KISII COUNTY PARTICIPATORY CLIMATE RISKASSESMENT REPORT

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ASDP	Agricultural Support Development Programme
CDD	Consecutive Dry Days
CIDP	County Integrated Development Plan
FLLoCA	Financing Locally-Led Climate Action
ISCOD	Institution for Sustainable Community Development
KFS	Kenya Forest Service
KeRRA	Kenya Rural Roads Authority
NAP	National Adaptation Plan
NCCAP	National Climate Change Action Plan
NARIGP	The National Agricultural and Rural Inclusive Growth Project
NEMA	National Environment Management Authority
PA	Paris Agreement
PPE	Personal Protective Equipment
PCRA	Participatory Climate Risk Assessment
PWDs	People with Disabilities
PWE	Public Works Engineer
REREC	Rural Electrification and Renewable Energy Corporation
SEM	Sustainable Environmental Management
SEP	Stakeholder Engagement Plan
TWC	Technical Working Group
UNFCCC	United Nations Framework Convention on Climate Change
USAID	The United States Agency for International Development
WASREB	Water Services Regulatory Board
WRA	Water Resources Authority
WRUA	Water Resource Users Association

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FORWARD

Climate change poses a significant challenge to Kenya's development goals outlined in Vision 2030. Several regions, including Kisii County, are already highly vulnerable to climate-related hazards. Irregular and unpredictable rainfall patterns and increased frequency of droughts and floods have become common occurrences in many areas. Kisii County, being a devolved unit with an economy reliant on climate-sensitive sectors, is particularly susceptible to the impacts of climate change. To address this, integrating climate change considerations into development policies and actions across various sectors has become a top priority. This approach aims to reduce greenhouse gas emissions and enhance the county's resilience to climate shocks. A participatory climate risk assessment was conducted to assess the vulnerability of different administrative units and sectors within Kisii County, identifying climate change risks and their impacts. The findings of this assessment will inform the development of a climate change action plan and adaptation plan for the county. The county government has already taken steps to support climate risk management through the implementation of the Kisii County Climate Change Act of 2021 and the Kisii County Climate Change Policy of 2019. With these measures in place, it is believed that Kisii County will transition into a low-emission and climate-resilient green economy in the near future.

Gideon Nyakweba
County Executive Committee Member - Water, Energy, Environment, Natural Resources and Climate Change

EXECUTIVE SUMMARY

Kisii County Government has mainstreamed climate change into its development policies and sector interventions through the County Integrated Development Plan (CIDP), Kisii County climate change policy of 2019, Kisii County Climate Change Act of 2021 and the regulations governing the climate change fund (Kisii County Climate Change Fund regulations of 2021). Due to the negative impacts of climate change, and the fact that Kisii County is an agricultural County, with climate sensitive sectors, it is necessary to adequately assess, document, and understand the types of risks that Kisii County faces or is likely to face as a result of climate change through a participatory process from the grassroots level.

The participatory climate risk assessment (PCRA) process involved the formation and training of the technical working group, desktop review of the conceptual and analytical contexts of climate change risks at the county level, stakeholder identification and engagement in all stages of the PCRA process. These levels varied from informing, to consultation or participatory involvement throughout the whole process of the local community members. The team (technical working group) also collected data through focus group discussions at the ward level, key informant interviews with all stakeholders and analysis undertaken thereafter. Workshop was done for report writing then final reports were then presented to County stakeholders for validation.

Through the analysis of the hazard map and seasonal calendar, the representative community members identified, prioritized and ranked the following hazards across the County in the following order of impact and magnitude; prolonged dry spells, floods, landslides, hailstones, epidemics (livestock and human diseases), thunderstorms, water pollution and strong winds. The community described the differentiated impacts of the past and current climate trends and risks on the different key interest groups in the county, with a focus on marginalized and vulnerable groups namely women, youth and people living with disabilities.

Communities within Kisii County are exposed to risks associated with climate change and could be rendered vulnerable. However, key interest groups in the county, with a focus on marginalized and vulnerable groups namely women, youth and people living with disabilities are most at risk. Causes of vulnerability to climate change impacts are multi-faceted and the most important one include poverty, food insecurity, prolonged dry spell, environmental degradation, reliance on rain-fed agriculture among others coupled with social and other economic factors.

Cross-sectoral perspective and concentration on climate sensitive strategic investment opportunities will enhance the adaptive capability and adaptability of critical livelihood, social and profitable approaches within Kisii County.

CHAPTER ONE

1 CHAPTER ONE: OVERVIEW OF THE PARTICIPATORY CLIMATE RISK ASSESSMENT

1.1 Background

1.1.1 Baseline

Kisii is one of the 47 counties in Kenya. The County is predominantly inhabited by Abagusii community, which represents over 90 percent of the total population.The County lies between Latitude 0º 40' 38.4" South and longitude 34º 34' 46º 61" East and covers an area of 1,323 km^2. The County had a population of 1,266,860 in 2019, comprising 605,784 males, 661,038 females, and 38 intersexes, according to the 2019 Kenya Population and Housing Census (KPHCR) with 12 percent of the population estimated to reside in the urban areas. The population is estimated to grow to 1,332,174 in the year 2022, 1,370,371 in the year 2025, and 1,396,619 in the year 2027. The minority communities in the county include the Luos, Luhyas, Nubians, Indians, Somalis, and Kikuyus. The County headquarters is located within Kisii Municipality. The County borders Nyamira, Narok, Homabay and Migori Counties.

The County is characterised by a hilly landscape with notable valleys traversed by rivers which flow westwards into Lake Victoria. Notable rivers are Gucha, Mogusii, Riana, Mogonga, Chirichiro, and Iyabe Rivers. Kisii County is segmented into three ecological zones: the Upper Midland (UM) accounting for 75 percent, the Lower Highland (LH) comprising 20 percent, and the Lower Midland (LM) being 5 percent of the total area. Approximately 78 percent of Kisii County is usable as arable, 57 percent being under crop.

The County experiences a highland equatorial climate, which leads to a bimodal rainfall pattern. The average annual rainfall in the area is approximately 1,600mm.In Kisii County, the long rainy season occurs from March to May (MAM), while the short rainy season is experienced between October and December (OND). The months of January, February, July, August, and September, on the other hand, are relatively dry.

The county is segregated into nine sub-counties serving as constituencies, along with a total of 45 wards, as illustrated in table 1:1.

Table 1-1: 45 Wards in Kisii County contributing to PCRA

CONSTITUENCY	WARDS
BONCHARI	Riana
	Bomorenda
	Bogiakumu
	Bomariba
SOUTH MUGIRANGO	Boikanga
	Tabaka
	Getenga
	Moticho
	Bogetenga
	Chitago Borabu
BOMACHOGE BORABU	Boochi Borabu
	Bombaba Borabu
	Magenche
	Bokimonge
BOBASI	Masige East
	Masige West
	Bassi Bogetaorio
	Bassi Central
	Nyacheki
	Bassi Chache
	Bassi Boitangare
	Sameta Mokwerero
NYARIBARI MASABA	Kiamokana
	Gesusu
	Masimba
	Nyamasibi
	Ichuni
BOMACHOGE CHACHE	Bosoti Sengera
	Machoge Bassi
	Boochi Tendere
NYARIBARI CHACHE	Ibeno
	Kisii Central
	Birongo

	Kiogoro
	Keumbu
	Bobaracho
KITUTU CHACHE NORTH	Marani
	Kegogi
	Sensi
	Monyerero
KITUTU CHACHE SOUTH	Nyatieko
	Nyakoe
	Bogeka
	Kitutu Central
	Bogusero

Source: KNBS, 2022

Kisii County CIDP 2023-2027 recognizes climate change as a major emerging developing issue with notable changes in weather patterns and a noteworthy influence on economic productivity. (Reduced agricultural yields, access to safe drinking water and heath and health systems). The county deliberately established the directorate climate changeunder the department of Water, Natural Resources, Environment, Energy, and Climate Change. Over the last four years of the Plan, total expenditure amounted to KShs.38.371 billion of which the department of Water, Environment, Natural Resources, Energy, and Climate Change was allocated KES 2,153.42B (County Treasury 2022). Climate change action a prioritized strategy for the county to ensure a resilience population through mitigation and adaptation measures such as establishment of climate information system (centres and stations), training farmers and on weather patterns, climate smart agriculture and innovations, gazettement of forests and adoption of green energy, establishment of Kisii County Climate Change and Sustainability Resource Centre (KCCSRC, among others. It is under the Participatory climate risk assessment (PCRA) that the county through the Climate Change unit will identify the key climate risks for the county and the strategic investment areas for climate resilience while being guided by locally led- adaptation. The PCRA will feed into the development of the participatory County Climate Change Action Plan (CCCAP). The PCRA and CCCAP will later be adopted by the County Assembly. The Climate Change Unit through FLLoCA's County Climate Institutional Support (CCIS) grants was able to conduct public participation at each of the 45 wards in the county through which climate risks and vulnerabilities were identified and greatly informed this report.

1.1.2 Participatory Climate Risk Assessment

Participatory Climate Risk Assessment in Kisii County is a crucial process that acknowledges the local effects of climate change and aims to empower communities for effective adaptation. This approach encourages collaboration among stakeholders, integrates climate adaptation into local planning, and enhances the resilience and

sustainability of the county's socio-economic and environmental systems. The county places a high priority on climate change action, recognizing it as a strategic necessity to ensure a resilient population. This involves a range of mitigation and adaptation measures, including:

- Establishing Climate Information Centers and Stations.
- Providing training to farmers on weather patterns and promoting climate-smart agriculture and innovations.
- Designating forests for conservation (gazettement) and adopting green energy sources.
- Creating the Kisii County Climate Change and Sustainability Resource Centre (KCCSRC), among other initiatives.

The county's Climate Change unit is responsible for executing these actions within the framework of the Participatory Climate Risk Assessment and Planning sub-program of the County Climate Action (CCA). This sub-program aims to conduct Participatory Climate Change Risk and Vulnerability Assessments, which will pave the way for the development and advancement of a participatory Climate Change Action Plan and Adaptation Plan. One of the primary objectives of the Kisii municipality is to promote sustainable development with an emphasis on environmental preservation and climate change mitigation. Participatory Climate Risk Assessment (PCRA) in Kisii County, Kenya, remains vital process aimed at understanding and addressing the local impacts of climate change in relation to:

- Vulnerability to Climate Change: Kisii County is vulnerable to various climate change impacts, including erratic rainfall patterns, increased temperatures, and extreme weather events like floods and prolonged dry spell. These changes have had have adverse effects on agriculture, water resources, health, infrastructure, and livelihoods.
- Agricultural Dependence: Agriculture is a major economic activity in Kisii County, with a significant portion of the population engaged in farming. Smallholder farmers rely on rain-fed agriculture, making them particularly vulnerable to climate variability and change.
- Water Resource Challenges: The County faces challenges related to water availability and quality. Changes in precipitation patterns and increased temperatures have effect on water sources, leading to shortages and potential conflicts over water resources.
- Health and Livelihood Implications: Climate change threatens public health in Kisii County by increasing the prevalence of climate-sensitive diseases like malaria and exacerbating malnutrition due to agricultural disruptions. Livelihoods, especially those dependent on rain-fed agriculture, are at risk.
- Local Initiatives and Adaptation: Kisii County has recognized the need to adapt to these changing climate conditions. Local communities, NGOs, and government agencies have initiated various projects and strategies aimed at enhancing resilience and reducing vulnerability.
- Participation of Stakeholders: Participatory CRA in Kisii County involved the active participation of local communities, experts, government officials, NGOs,

and other stakeholders. This participatory approach ensures that the perspectives, knowledge, and concerns of local people are incorporated into the assessment process.

