2022–2027

Department of Environment, Water, Energy, Climate Change, Irrigation and Natural Resources							
Water Services							
Increase access to safe domestic water through extended network from water service providers and harnessing water harvesting for human and livestock consumption.	Purchase and laying of water distribution pipes to bolster supply. Purchase and distribution of water storage tanks for household use.	Pipes procured and distributed. Storage tanks procured and distributed.	All wards	Kilometers of laid pipe network Number of storage tanks issued to residents	CGK– DEWNR	100	2022–2027
Reduce irrigation water losses through percolation	Concrete lining of irrigation canals	Kilometers lined with concrete Number of wards covered.	400 4 wards	Physical verification. Project Completion Certificates	CGK– DEWNR NIA	200 400	2023–

				Progress reports			
Provision of water storage facilities for water conservation	Install Bulk Water Storage Facilities for Sagana Township, SAIC and Environs	No. of storage tanks constructed.	Kariti and Kiine wards	Storage tanks constructed and in use	CGK– DEWNR	20	2023–2027
Environmental services							

Proposed intervention	**Activity**	**Indicator**	**Target**	**Means of Verification**	**Responsibility**	**Cost (M)**	**Time frame**
Installation of an sustainable solid waste management	Development and installation of material recovery facilities, incineration unit and sanitary	Material recovery Facilities, Operation offices, Baling unit,		Number of equipment procured.	CGK– DEWNR	110	2022–2027

infrastructure	landfills Acquisition of Waste skips and Skip loader for waste collection and transportation	Storage area, Incineration unit and sanitary landfills constructed at the Sagana Climate Smart Agro–processing Park And Kutus dumping area Waste skips and skip loader procured	All wards	Receipts, delivery notes, invoices Receipts, delivery notes, invoices Completion certificates Number of equipment procured. Receipts, delivery notes, invoices	CGK– DEWNR	40	

Establish liquid waste management system	Install sewer lines and connect all urban areas to sewer lines	Sewer line in place No of urban areas connected to sewer lines	1 sewer line	No of operational sewer lines in place	CGK–Environment	500	2023–2027
Proposed	**Activity**	**Indicator**	**Target**	**Means of**	**Responsibility**	**Cost**	**Time**

intervention				Verification		(M)	frame
Improve preparedness for erratic rainfall and develop early warning stations	Installation and operationalization of Climate Information System Installation and operationalization of Sub– County weather stations	An operational CIS in place Operational Weather Stations	1 5	Physical verification Reports generated by the CIS Physical verification Weather reports generated by the stations	CGK – Environment	10 30	2023–2027
Conservation of Riparian spaces along rivers	Enforcing conservation of wetlands & riparian through replacement of	No. of rivers with riparian areas conserved	6	Physical verification No of	CGK – Environment	50	2023–2027

	eucalyptus with bamboo			bamboo trees planted along rivers			
Lands, Physical Planning and Urban Development							
Installation of Cabro in Urbans areas to manage storm water	Installation of Cabro in major urban areas in the County	No. of towns with Cabro developed	5	Physical verification Cabro Installation report	CGK– Urban Development	100	2023–2027

CONCLUSION

The Kirinyaga County Participatory Climate Risk Assessment PCRA report identifies the urgent need to address climate change risks and hazards through adaptation strategies and mitigation measures. The report adopted local participatory and collaborative approach in understanding the importance of current and future climate risks/ hazards to inform decision making and planning. The report used multi-sectoral stakeholders' approach to collect and analyze data on adaptation priorities in the county.

The report highlights the climate risks/hazards the County government of Kirinyaga faces which include; water scarcity, drought, pests and diseases flooding, erratic rains, deforestation, land degradation, erratic rains, pollution (water & lands) and soil erosion. To address these risks, the report identifies and prioritizes the strategic adaptation investments and actions which include water harvesting infrastructure, climate smart agriculture practices, sustainable land management practices, agro forestry, restoration of wetlands, conservation of riparian lands.

These investments aim at strengthening county adaptive capacity to cope with impacts of climate change. The report prioritizes several investment actions

identified through the stakeholder's engagement culminating with sound strategic interventions for Kirinyaga County. Finally, by implementing the recommendations in the report, the county will enhance its resilience to changes in climate, restore and protect ecosystems while promoting development.

APPENDICES