- Data Collection and Analysis: The assessment process involves collecting data on historical climate trends, current vulnerabilities, and potential future scenarios. Data collection methods include surveys, interviews, focus group discussions, and the use of climate models.
- Risk Identification and Prioritization: Through community engagement, the assessment identifies specific climate-related risks and vulnerabilities. These may include crop failure, reduced water availability, increased disease prevalence, and food insecurity.
- Development of Local Strategies: Based on the findings, the community, in collaboration with experts, develops context-specific adaptation and mitigation strategies. These strategies aim to enhance resilience, protect livelihoods, and improve community well-being.
- Integration into County Planning: The strategies and recommendations arising from the Participatory CRA are integrated into Kisii County's development plans and policies, including the County Climate Change Action Plan. This ensures that climate adaptation is mainstreamed into county governance and decision-making.
- Ongoing Monitoring and Evaluation: PCRA is not a one-time event but an ongoing process. Regular monitoring and evaluation will help assess the effectiveness of implemented strategies and make adjustments as needed.
- Contribution to National Climate Efforts: The experiences and insights gained from Kisii County's PCRA will contribute to the broader national efforts to address climate change in Kenya, including the National Climate Change Adaptation Plan and commitments under international climate agreements.

1.2 Policy Context

1.2.1 Introduction

Climate change has been known to be a global problem and therefore requires a global solution by all actors. Kenya committed to protecting the climate system for the benefit of the present and future generations by supporting the United Nations Framework Convention on Climate Change (UNFCCC) process, ratifying the Kyoto Protocol in 2005, and contributing to continental and regional climate change initiatives. The 2013-2017 and 2018-2022 National Climate Change Action Plan (NCCAP) provides an implementation framework for the National Climate Change Response Strategy (NCCRS). Upon this foundation the National Climate Change Policy, the NCCRS, the NCCAP, and the National Climate Change Act, 2016 were built and provides a framework for this Plan. The County prioritizes the issue of climate change which is why it focuses on developing relevant plans and strategies that aim towards promoting resilience to the effects of climate change.

1.2.2 **Global frameworks**

- **The Paris Agreement (PA)**, operating under the United Nations Framework Convention on Climate Change (UNFCCC), strives to enhance the worldwide response to the dangers of climate change by ensuring that the global temperature increase remains well below 2°C above pre-industrial levels in this century. Kenya's Nationally Determined Contributions (NDC) outline the country's initiatives to support the global objective set forth in the Paris Agreement, encompassing both mitigation and adaptation efforts. On January 27th 2017, the Paris Agreement became effective for Kenya, and in accordance with Article 2(6) of the 2010 Constitution of Kenya, it is now an integral part of Kenyan law. Africa's Agenda 2063 serves as a comprehensive blueprint and master plan for the continent, designed to achieve the objectives of inclusivity and sustainable development. It reiterates the availability of climate resilient and low carbon production systems by the year 2063. As a result, it aims to substantially reduce vulnerability to climate risks and associated natural disasters.
- **Sustainable Development Goals (SDGs)**: The SDGs, particularly Goal 13 (Climate Action), emphasize the need for urgent action to combat climate change and its impacts. PCRA aligns with this goal by addressing climate-related risks and vulnerabilities in the pursuit of sustainable development.
- **Sendai Framework for Disaster Risk Reduction**: The Sendai Framework, adopted in 2015, highlights the importance of understanding and managing disaster risk, which includes climate-related risks. PCRA contributes to disaster risk reduction by identifying and addressing vulnerabilities and enhancing community resilience.
- **Intergovernmental Panel on Climate Change (IPCC) Assessments**: The IPCC regularly assesses scientific information related to climate change. These assessments inform policymakers and underscore the urgency of adaptation measures. PCRA is a tool for local-level implementation of IPCC recommendations.
- **Global Adaptation Initiatives**: Various global initiatives, such as the Global Commission on Adaptation (GCA), focus on promoting adaptation and resilience-building efforts at the local, national, and global levels. They emphasize the importance of community engagement and local adaptation planning, which align with PCRA.
- **Green Climate Fund (GCF):** The GCF is a financial mechanism under the UNFCCC that supports climate adaptation and mitigation projects in developing countries. Kisii County can access funding from GCF to implement adaptation projects informed by PCRA.
- **National Adaptation Plans (NAPs**): The NAP process, guided by the UNFCCC, encourages countries to develop and implement comprehensive adaptation plans. PCRA is a valuable tool for gathering local input and data to inform NAPs.

1.2.3 National and County Frameworks

In recent years, Kenya has put in place a strong regulatory framework consisting of laws, policies, plans, and institutions at both the national and county levels to tackle the challenges posed by climate change. The Constitution of Kenya (2010) serves as the cornerstone for establishing an institutional and legal framework for addressing climate change. Article 10 outlines national values and principles of governance, including sustainable development, devolution of government, and public participation, which must be adhered to when formulating and implementing laws and public policies, including those related to climate change. Article 42 guarantees every Kenyan the right to a clean and healthy environment, ensuring the protection of the environment for the benefit of current and future generations.

Kenya's climate change response is primarily guided by the Climate Change Act of 2016, which plays a crucial role in integrating climate change considerations into the functions of various sectors, ministries, departments, and agencies. This legislation also forms the legal basis for the National Climate Change Action Plan (NCCAP). Moreover, Kenya has developed several key documents and strategies to address climate change, including the National Climate Change Response Strategy (2010), the first NCCAP (2013-2017), the National Adaptation Plan (NAP 2015-2030), the Kenya Climate Smart Agriculture Strategy (2017-2026), the Climate Risk Management Framework (2017), the National Climate Change Policy (2018), and the National Climate Finance Policy (2018), among others. These plans and policies address various aspects of climate change across different sectors. Additionally, at the county level, Kisii County, along with 22 other counties, has established regulations for climate change funds, allocating a portion of their development budgets to support local adaptation and initiatives of mitigation.

Kisii County has equally taken great strides in ensuring that climate change governance structures are in place. These include; the Kisii County Climate Change Policy and the Kisii County Climate Change Act of 2020 and 2021 respectively, Kisii County Climate Change Fund Regulations 2021, Kisii County Climate Change Adaptation Plan, 2021 and the Kisii County climate risk assessment among others. By leveraging the Climate Change Fund Mechanism, the County has also established a Steering Committee, a County Planning Committee and Ward Planning Committees, for ensuring that a bottom-up approach is realized in identifying, implementing and reporting of Climate investments within the County. A County Climate Change Unit is also in place to coordinate climate adaptation and measures of mitigation in the County. Further, mainstreaming of climate change actions has been incorporated in the current generation of the County Integrated Development Plan (CIDP) and Annual Development Plans of all sectors.

1.3 Importance of the PCRA

The Participatory Climate Risk Assessment for Kisii County aims to lay the groundwork for comprehensive Climate Risk Management (CRM) by determining the potential harm that climate change and its impacts may inflict on the county, sectors, or communities. The PCRA process actively involved local stakeholders who identified

current and future climate risks and proposed projects and actions that reduce vulnerability.

The bottom-up approach, which emphasizes community engagement and participation is key and of significant value in the context of Participatory Climate Risk Assessment for Kisii County. This approach not only enhances the quality and relevance of the assessment but also strengthens the linkage between local, county, and national climate action plans. The approach aimed at

- Empowering local communities: The bottom-up approach recognizes that communities in Kisii County possess valuable knowledge about their environment, vulnerabilities, and coping strategies. Engaging them in the PCRA process empowered them to actively contribute to their own resilience and adaptation efforts.
- Localized data and insights: Local communities often have a deep understanding of climate-related risks and impacts specific to their region. By involving them in data collection and analysis, the PCRA accessed localized information that might be missed through top-down assessments.
- Ownership and buy-In: When communities actively participate in the PCRA, they have a sense of ownership over the process and its outcomes. This encourages buy-in and commitment to implementing adaptation measures, making them more effective.
- Identifying unique vulnerabilities: Different communities (Sub counties and wards) within Kisii County face varying climate risks and vulnerabilities. A participatory approach allowed for the identification of unique vulnerabilities and tailoring of adaptation strategies to specific local needs.
- Building resilience at the grassroots level: PCRA helped to build resilience from the ground up. When communities are involved in identifying and prioritizing risks, they are more likely to develop locally relevant and sustainable solutions.
- Integration into County Planning: The insights and recommendations generated from PCRA feed directly into the Kisii County Climate Change Action Plan. This ensures that local priorities and needs are integrated into the county's climate strategy and that climate action is context-specific.
- Coordination with national efforts: The County Climate Change Action Plan, which includes adaptation strategies informed by the PCRA, aligns with national climate policies and strategies in Kenya. This coordination ensures that county-level actions contribute to national climate goals.
- Scaling up to National level: The data, experiences, and strategies generated through the PCRA in Kisii County will be aggregated and shared at the national level. This information will inform the National Climate Change Adaptation Plan for Kenya, enriching the overall adaptation strategy of the country.
- Strengthening climate governance: Engaging communities in the PCRA process fosters transparency and accountability in climate governance. It ensures that local voices are heard and that climate policies and plans are inclusive and responsive.
- Improved resilience and adaptation: Ultimately, the value of the PCRA lies in its potential to enhance the resilience of Kisii County to climate change impacts. By

incorporating community perspectives, it helped identified effective, context-specific adaptation measures that benefit both communities and the environment. This localized approach, in turn, contributes to national climate adaptation efforts, creating a more holistic and effective response to climate change in Kenya.

The resulting assessment included the identification of critical climate risks specific to the county, along with strategic investment areas that promote climate resilience.

The report constitutes the following:

i. Risks posed by climate change to different facets (people, economy, value chains, infrastructure, ecosystems etc.) of the County's economy
ii. Assessment of vulnerabilities of the county government to the impacts of climate change
iii. Evaluating the climate change-related hazards faced by the county.
iv. Magnitude of the risks experienced and projected to be experienced in future, from climate projections
v. Indicators for the climate risks identified
vi. Monitoring framework for the climate risks identified
vii. Possible solutions to counter the climate risks identified
viii. Enhancing institutional and human capacity to effectively respond to climate change, including the implementation of demand-driven management of knowledge and mobilization efforts.
ix. Ensuring that climate knowledge and information is available and accessible, including the establishment of systems for climate monitoring and early warning for timely and effective response.
x. Developing strategic partnerships for climate action, including defining the roles of various stakeholders at the county level
xi. Preparation of overlay maps of risks and vulnerability indices.

1.4 Key steps in the County's PCRA process

1.4.1 Key steps

Participatory Climate Risk Assessment for Kisii County process involved engaging local communities and stakeholders to identify, assess, and prioritize climate-related risks and vulnerabilities and included the steps discussed.

Preparation and Planning:

Step 1: Preparation, Planning and establishing a technical working group.

This involved defining the scope and objectives of the PCRA. Clear timeline, budget, and a multidisciplinary team were established that included experts, facilitators, and community representatives. Establishing a technical working group to lead the PCRA was undertaken on 26th April 2023, during a meeting on Participatory Climate Risk Assessment held at the Agricultural Training Centre. The members of the TWG included: Directorate of Climate change; Kenya Meteorological department, National prolonged dry spells management authority, social services, Administration

environment, directorates of water, environment, energy, economic planning, physical planning, agriculture, education and public participation. The members were sensitized on the three phases of PCRA (Participatory Climate Risk Assessment; Participatory Climate Change Action Planning; and climate change adaptation).

Step 2: Stakeholder identification and engagement

The aim of conducting a stakeholder analysis was to identify and engage key stakeholders at the County, Sub-county, and Ward levels who can contribute to and should be involved in the participatory climate risk assessment and climate action planning process. This includes representatives from marginalized groups and those who are particularly vulnerable to the impacts of climate change.

The TWG identified all relevant stakeholders that fell within these four groups:

i) Formally responsible for climate action and building resilience;
ii) Involved in climate action and responses to climate impacts;
iii) Knowledgeable and have expertise relevant to climate action and building resilience, including knowledge on the climate system and climate risks;
iv) Impacted by climate change.

The TWG later narrowed down the list to the most critical individuals and organizations that would take part in the workshop considering representation of ward committees, CBOs, women, youth, and persons with special needs. A list of 45-50 members of the technical working group was selected to lead the process at the community level. These members would be the lead facilitators during the PCRA. The process undertook the wider engagement process at sub-county or ward level involving communities and other key local actors. The aim of this process was to ensure communities and other key local actors actively participate and have a strong voice in the participatory climate risk assessment and climate action planning process. Each ward was represented by between 10 to 15 members with inclusivity aspect considered

During the identification of the stakeholder the following sectors and types of stakeholders were considered: community based and grass roots organizations, civil society organizations, faith based organizations/representatives, customary/traditional institutions, indigenous groups, local producer groups, local experts, community leaders and representatives (including traditional, spiritual and cultural), business groups and umbrella organizations, academia/research organizations, representatives of people living with disabilitiesyouth groups, women groups, and traditionally marginalized and vulnerable groups.

Step 3: Capacity building

Training and capacity-building activities for community members and stakeholders was undertaken to ensure they understand the PCRA process, its goals, and their roles. It ensured that stakeholders are adequately prepared and equipped to participate effectively. This step;

- Identified the specific capacity-building needs of different stakeholders involved in the PCRA process. This included local communities, government officials, NGOs, and other partners.
- Determined the key stakeholders who require capacity building. This included community leaders, farmers, women's groups, youth, government extension officers, and technical experts.
- Developed a training plan that outlined the objectives, content, methodologies, and duration of capacity-building activities. Ensured that the training is tailored to the needs and knowledge levels of the participants.
- Prepared training materials and resources that cover various aspects of climate change, vulnerability assessment, risk identification, and adaptation planning. These materials should be accessible and user-friendly.
- Conducted training sessions, workshops, and awareness campaigns for different stakeholder groups. These sessions should be interactive and participatory, encouraging active engagement and learning.
- Organized field visits and practical exercises to help participants apply their newly acquired knowledge and skills in real- situations. This included vulnerability assessments and risk mapping in wards.
- Guided the stakeholders in developing adaptation strategies and action plans based on their local knowledge and the information gathered during the PCRA process.

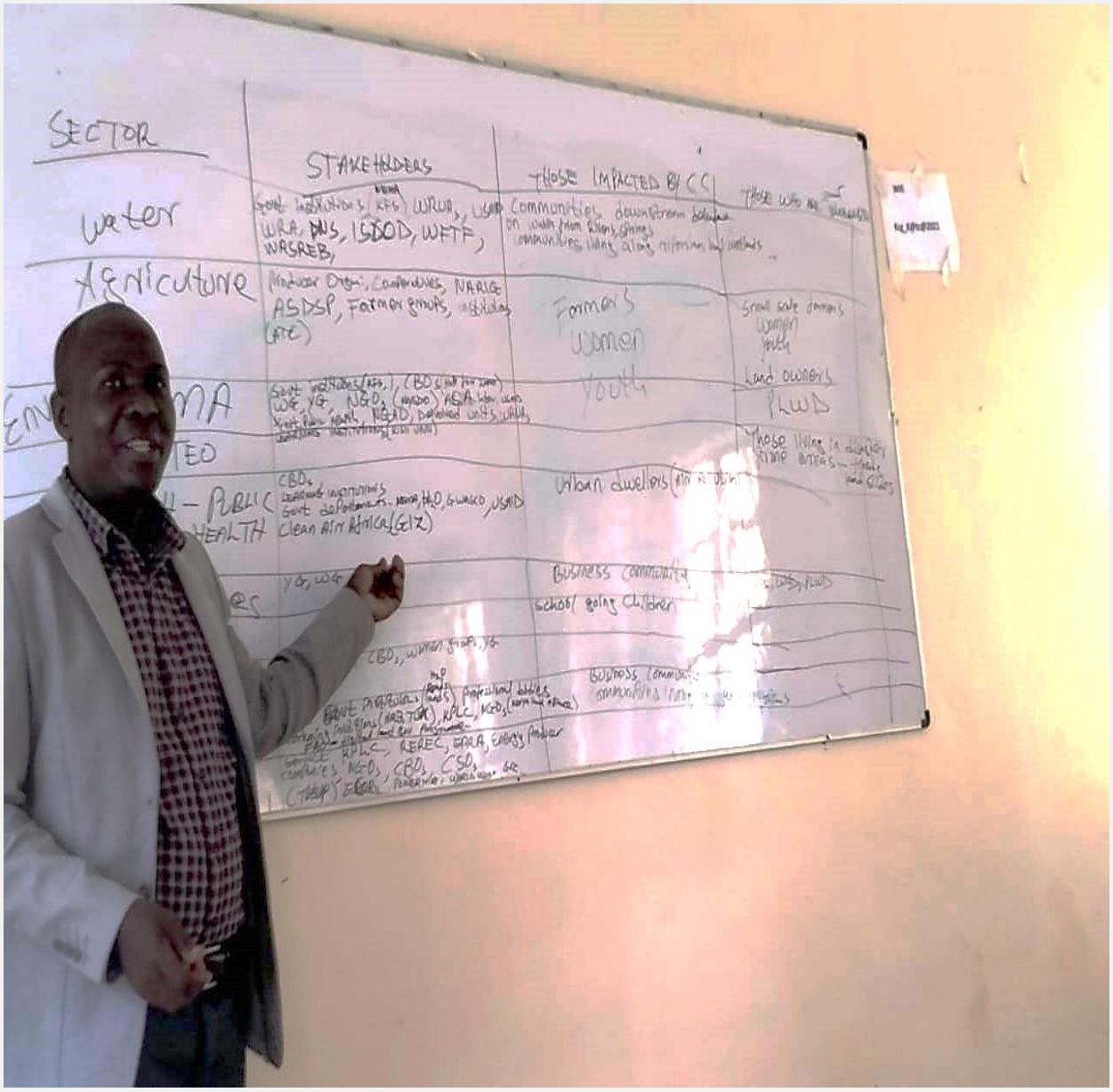


Plate 1-1: Ongoing stakeholder analysis by the technical working group

Source: Fieldwork

Table 1-2: List of sectors and its stakeholder for PCRA

Sector	Stakeholder
Water, Public Health and Sanitation	Government institution (WRUA, WRA etc.) Davis and Shirtlif, ISCOD Institution for Sustainable community Development, WFFT, WASREB, Clean Air Africa, GWASCO
Agriculture	Producer organization, cooperatives. NARIGP, ASDSP, Farmers groups, ATC,
Environment and Land	County and Ward Environment committee, NEMA, KFS, Western key water program, NGAO, Meteorology department, Lands department, Government Institutions (,Roads) professional Learning Institutions (NRB, TUK,) KPC, NGOs, (Kenya Land Alliance) FRO, Digital Land Government Program.
Social Services	Youth groups, PLWD, Women Group, Religious Organizations
Education and Academia	Kisii University
Climate Change	Ward Climate Change Planning Committee, Environment committee of Assembly, Opinions Leaders Politicians
Energy	Service providers – KPLC, REREC, EPRA, Energy producer Company, , CSOs (Tujikaze THUP), Equilibrium, power hive, GIZ
Non State Actors	Civil Society Organizations, CBO, Women Groups, Mogusii Santa, Hope for Tomorrow, NGOs, Public Health, USAID

Step 4: Contextual Analysis:

Initial review of climate data, historical records, and existing studies to understand the local climate context and potential climate-related risks was undertaken.

Step 5: Community awareness and mobilization

Community awareness and mobilization were critical components of the Participatory Climate Risk Assessment process in Kisii County, Kenya. Effective mobilization ensured active community participation and engagement in the assessment and entailed

- Identifying the key objectives of community awareness and mobilization efforts. Determining the target audience, this included local residents, community leaders, women's groups, youth, and other stakeholders.
- Identifying and engaging with key stakeholders who can support and facilitate community mobilization, such as local leaders, community-based organizations, and extension officers.
- Conducting a preliminary assessment of the local context, including the community's existing knowledge of climate change and its impacts. This information helped to tailor awareness activities effectively.
- Organizing community meetings and consultations to introduce the PCRA process, its goals, and expected outcomes. Sought input and feedback from community members to ensure their concerns and perspectives were integrated.

- Engaging with local leaders, elders, and influencers to gain their support and endorsement of the PCRA process. They helped to build trust and credibility within the community.
- Mobilizing community members to participate in data collection activities, such as surveys, interviews, and focus group discussions. This ensured they understand the purpose and significance of these activities.

Step 6: Data collection

This involved collecting data on climate hazards, vulnerabilities, and exposure. Use of various methods such as surveys, interviews, focus group discussions, and site visits were undertaken. Prior to data collection sessions session the group facilitators made sure they were familiar with relevant data and issues for the table group discussions they would be leading while note takers were prepared to use the response matrices to collect the information in this session. Respondents at the community (ward) level included between 10 to 15 members including the ward committees. Inclusivity was considered to have the participation of people of different age, disabilities, gender and class.

Step 7: Vulnerability Assessment

This step entailed analysis the data to assess the vulnerabilities of different sectors (e.g., agriculture, water resources, health, infrastructure) to climate change impacts.

Step 8: Data collection Risk Identification

This step entailed identification of specific climate-related risks, including extreme weather events, changing rainfall patterns, and temperature increases, and their potential impacts on Kisii County communities and sectors.

Step 9: Participatory Mapping

Engagement of communities in mapping exercises to identify vulnerable areas, valuable resources, and key infrastructure that may be at risk from climate hazards.

Step 10: Risk Prioritization

Prioritization of the identified risks was based on criteria such as severity, likelihood, and the potential for harm. Stakeholders were engaged in discussions to reach a consensus on priorities.

Step 11: Development of Adaptation Strategies

Local communities and stakeholders developed context-specific adaptation strategies and action plans to address the identified risks and vulnerabilities.

Step 12: Documentation and Reporting:

Documentation of the PCRA process, findings, and recommendations in a clear and accessible format was undertaken. Sharing of the results with stakeholders,

including community members, and use the information to inform County and National climate action plans.

1.4.2 Tools and methods of data collection

Tool 1: Hazard mapping

The objectives of this exercise were:

i) To become familiar with the community and to see how the place is perceived by different groups within the community.
ii) To identify important livelihood resources in and around the community
iii) To initiate the identification of hazards affecting the community (both climate-related and other)
iv) Understand neighbourhood and threats

Key question(s): What have been the main threats/hazards facing the community in the last 20-30 years?

The participants in each ward were explained chose a suitable medium and place for drawing their respective wards to meet the objectives as explained to them. The representative members identified landmarks and boundaries and indicated the settlement areas, important facilities and resources. The members also identified and marked or indicated the areas at risk from different hazards on the maps. Where possible the members indicated the safe spaces.

Source:Fieldwork

Plate 1-2: Representative members of Nyamasibi ward during hazard mapping

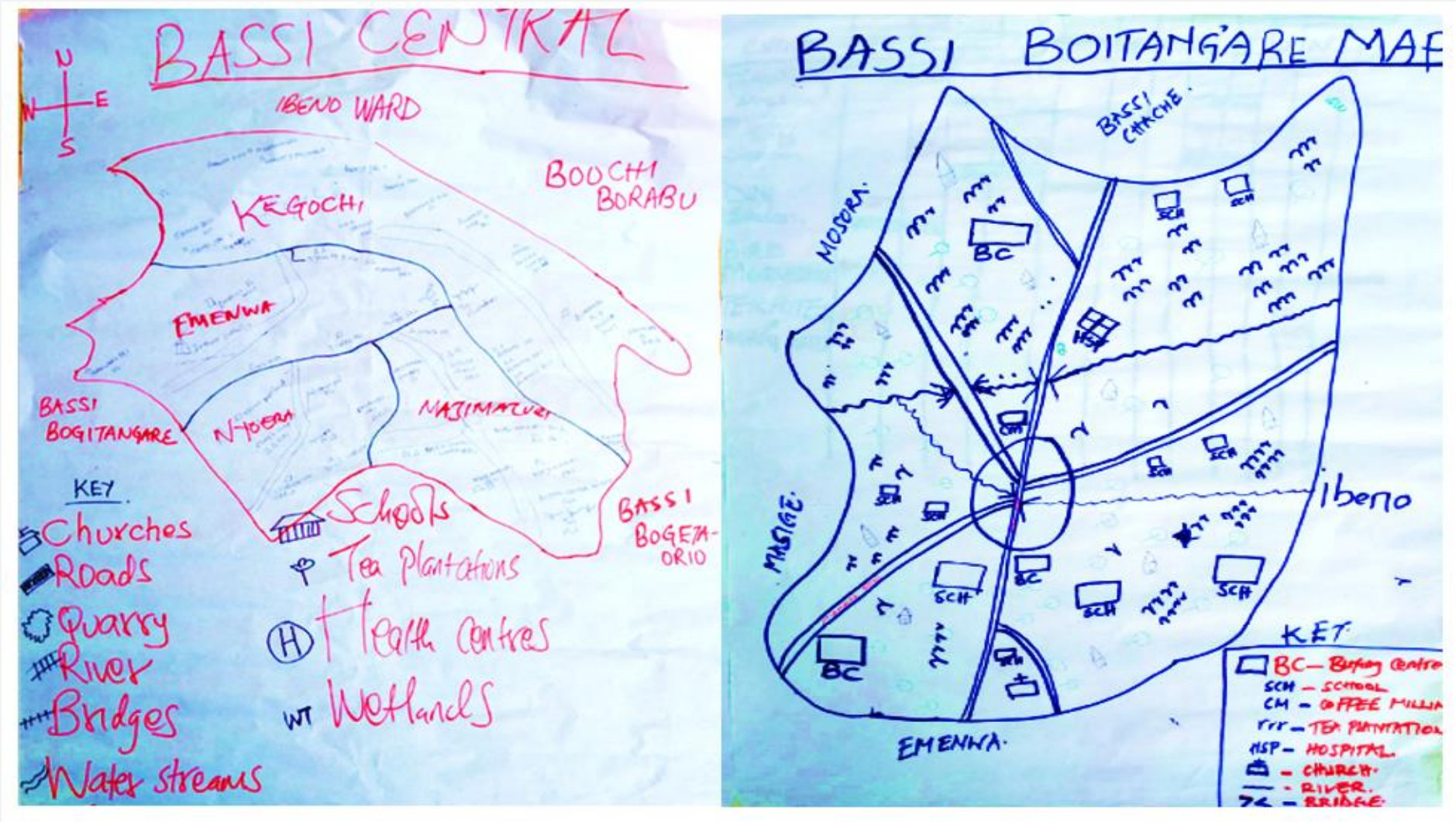


Plate 1-3: Ward maps for Bassi Central and Bassi Boitangare wards

Source: Fieldwork

Tool 2: Seasonal Calendar

Objectives

i) To analyse seasonal changes in activities and periods of stress or scarcity.
ii) To identify important livelihood activities and events.
iii) To document community observations of changing trends in seasonal patterns of the events and risks.

Key questions:

Have you noticed changes in the climate over the last 10, 20-30 years? Explain.

Have you noticed changes in frequency and intensity in the identified climate hazards over the last 10, 20-30 years?

The representative members in the respective wards were guided to identify events, activities and hazards (identified by the hazard map) and document observations of changing trends in the seasonal patterns of events and risks. The representation was to be indicated in terms of current time (10 years) and historical (more than 20 years).

Plate 1-4: Seasonal calendar for Bogiakumu ward

Source: Fieldwork

Prioritization

The objectives: Create a common understanding of the main hazards affecting the community and either vote to prioritize the 3 main hazards affecting them.

Key question: *Which are the 3 main/most threatening climate risks/ hazards affecting your community?*

Participants voted and summarized the climate risks identified in the hazard map and seasonal calendar exercises, and identified the hazards most relevant for their community.

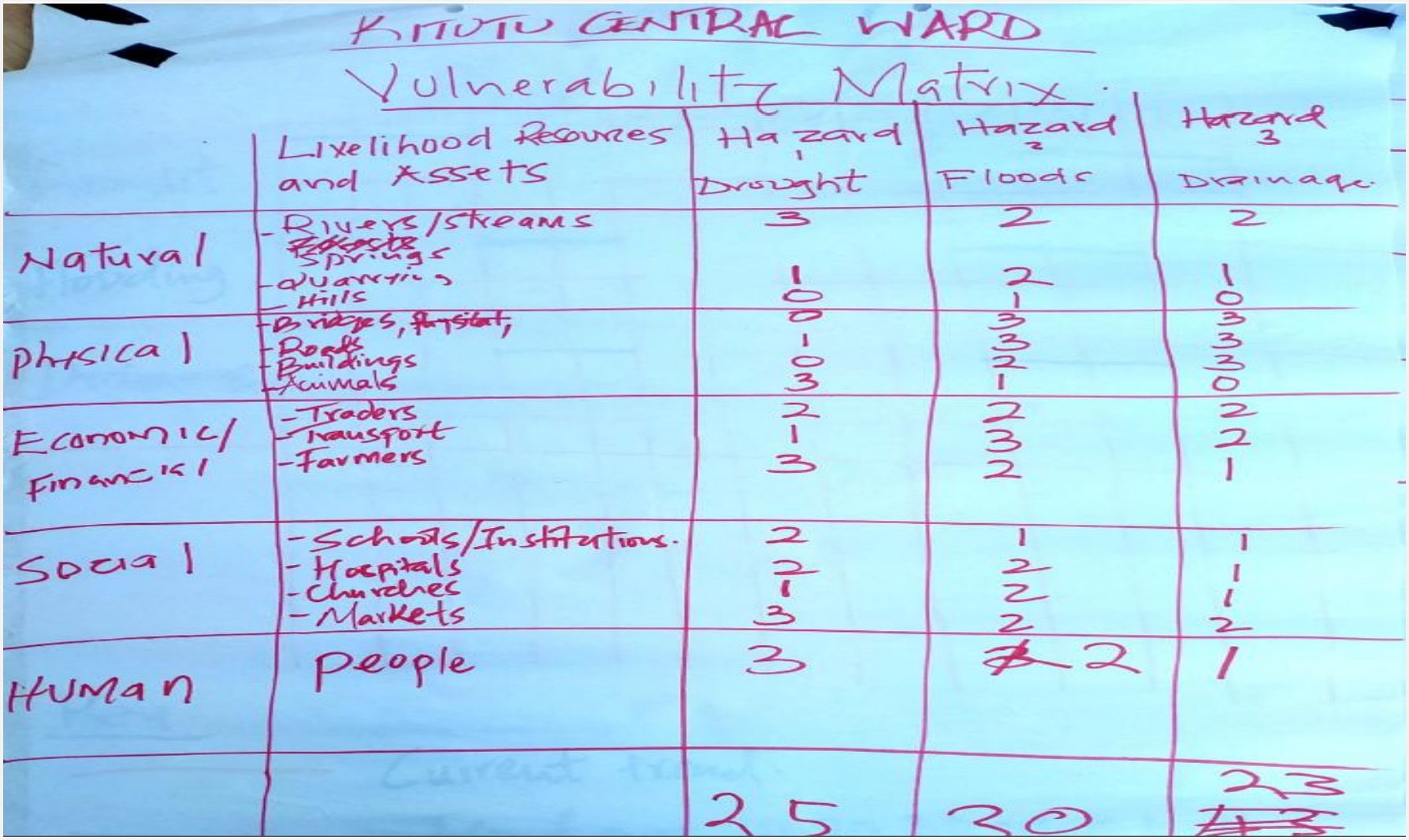
Tool 3: Vulnerability matrix

Purpose and the use of this Vulnerability assessment matrix:

i) To enable participants' identify the assets and resources most important to people's livelihoods.
ii) They then use a matrix to determine which of the community's livelihood assets and resources are most vulnerable to the main hazards in the community (3 main prioritized hazards).
iii) Participants then evaluate the level of impact of the hazards.

Objectives of this exercise were to:

i) Identify the community's most important resources and assets
ii) Identify the vulnerability of the assets and resources to the hazards
iii) Determine which assets and resources are most at risk
iv) Determine which hazards are most harmful to the resources and assets



KITUTU CENTRAL WARD

Vulnerability Matrix.

	Livelihood Resources and Assets	Hazard 1 Drought	Hazard 2 Floods	Hazard 3 Drainage
Natural	- Rivers/Streams	3	2	2
	- ~~Forests~~ Springs	1	2	1
	- Quarries	0	1	0
	- Hills	0	3	3
Physical	- ~~Bridges, Tarmac~~	1	3	3
	- Roads	0	2	3
	- Buildings	3	1	0
	- Animals			
Economic/ Financial	- Traders	2	2	2
	- Transport	1	3	2
	- Farmers	3	2	1
Social	- Schools/Institutions.	2	1	1
	- Hospitals	2	2	1
	- Churches	1	2	1
	- Markets	3	2	2
Human	People	3	~~3~~ 2	1
		25	30	23 ~~23~~

Plate 1-5: Vulnerability matrix for Kitutu Central ward

Source: Fieldwork

2 CHAPTER TWO: KISII COUNTY CLIMATE HAZARD PROFILE

2.0 Historical climate hazards and trends

Kisii County exhibits a highland equatorial climate resulting into a bimodal rainfall pattern with an average annual rainfall of 1,600mm. The long rains are between March to May (MAM) while the short rains are received from October to December (OND); with the months of January and February being relatively dry. The maximum temperatures in the County range between 21°C to 30°C, while the minimum temperatures range between 13°C to 20°C. The high and relatively reliable rainfall patterns coupled with moderate temperatures are suitable for growing crops like tea, coffee, pyrethrum, maize, beans and bananas as well as dairy farming.

Kisii County Rainfall distribution Zones: There are three Rainfall distribution zones in Kisii County; Zone 3 receives highest amount of rainfall of 1700-1900mm annually, followed by zones 2 which receives rainfall of 1600-1700mm annually and finally zone1 which receives annual amount of rainfall of 1400-1600mm respectively as shown in figure 1.

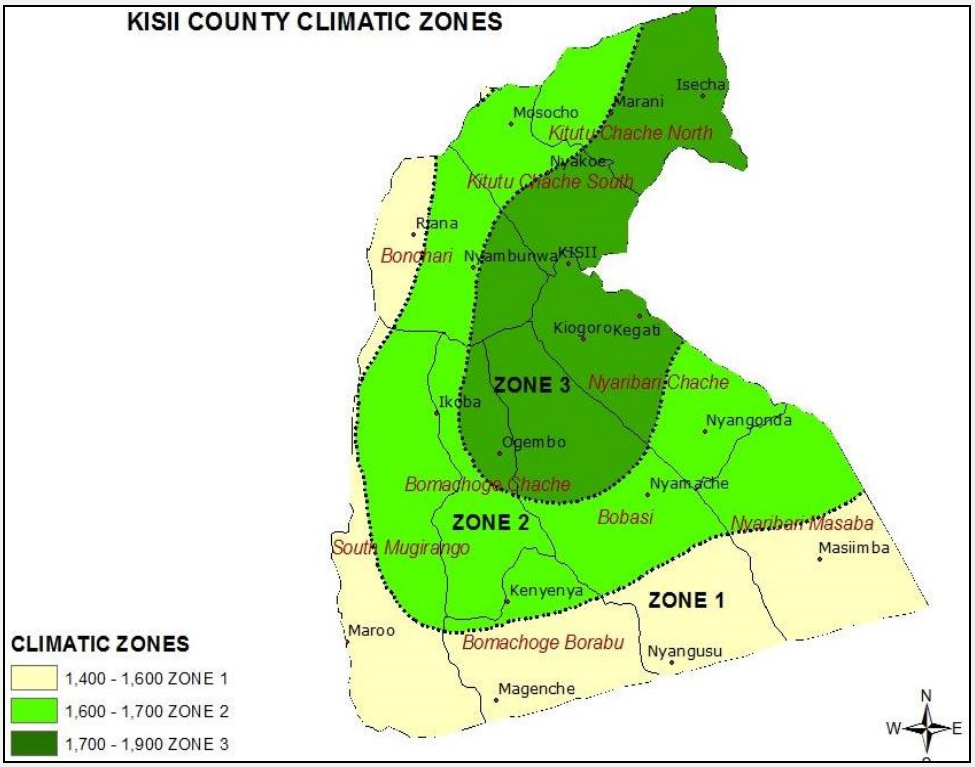


Figure 1: Climatic Zones of Kisii County

Mean annual rainfall and temperature trends: Generally, statistical analysis of rainfall trends in Kisii County indicate that depressed rainfall patterns have been experienced in the County over the past years (Figure 2). Annual rainfall depicts a fluctuating trend all over the years. There is high variability in the amount of mean rainfall received in the County over the years, for instance 2005 experienced the lowest amount of rainfall in the series while 2001 recorded the highest amount of rains annually.

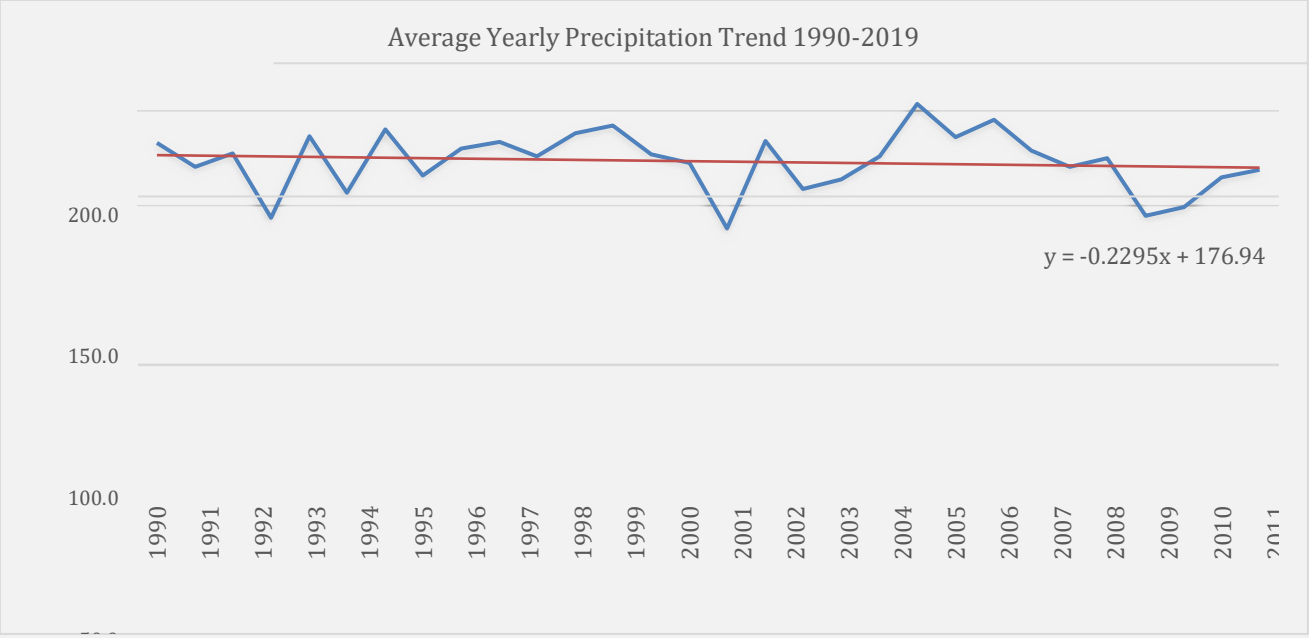


Figure 2: Precipitation trend for the study area

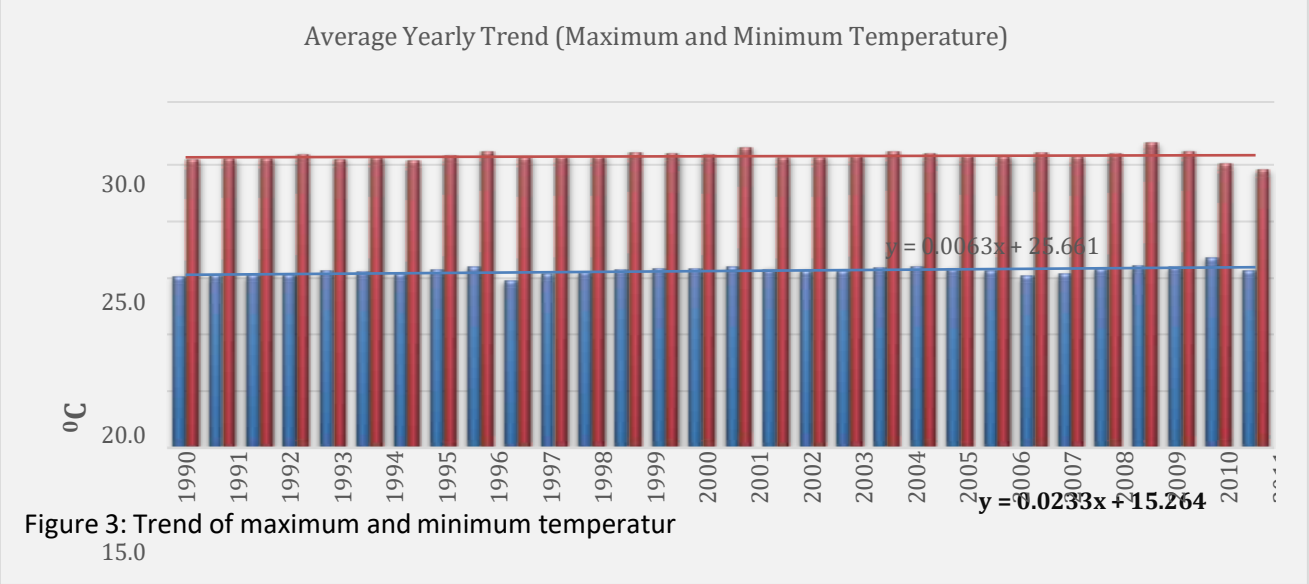


Figure 3: Trend of maximum and minimum temperatur

2.1 Vulnerability profile

Kisii County has been experiencing the impacts of climate change, including erratic rainfall patterns, unpredictable onset and cessation of rainfall seasons, prolonged dry spells, increased daytime temperatures, heavy rainfall events, and the disappearance of natural water sources. These changes have had a significant effect on the agricultural sector, which is crucial for the county's socioeconomic development. Agriculture plays a vital role in achieving food and nutrition security, poverty reduction, and employment generation in Kisii County.

Around 80% of the workforce in Kisii County is involved in agriculture, which contributes to 60% of the county's GDP. However, the fluctuations in income generated from crop and livestock farming can be attributed to irregular rainfall patterns, fragmented land, infertile soil, and limited use of agricultural inputs. These factors have led to declining crop yields and negatively affected the income generated from crop farming for households in the region. In contrast, due to the limited availability of land, farmers are increasingly adopting intensive livestock production systems. This shift, coupled with a rising demand for livestock products, particularly in urban areas, has resulted in increased income from livestock farming.

Within the agricultural sector, dairy milk contributes the most (51%) to the livestock sector's GDP, while maize (54%), beans (30%), and bananas (16%) are the major contributors in the crops sector. Crop cultivation, in particular, plays a significant role in household's income generation. On-farm income for households averages Kshs 39,511 per year, with 61% coming from crops, 14% from livestock, and 25% from other sources. Male-headed households depend more on on-farm activities for income (38%), compared to female-headed households (37%) and youth-run households (24%).

Kisii County has a high age dependency ratio, standing at around 85%, which is above the national average of 82%. This ratio compares the economically productive individuals (aged 15-64) to dependents (under 15 or over 65 years of age). The absolute poverty rate in the county is estimated to be 45%, higher than the national rate of 32%. Additionally, 51% of the population in Kisii County live below the poverty line of US$1.90 a day. Access to electricity for lighting is limited, with only around 30% of households having access, and merely 1% having electricity for cooking. Approximately 21% of households have access to potable water.

Key areas of concern in Kisii County include agriculture, energy, water resource management, infrastructure, and health. Climate change has resulted in longer dry spells, increased flooding, and other extreme weather events, which degrade and reduce the availability of clean drinking water. This, in turn, contributes to an increase in water-related diseases such as cholera and diarrhoea, especially in areas with inadequate sanitation infrastructure. Insufficient access to safe drinking water, poor sanitation facilities, and lack of proper hygiene practices are major factors contributing to poor health and life-threatening diseases within the county. Women, who are often

responsible for tasks such as washing and water collection, are particularly vulnerable to water-related diseases. Efforts need to be focused on addressing these challenges to ensure improved access to clean water, sanitation, and hygiene practices in order to safeguard public health in Kisii County. (CIPD 2023-2027).

2.2 Current climate hazards and trends

2.2.1 Overview

The purpose of this section was to understand the key threats/hazards facing the community in the last 20-30 years with use of hazard maps and seasonal calendars. The participants gave an analysis of the hazard prioritization based on the three most threatening per ward.

2.2.2 Sub-County hazard profiles

The sub-county ranking was obtained by scoring the top three threats for each ward as shown in the spatial distribution of hazards per ward in Table 2.13. The most threatening hazard (H1) was assigned a weight of '3', the moderately threatening hazard (H2) was assigned weight of '2' while the least of the top three (H3) was assigned weight '1'. To consolidate and rank the threats in the sub-counties, each of the hazards was multiplied by the weight.

For instance, in Bobasi sub-county flood was obtained as follows:
*Weight of Floods = (Number of Floods appearing as H1*3) + (Number of floods as H2*2) + (Number of Floods appearing as H3*1)*
*Weight of Floods= (3F*3) + (3F*2) + (0F*1)*
*Weight of Floods= (3*3) + (3*2) + (0*1)*
Weight of Floods=15

In the same Bobasi sub-county, prolonged dry spells were obtained as follows:
*Weight of Prolonged dry spells= (Number of Prolonged dry spells appearing as H1*3) + (Number of Prolonged dry spells as H2*2) + (Number of Prolonged dry spells appearing as H3*1)*
*Weight of Prolonged dry spells= (3PDS*3) + (1PDS*2) + (2PDS*1)*
*Weight of Prolonged dry spells= (3*3) +(1*2) + (2*1)*
Weight of Prolonged dry spells =13

Resultantly the top 5 threats per sub-county were obtained for example in Bobasi the top five were: Floods (15); prolonged dry spells (13); Heavy rains (6); Epidemics (5) and Thunderstorms (4).

Table 2-1: Current Sub-county hazard profiles

Rank	Bobasi	B. Borabu	B. Chache	Bonchari	Kitutu Chache North
1	Floods (15)	Floods (7)	Floods (9)	Prolonged dry spells (6)	Floods (10)
2	Prolonged dry spells (13)	Prolonged dry spells (4)	Landslides (2)	Diseases (5)	Prolonged dry spells (4)
3	Heavy rains (6)	Waste disposal (3)	Hailstorms (2)	Floods (4)	Thunderstorms and lightning (4)
4	Epidemics (5)	L/Slides (3)	Water pollution (2)	Hailstorms (3)	Hailstorms (3)
5	Thunderstorms (4)	Pests/Diseases (2)	Thunderstorms (1)	Water shortage (3)	Landslides (2)

Table 2-2: Current sub-county hazard profiles

Rank	Kitutu Chache South	Nyaribari Chache	Nyaribari Masaba	South Mugirango
1	Prolonged dry spells (12)	Prolonged dry spells (17)	Prolonged dry spells (15)	Dry spells (12)
2	Floods (12)	Hailstorms (5)	Floods (4)	Landslides (11)
3	Water pollution (2)	Soil erosion (5)	Thunderstorms (4)	Soil erosion (6)
4	Landslides (2)	Dry spells (3)	Hailstorms (2)	Floods (3)
5	Strong winds (1)	Landslides (3)	Landslide (1)	Diseases (1)

2.2.3 Current Kisii County Hazard Profile

To score hazards across the county, separate scores for a particular hazard were summed to obtain a cumulative weight depending on the number of appearances in the 9 sub-counties. For instance, prolonged dry spell appeared in all 8 sub-counties with a cumulative score of 83 (13, 4, 6, 4, 12, 17, 15 and 12) in reference to table 2.1 and 2.2 above. Floods appeared in 8 sub-counties with respective scores as Floods (15), Floods (7), Floods (9), Floods (4) Floods (10), Floods (12), Floods (4), and Floods (3). The scores are added to obtain the cumulative score (i.e., 15+7+9+4+10+12+4+3=64). The same procedure was followed for the other hazards, landslides, hailstones, epidemics, thunderstorms, water pollution and strong winds).

Table 2-3: Current County hazards

Hazard	Score	Rank
Prolonged dry spells	83	1
Floods	64	2
Landslides	24	3
Hailstones	16	4
Epidemics	14	5
Thunderstorms and lightening	13	6
Water pollution	7	7
strong winds	3	8

Following the analysis of the hazard map and seasonal calendar, the representative community members identified, prioritizedand ranked the following hazards across the county in the following order of impact and magnitude as prolonged dry spells, floods, landslides, hailstones, epidemics (livestock and human diseases), thunderstorms, water pollution and strong winds.

2.3 Exposure and vulnerability profiles in Kisii County

The hazards identified and ranked in section 2.1 are discussed in the order of priority as follows.

i. Hazard 1: Prolonged dry spells

Kisii County encounters periods of relative dry spells, which refer to periods with rainfall amounts below 100 mm, typically occurring between the two rainy seasons. These dry spells typically take place in January and February, as well as in July. The prolonged dry spells in this area were associated with climate change, the changing rainfall patterns; and low rains. The areas affected most are listed in table 2-4 below.

Table 2-4: Sub-county prolonged dry spell occurrence

Sub-county	Wards	Remarks
Bobasi	Bassi Chache, Nyacheki and Sameta Mokwerero	Moderate impact
Bomachoge Borabu	Bombaba	Low impact
Bonchari	Bomorenda, Riana, Bomariba	Bomorenda more threatened
Kitutu Chache North	Kegogi and Marani	Moderate impact
Kitutu Chache South	Bogusero, Kitutu Chache central, Nyakoe, Birongo	High impact
Nyaribari Chache	Ibeno, Keumbu, Kiogoro and Kisii Central	High impact
Nyaribari Masaba	Gesusu, Ichuni, Kiamokana, Masimba and Nyamasibi	High impact

The most affected sub-counties are Kitutu Chache South and Nyaribari Masaba while Bomachoge Borabu is least affected. Bomachoge Chache sub-county is not threatened by prolonged dry spells.When the prolonged dry spells strike in livelihoods the most affected are in the order of farmers, and businessmen while in the household the most affected are in the order of children and mothers. The elderly and people living with disabilities (PWDs) are also affected. The farmers are affected most as during the prolonged dry spells the crops are stressed by high temperatures, diseases and water scarcity.

The water scarcity in Kisii County is exacerbated by the heavy water consumption by the blue gum(eucalyptus trees). Business men are affected as the purchasing power of the locals reduce in regard to other commodities as the demand shifts toward food stuffs (staple food). Children, elderly and the PWDs are affected as they are dependent members of the family. The mother are the care givers and as such they are more than fathers as most of the time, they are the ones that spend much time toiling and nurturing for these dependents.The participants cited the following measures as coping strategies:

- Survival on relief food donations from the government or Non-Governmental organizations.
- Selling of soapstone.
- Migrating to the nearest towns for employment.
- Indulgence in criminal activities for most youth
- Harvesting wild honey.
- Forced early marriages for young girls.

ii. Hazard 2: Floods

Kisii County follows a pattern of two distinct growing seasons. The long rainy season extends from February to June, while the short rainy season occurs between August and December. Generally, the long rainy season tends to be wetter compared to the short rainy season. During the months of April and May, Kisii County receives the highest amount of rainfall, with monthly precipitation exceeding 200 mm. This information is based on the Kenya County Climate Risk Profile Series for Kisii County.

Floods were identified as hazards with ‘goodies’ as when they strike, they have negative impacts in the beginning but as they recede farmers make use of the opportunity to grow crops that end up in bumper yields hence, they rate its magnitude as moderate due to the its offsetting results. The floods are as a result of the long rains in April to June, flash floods in December. When the floods strike the generally the entire community is affected but mostly affected are children and mothers due to diseases associated with them such as the diarrheal and malaria.

In regard to livelihoods the farmers are affected most, followed by pastoralists then the businessmen. For farmers plots along the rivers are flooded

with water submerging the crops causing anoxia and eventually death, erosion of the top soils and deposition of poor soils.

Table 2-5: Sub-county flood risk occurrence

Sub-county	Wards	Areas most affected
Bobasi	Bassi Bogetaorio, Bassi Boitangare, Bassi Chache, Nyacheki and Sameta Mokwerero	Bassi Bogetaorio and Bassi Boitangare most affected
Bomachoge Borabu	Bombaba Borabu Boochi Borabu and Magenche	Bombaba Borabu most affected
Bomachoge Chache	Boochi Tendere, Bosoti Sengera and Majoge Bassi	High impact
Bonchari	Bogiakumu, Riana	Low magnitude
Kitutu Chache North	Kegogi, Marani Monyerero	Have high magnitude
Kitutu Chache South	Bogeka, Bogusero, Kitutu Chache central, and Nyakoe	High impact; Bogeka most impacted

Floods not a threat in Nyaribari Chache and South Mugirango Sub-counties.
During the floods the members of the community take the following measures as coping strategies:

- Casual labour for both members of the household
- Basketry for women
- Criminal activities such as theft for most youth
- Cry for relief food from humanitarian organizations such as KRCS, government and other NGO's
- Turn receding flood water as opportunities for crop production. The members noted a bountiful harvest especially for bananas.

Plate 2-1: Flooding within Kisii central business district

iii. Hazard 3: Landslides

In Kisii County, landslides on the sloppy areas mostly during rain seasons and not so common from human activities. According to the community's perspective, the most vulnerable areas to landslides include:

- Steep terrain, particularly areas located at the bottom of canyons.
- Land that has been altered or modified by human activities, such as deforestation or construction.
- Channels along streams or rivers.
- Any location where surface runoff is directed or where the land is heavily saturated.

Table 2-6: Sub-county Landslide risk occurrence

Sub-county	Wards	Remarks
Bobasi	Bassi Bogetaorio, Bassi Cache and Sameta Mokwerero	High impact
Bomachoge Borabu	Magenche	Low
Bomachoge Chache	Boochi Tendere and Bosoti Sengera	Moderate
Bonchari	Bogiakumu	Low
Kitutu Chache North	Marani and Monyerero	Moderate
Kitutu Chache South	Bogeka and Bogusero	Moderate
Nyaribari Chache	Bobaracho	Low
Nyaribari Masaba	Nyamasibi	Low
South Mugirango	Bogetenga, Boikanga, Chitago Borabu, and Tabaka	High impact

All sub-counties have at least a ward recording landslides. South Mugirango leads followed by Bobasi and Bomachoge Chache, Bonchari, Nyaribari Chache and Nyaribari Masaba are least affected by landslides. The ranking was based on the number of wards threatened or affected by the hazard.

Plate 2-2: A landslide at Maili Mbili in Bobaracho ward, Kisii County

iv. Hazard 4: Hailstorms

Hailstones are formed when thunderstorm updrafts carry raindrops above the freezing level in the atmosphere, causing them to freeze and form ice

pellets. According to community members, hailstorms are typically associated with thunderstorms.

Table 2-7: Sub-county hailstone risk occurrence

Sub-counties	Wards	Remarks
Bomachoge Borabu	Boochi Borabu	Low
Bomachoge Chache	Boochi Tendere	Low
Bonchari	Bogiakumu	Low
Kitutu Chache North	Sensi	Low
Nyaribari Chache	Birongo, Ibeno, Keumbu and Kiogoro	High impact
Nyaribari Masaba	Kiamokana	Low
South Mugirango	Bogetenga	Low

Nyaribari Chache sub-county has reported the highest occurrence of hailstorms. Other sub-counties affected by hailstorms include Bomachoge Borabu, Bomachoge Chache, Bonchari, Kitutu Chache North, Nyaribari Chache, Nyaribari Masaba, and South Mugirango. The communities have identified several effects associated with hailstorms, including:

- Destruction of cropsand farms (maize, legumes and tea most affected) leading to low yields.
- Destruction of property.
- Death or injury to the livestock. Livestock, particularly cattle and sheep, grazing in open areas are highly susceptible to hailstorms, and it often leads to death or injury, particularly among the young animals. They are the primary victims of hail during such weather events.
- Compromise grip on roads thus affect transport sector.

The most affected livelihoods and assets during hailstorms include crops, structures (such as buildings and infrastructure), and roads. These hailstorms pose a significant threat to these assets, leading to damage or destruction. In terms of vulnerable populations, children, the elderly, and people with disabilities are particularly at risk, especially if they are caught in the midst of a hailstorm while going about their daily activities. It is important to prioritize their safety and well-being during such events.

Coping strategies

- Early harvesting before destruction
- Staying inside or housing the livestock
- Covering small crops and fruits

Recommended strategies

- Insurance of property, crops and livestock
- Canopy management
- Investment in radio-active detection arrangement (RADAR)

- Creation of shock waves
- Dissemination of thunderstorm and hailstones forecast
- Post hailstorm disaster management and rehabilitation.

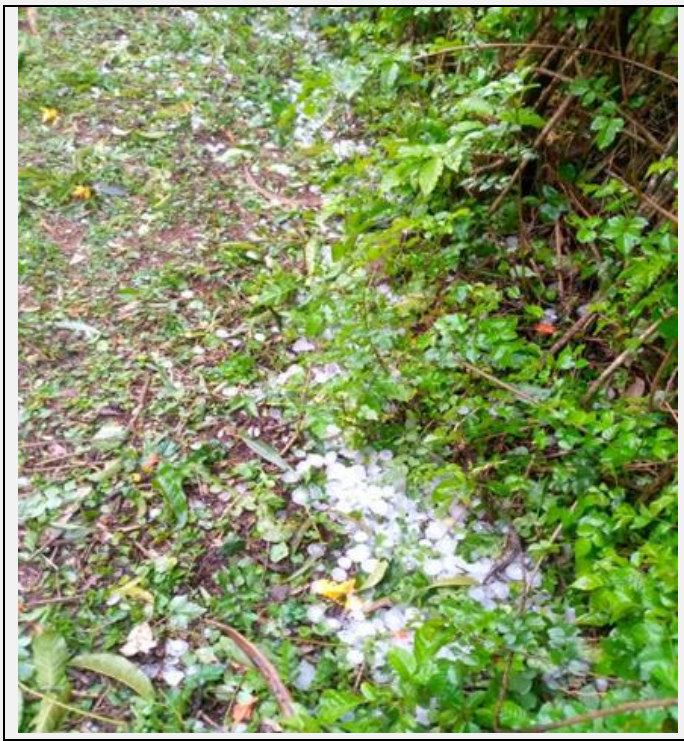



Plate 2-3: Shot of hailstorms in Nyansakia, Moticho ward in South Mugirango Sub County. Hailstorms is a common hazard in the County destroying crops and trees

v. Hazard 5: Epidemics

The common diseases cited were: malaria (vectored by mosquitoes during to floods and rains); pneumonia (cold season); HIV-AIDS; Diabetes; Cholera; TB; typhoid; skin infections; hypertension due to stress; cold/flu; cough; eye infections; delivery complications; epilepsy; polio; and ulcers.

The causes of these diseases among others were:

- Water contamination for diarrheal and cholera
- Prolonged dry spells for pneumonia
- Malnutrition causing poor health and predisposition to ulcers, skin infections and cancer

Mostly affected

- Children (especially under the age of five years) and lactating mothers by malnutrition, diarrheal infections (cholera and typhoid) and malaria.
- Youth and adults by HIV-AIDS; children (indirect being left orphans)
- Pneumonia-children
- Hypertension-mothers family related stress-mothers have more stressors than any other member of the household.

Table 2-8: Sub-counties epidemics occurrence

Sub-county	Wards	Remarks
Bobasi	Nyacheki	Priority hazard
Bomachoge Chache	Bosoti Sengera	Priority hazard
Kitutu Chache North	Kegogi	Priority hazard
Nyaribari Chache	Ibeno	Priority hazard
Nyaribari Masaba	Masimba	Priority hazard
South Mugirango	Moticho, Tabaka	Priority hazard

vi. Hazard 6: Thunder and lightning

Thunder and lightning were cited in Bobasi, Bomachoge Chache and Kitutu Chache North. A recent case is reported on 12th March 2023 where two football players died after they were struck by lightning while playing at Manyansi playgrounds in Kitutu Chache North Constituency.

Effects on assets and livelihoods

- Death of humans and livestock
- Injury to humans and livestock
- Destruction of trees and forests thereby destroying biodiversity.
- Interference with power and communication leading to blackouts.

Table 2-9: Sub-counties thunderstorms and lightning risk occurrence

Sub-county	Wards	Remarks
Bobasi	Masige East, Masige West	Priority hazard
Bomachoge Chache	Bosoti Sengera	Priority hazard
Kitutu Chache North	Monyerero and Sensi	Priority hazard

2.4 Differentiated impacts of climate trends and risks

As per the community's observations, there are distinct impacts of past and current climate trends and risks on various key interest groups within the county. The community has emphasized the need to consider the differentiated impacts on specific groups, including women, youth, ethnic minorities, people living with disabilities, and other marginalized and vulnerable populations. These groups may experience unique challenges and vulnerabilities due to climate change, requiring targeted attention and support in climate adaptation and resilience-building efforts. Recognizing and addressing these differentiated impacts is crucial for promoting equitable and inclusive climate action within the county.

Table 2-10: Differentiated impacts of climate trends and risks

Hazard	Effects	Most affected
Prolonged dry spells	▪ Increase in poverty due to lack of rains, crops wilt. ▪ Human wildlife conflict given that wild animals invade for field. ▪ Loss of life due to acute hunger and famine; and due to conflicts ▪ Sell of properties e.g., land to sustain themselves ▪ Drop of businesses due to lack of farm produce and death of livestock. ▪ Young girls indulge in sexual favors hence early pregnancies due to hardship at home. ▪ Young girls opt to get married at an early age due to hardship. ▪ Increase of family conflict leading to divorces.	Farmers mostly affected Children and mothers Elderly and people with disabilities
Floods	▪ Property along the rivers is swept away-e.g., crops such as bananas, mangoes, green grams; livestock; structures such as shanties etc. ▪ Increased prevalence of human, livestock and crop diseases e.g., malaria due to mosquitoes, cholera, amoeba, bilharzias, worm diseases for humans; fungal, bacterial and fungal for crops etc. And consequently, reduced medical supplies ▪ Erosion of the top soil leaving the land unproductive ▪ Siltation of poor unproductive soils and alluvial soil (opportunity); siltation of water sources ▪ Submergence of crops leading to anoxia (rotting) and weathering and death thus crop failure ▪ Cut off of linkages e.g., roads and bridges ▪ Drop in business due to shortage in supply of goods and services ▪ Escalation of prices for most of the commodities in the markets ▪ Accidental loss of lives ▪ Improved crop yield	Mostly affected are children and mothers due to diseases associated with them such as the diarrheal and malaria
Land slides	• Loss of lives	Bobasi, South Mugirango and

	• Loss of livestock • Injury to people and animals • Displacements of people and animals • Loss of fertile soil • Destruction of property and structures ▪ Increased costs for repairing, replacing, or maintaining damaged properties and installations within the affected landslide areas or due to landslide-induced flooding. ▪ Decline in productivity in industries, agriculture, forestry, and tourism due to damage to land, facilities, or disruptions in transportation systems. ▪ Reduction in tax revenues resulting from property devaluation caused by landslides. ▪ Implementation of measures to prevent or mitigate further damage from landslides, which require additional resources and investment. ▪ Negative effects on water quality in streams beyond the landslide areas. ▪ Reduction in human and animal productivity due to injuries, fatalities, or psychological trauma caused by landslides.	Bomachoge Chache sub-counties mostly affected
Hailstorms	▪ Destruction of crops and farms (maize, legumes and tea most affected) leading to low yields. ▪ Destruction of property. ▪ Death or injury to the livestock. Livestock, particularly cattle and sheep, grazing in open areas are highly susceptible to hailstorms, and it often leads to death or injury, particularly among the young animals. They are the primary victims of hail during such weather events. ▪ Compromise grip on roads thus affect transport sector.	Nyaribari Chache sub-county recorded the most hailstorms
Epidemics	▪ High mortality rates (death) especially for children under 5 years for malaria ▪ Stress leading to hypertension ▪ Mental effects e.g., the cerebral malaria and nuisance	Children (especially under the age of five years) and lactating mothers by malnutrition, diarrheal

	▪ Loss of energy leading to low productivity thus leading to poverty ▪ Impaired sight in case of eye infections ▪ Disabilities	infections (cholera and typhoid) and malaria.
Thunder and lightning	• Death of humans and livestock • Injury to humans and livestock • Destruction of trees and forests thereby destroying biodiversity. • Interference with power and communication	Bobasi, Bomachoge Chache, Kitutu Chache North Sub-counties most affected

Plate 2-4: Impact of landslides on physical structures
Source: Fieldwork

2.5 Hazards Impacts on livelihoods and assets

The resources are prone to various hazards that are prevalent in the county in to varying extents. The hazards in order of severity or impact include: prolonged dry spells/ prolonged dry spell, floods, landslides, hailstorms, epidemics and thunderstorms and lightning.

Table 2-11: Hazards impacts on livelihoods and assets

Category	Assets and livelihoods	Vulnerabilities
Natural	• Rivers • Forests • Streams • Swamps • Hills • Soapstone quarries	• Rivers and streams are mostly affected by prolonged dry spelland prolonged dry spells that greatly reduce the availability of water from these sources and sometimes dry them up completely. Heavy continuous rains also cause flooding hence overflowing rivers and streams. • Forests are also affected majorly by prolonged dry seasons. Hailstorms and strong winds also destroy trees. • Hills, slopes and parts of land are prone to Landslides and mudslides • Soapstone Quarries are prone to destruction by floods that fill them up and also by landslides that cover them up
Physical	• Factories (Tea) • Roads • Bridges • Buildings • Land	• Tea Factories are mostly prone to flood • Floods make roads impassable, occasionally by landslides • Floods sometimes destroy bridges or pass over bridges • Floods destroy buildings, Hailstorms and strong winds destroy weaker buildings (carrying away roofs)
Economic	• Crops • Markets • Land (for farming) • Buildings (for business) • Livestock	• Major cash crop being tea and other crops like maize, coffee are majorly affected by prolonged dry spells and prolonged dry spells, floods and hailstorms. • Floods disrupts marketing activities • Heavy rains and landslides facilitate soil shift and exposure • Livestock are affected by almost every hazard (floods, dry spells, diseases,
Social	• Faith based organizations • Schools	• Flood make some schools, faith-based organizations, health facilities inaccessible by destroying transport and communication infrastructure.

	• Health facilities	
Human	• Workforce	• Floods affect mobility • Prolonged dry spells cause dehydration and loss of energy • All disasters can cause loss of life and psychological and mental illness

Table 2-12: Sectoral hazard impacts in Kisii County

No	Sector	Climate Change risk	Resultant impacts	Level of Vulnerability		
				Low	Moderate	High
1	Agriculture	• Changing weather patterns	• Shifts in planting seasons • Low agricultural productivity due to crop failure • Post-harvest losses			√
		• Exposure to invasive and parasitic species & pathogens	• Low livestock and crop production		√	
		• Increased prolonged dry spells occurrences	• Reduced fish production, as changing water conditions and temperature fluctuations can affect fish habitats and breeding patterns. • Livestock deaths due to declining pasture availability, limited access to water sources, and increased heat stress. • Changes in disease patterns, including the potential re-emergence of climate-related diseases and pests that significantly impact livestock and crops. An example is the fall armyworm, which poses a threat to		√	

			agricultural productivity.			
		• Reduced water table and levels	• Water scarcity • Crop failure • Reduced livestock production • Reduced fish production			√
		• Deforestation	• Soil erosion • Reduced soil moisture • Reduced soil fertility •			√
		• Extreme land fragmentation/subdivision	• Encroachment to riparian lands • Low agricultural productivity • Loss of wetlands • Loss of biodiversity			√
2	Environment, natural resources, and energy	• Forest fires	• Increased greenhouse gas emissions • Loss of biodiversity • Loss of medicinal plant sources		√	
		• Prolonged dry spells	• Decline in forest productivity, leading to restricted availability of fuelwood which are crucial for cooking and heating purposes in many communities. The decline in forest productivity exacerbates the challenges faced by local populations, particularly those dependent on fuelwood as a primary energy source. • Water scarcity • Natural resources conflict that exacerbates gender inequality and gender-based violence • Environmental degradation.		√	

			• Desertification			
		• Landslides/mudslides	• Loss life and property • Loss of arable land • Environmental degradation		√	
		• Emergency of alien species	• Destruction of indigenous plants • Emergence of new pests and diseases		√	
		• Increased solid waste generation	• Increase in air pollution: Changes in weather patterns, such as temperature inversions and stagnant air masses, can lead to the trapping of pollutants close to the ground, resulting in increased air pollution. This can have detrimental effects on human health and the environment. • Increased greenhouse gas emissions: Climate change itself can be a driver of increased greenhouse gas emissions. Rising temperatures, changes in land use patterns, and altered natural processes can release additional greenhouse gases into the atmosphere, exacerbating the climate change problem. This further contributes to the cycle of climate change and its impacts. • Global warming due to rising temperatures • Water pollution from the spillage of waste into rivers • Increased disease-causing pathogens, insects and rodents			√
		• Loss of genetic material	• Extinction of indigenous plants and animal species • Establishment of a gene bank			√

		• Lightning strikes	• Loss of lives and property			√
3	Trade, tourism and industry	• Likelihood of experiencing more frequent and severe rainfall events.	• Destruction of infrastructure and facilities • Risk to workers' health and safety • Loss of lives and property • Increased water borne diseases • Loss of livelihoods			√
		• Loss of traditional knowledge related to weather patterns, agricultural practices, medicinal plants, and natural resource management	• Culture erosion			√
		• Water scarcity	• Rising risk of workers' safety and health • Increase of water borne diseases such as malaria, typhoid etc.			
4	Education	• Flooding/ flash floods	• Loss of livelihoods • Destruction of infrastructure		√	
		• Prolonged dry spells	• Declines in school attendance and rising dropout rates, particularly in vulnerable communities.		√	
		• Extreme high/low temperatures	• Increased cases of respiratory diseases • Reduced learning hours • Non-attendance of schools		√	
5	Infrastructure	• Climate variability (Flooding, Thunderstorms, Strong winds, Whirl winds and lightning strikes)	• Damage/ loss of infrastructure.			√

6	Health	• Climate extremes (Prolonged dry spells, temperature and floods)	• An increased number of people without access to clean drinking water. • Increased cases of food insecurity and malnutrition • Increased exposure to diseases such as asthma, malaria and other respiratory diseases			√

2.6 Spatial distribution of risks

This is a spatially break down the climate risk projections into smaller geographical planning units-wards, linking to the main livelihood and economic sectors in each respective ward.

Table 2-13: Spatial distribution of main three hazards per ward

Sub-county	Ward	H1 (*3)	H2 (*2)	H3 (*1)
Bobasi	Bassi Bogetaorio	Floods	Pests and diseases	Landslides
	Bassi Boitangare	Floods	High temps	Pests and diseases
	Bassi Central	Floods	Prolonged dry spells	Diseases
	Bassi Cache	Prolonged dry spells	Floods	Landslides
	Masige East	Heavy rains	Thunderstorms	Prolonged dry spells
	Masige West	Heavy rains	Thunderstorms	Prolonged dry spells
	Nyacheki	Prolonged dry spells	Floods	Livestock diseases
	Sameta Mokwerero	Prolonged dry spells	Floods	Landslide
Bomachoge Borabu	Bokimonge	Waste disposal	Swamps	Water shortage
	Bombaba Borabu	Floods	Pests and diseases	Prolonged dry spells
	Boochi Borabu	Prolonged dry spells	Floods	Hailstorms
	Magenche	Landslides	Floods	Strong winds
Bomachoge Chache	Boochi Tendere	Floods	Hailstones	Landslides
	Bosoti Sengera	Floods	Landslides	Thunderstorms
	Majoge Bassi	Floods	Water pollution	Swamps
Bonchari	Bogiakumu	Hailstorms	Floods	Landslides

	Bomariba	Water shortage	Diseases	Prolonged dry spells
	Bomorenda	Human diseases	Prolonged dry spells	Changing rain patterns
	Riana	Prolonged dry spells	Floods	Changing rain patterns
Kitutu Chache North	Kegogi	Floods	Prolonged dry spells	Invasive diseases
	Marani	Floods	Prolonged dry spells	Landslides
	Monyerero	Floods	Thunderstorm	Landslides
	Sensi	Hailstorms	Thunderstorm	Flood
Kitutu Chache South	Bogeka	Flood	Prolonged dry spells	Landslides
	Bogusero	Prolonged dry spells	Floods	Landslides
	Kitutu Chache central	Prolonged dry spells	Floods	Poor drainage
	Nyakoe	Prolonged dry spells	Floods	Strong winds
	Nyatieko	Flood	Water pollution	Prolonged dry spells
Nyaribari Chache	Birongo	Soil erosion	Prolonged dry spells	Hailstorms
	Boraracho	Landslides	Soil erosion	Prolonged dry spells
	Ibeno	Prolonged dry spells	Hailstorms	Pests and diseases
	Keumbu	Prolonged dry spells	Hailstorms	Lightening
	Kiogoro	Prolonged dry spells	Hailstorms	Lightning
	Kisii Central	Prolonged dry spells	Prolonged dry spells	Hailstorms
Nyaribari Masaba	Gesusu	Prolonged dry spells	Soil erosion	Thunderstorms
	Ichuni	Prolonged dry spells	Floods	Thunderstorms
	Kiamokama	Prolonged dry spell	Hailstorms	Deforestation

	Masimba	Prolonged dry spells	Floods	Diseases
	Nyamasibi	Prolonged dry spells	Thunderstorms	Landslide
South Mugirango	Botetenga	Landslides	Prolonged dry spells	Hailstorms
	Boikanga	Floods	Landslides	Dry spells
	Chitago Borabu	Landslides	Prolonged dry spells	Erosion
	Getenga	Erosion	Prolonged dry spells	Swamps
	Moticho	Prolonged dry spells	Soil erosion	Pests and diseases
	Tabaka	Land slides	Prolonged dry spells	Diseases

Legend:

H1-Highly ranked hazard assigned weight 3

H2: Moderately ranked Hazard assigned weight 2

H3: Lease ranked Hazard assigned weight 1

2.7 Impact of future scenarios ranked per hazard identified

Hazard: Prolonged Dry spell		
	Direct Impacts	**Indirect Impacts**
Natural Resources		
Land/Soil	▪ Soil infertility and low crop yield ▪ Farmers' crops dying ▪ Wind erosion of loose soils	▪ Smallholder farmers may indeed be required to allocate funds for new or additional water supplies in response to the impacts of climate change. As changing weather patterns affect rainfall distribution and water availability, farmers may face challenges in securing sufficient water for their crops and livestock. ▪ Reduced incomes ▪ Many youth choose to migrate from rural areas or smaller towns to larger cities or other urban centers.
Pasture	Drying of pasture leading Starvation of livestock and death cases	▪ Spending more on purchase of livestock feeds altering household budget and reducing household purchasing power. ▪ Economic losses due to death of livestock
Water (domestic)	Reduction in water supply levels, making it challenging to provide safe, affordable, acceptable, available, and accessible drinking water and sanitation services for all. The impacts of climate change, such as increased water scarcity, changes in precipitation patterns, and extreme weather events strain water resources and infrastructure.	▪ Diseases caused by lack of water or unclean water and starvation due to lack of sufficient water leading to cases of waterborne and food borne diseases. ▪ Spending more on purchase of water for domestic uses altering household budget and reducing household purchasing power. ▪ Inter human conflict over competing water needs
Water (livestock)	Reduction in supply	▪ Spending more on purchase of water for livestock altering household budget and reducing household purchasing power. ▪ Heat stress, diseases and cases of death of livestock leading to economic losses.
Forests	Drying of trees in areas such as Nyangweta, Donyo and Ritumbe	▪ Desertification, decrease in forest productivity. ▪ Reduced energy supply at household within the County
Wetlands	Drying of wetlands	▪ Reduction in agricultural activities hence starvation

Rivers	Drying of rivers	▪ Reduction in fishing activities hence loss of livelihoods ▪ Human-wildlife conflict over scarce water resources
Livelihood/Productive Activities		
Livestock (Herd)	Inadequate or lack of pasture for livestock	▪ Starvation and death ▪ Spending more on purchase of water for livestock altering household budget and reducing household purchasing power. ▪ Heat stress, diseases and cases of death of livestock leading to economic losses.
Agriculture	Low crop yield, pests and diseases	▪ Loss of livelihoods, starvation
Trade/Small Business	Loss of livelihoods	▪ Poverty
Domestic and Household	Changes in disease patterns	▪ Diseases and death
Fisheries	Low yield	▪ Loss of livelihood hence poverty
Other (specify)		▪
Infrastructure and Services		
Buildings		
Services (Education/Health)	Strain on health services due to drought-related diseases and reduction in school attendance due to hunger	▪ Anxiety or depression about economic losses caused by prolonged dry spell ▪ Health problems related to low water flows and poor water quality ▪ Deaths and rise in illiteracy levels ▪ Increased ailment related to dust
Markets	Kisii County's economy is heavily dependent on agriculture, which includes companies engaged in manufacturing agricultural machinery and food production. However, these businesses are at risk of experiencing financial setbacks when an extended period of prolonged dry spell adversely affects or damages crops and livestock.	▪ Disrupted livelihoods and commodity supply chain especially for agricultural sector increasing vulnerability to the affected households.

Transportation	Less movement due to heat stress and depletion of items necessitating transportation	▪ Slowed down economy due to hindered flow of goods and services from one point to another
Energy	High temperatures associated with prolonged dry spell that often accompany and exacerbate drought affect the energy supply chain, reduce biofuel feedstocks, and increase the risk of wildfire, which can impact energy infrastructure.	▪ Economic losses due to energy supply disruption. ▪ Reduced renewable energy access for rural household that depends on wood
Ranking	1	1

Hazard: Floods		
	Direct Impacts	Indirect Impacts
Natural Resources		
Land/Soil	▪ Soil infertility and low crop yield as a result of nutrient leaching ▪ Loss of crops ▪ Erosion of farmlands	Reduced production of cash and food crops
Pasture	▪ Waterlogged increases the risk and rate of pasture death	Reduced forage
Water (domestic)	▪ Polluted water for home use	▪ Rise in diseases like cholera
Water (livestock)	▪ Polluted water for livestock intake	▪ Increase in animal diseases
Forests	▪ Destruction of trees by too much water	▪ Deforestation and loss of benefits of trees to the ecosystem
Wetlands	▪ Positively wetlands reduced flooding, landslides and storm surges. Wetlands includes Nyanturago, Kiogoro, Etora, Itibo, and Mogonga.	▪ Managed flash floods, storm surge, and localized flooding saves money that can be used in flood disaster response.
Rivers	▪ Overflow	▪ Waterborne diseases, deaths by drowning and suffocation of economic activities from rivers like fishing
Livelihood/Productive Activities		
Livestock (Herd)	▪ Drowning or being washed away	▪ Loss of livelihoods
Agriculture	▪ Crop destruction	▪ Loss of livelihoods hence lack of food
Trade/Small Business	▪ Inability to trade because of destruction of items of trade and hindrance of movement	▪ Loss of livelihood hence poverty due to lack of earning from trade
Domestic and Household	▪ Displacement of households	▪ Trauma, insecurity and poverty
Fisheries	▪ Hindrance to fish from overflowing rivers.	▪ Loss of livelihoods
Infrastructure and Services		

Buildings	▪ Erosion of buildings' strata, reduced structural integrity, flooded buildings being uninhabitable or weaker buildings getting washed away ▪ Strong winds, flooding, and ground shaking exert forces that can cause substantial effects on the environment and built structures	▪ Losses due to repair or loss of buildings. ▪ Mental health effects following widespread flooding
Services (Education/Health)	▪ Inability to access schools and hospitals.	▪ Increase in illiteracy and health complications/deaths ▪ Spread of infectious diseases
Markets	▪ Disrupted market activities	▪ Cash flow disrupted hence poverty
Transportation	▪ Disrupted transport network	▪ Flow of goods and services hindered hence losses and inaccessibility to income streams
Communications	▪ Destruction of communication and power lines	▪ Loss of revenue or income because communication by means of mobile networks and internet is disrupted.
Energy	▪ Flood affect the energy supply chain can impact energy infrastructure.	▪ Economic losses due to energy supply disruption. ▪ Reduced renewable energy access for rural household that depends on wood
Ranking	2	2

Hazard: Landslides		
	Direct Impacts	Indirect Impacts
Natural Resources		
Land/Soil	▪ Soil Erosion	▪ Less production
Pasture	▪ Loss of pasture	▪ Starvation of livestock
Water (domestic)	▪ Disrupted water supply	▪ Unhygienic living hence diseases
Water (livestock)	▪ Disrupted water supply	▪ Starvation
Forests	▪ Destruction of trees	▪ Deforestation and decrease in forest productivity
Wetlands	-	-
Rivers	▪ Disruption of river courses especially river Gucha network and tributaries	▪ Disruption of livelihood like fishing and water sources
Livelihood/Productive Activities		
Livestock (Herd)	▪ Displacement, injury or death of livestock	▪ Loss of livelihood hence poverty
Agriculture	▪ Destruction of crops	▪ Hunger and loss of income sources
Trade/Small Business	▪ Disruption of trade due to destruction of trading spots and trading items and hindrance of movement	▪ Disruption of cash flow, goods going bad hence losses
Domestic and Household	▪ Destruction of homes and structures	▪ Displacement of people and trauma. ▪ Loss of livelihood and poverty
Fisheries	▪ Covering of fishing spots	▪ Loss of livelihood
Infrastructure and Services		
Buildings	▪ Destruction of buildings	▪ Losses and expenses repairing or rebuilding
Services (Education/Health)	▪ Disruption of health and education services due to hindered movement of destruction of these infrastructure	▪ Increase in illiteracy and ultimately, crime and also deaths
Markets	▪ Disruption of market activities	▪ Inability to buy or sell goods and services hence lack of income leading to losses and poverty
Transportation	▪ Hindrance of movement	▪ Loss of livelihood. Goods going stale and inability to transfer services.

Communications	▪ Destruction of communication and power lines	▪ Loss of revenue or income because communication by means of mobile networks and internet is disrupted
Ranking	3	3

Hazard: Hailstorms		
	Direct Impacts	Indirect Impacts
Natural Resources		
Land/Soil	▪ Damage to soil	▪ Loss of agricultural livelihood hence poverty
Pasture	▪ Defoliation of pastures	▪ Starvation of livestock
Water (domestic) Water (livestock)	▪ Causes flash floods and mudslides in steep areas. ▪ Lakes, rivers, streams, and other water reservoirs are replenished as hail melts into the ground The negative impacts is water logging of households	▪ Enhance water availability after the storms.
Forests	▪ Destruction of trees	▪ Deforestation and decrease in forest productivity
Wetlands	▪ Destruction of wetlands vegetation already under threat in Kisii County	▪ Decrease habitat, landscape diversity, and connectivity among aquatic resources.
Livelihood/Productive Activities		
Livestock (Herd)	▪ Harming or killing livestock	▪ Loss of livelihood hence poverty
Agriculture	▪ The destruction of cash and food crops occurs when crops are severely damaged or defoliated. This not only downgrades the quality of the crops but also leads to subsequent losses due to diseases like blight, mould, canker, and fruit rots.	▪ Reduced harvests and livestock deaths affecting agribusiness. ▪ Loss of livelihood and hunger
Trade/Small Business	▪ Destruction of items of trade	▪ Loss of livelihood hence poverty
Domestic and Household	▪ Destruction of structures and houses	▪ Losses and disruption of comfortable living
Fisheries	▪ Disruption of fishing activities	▪ Disruption of income from fishing
Infrastructure and Services		
Buildings	▪ Damage to automobiles, break windows, tear roof coverings, and result in water damage to ceilings, walls, floors, appliances, and personal belongings	▪ Economic losses to the affected properties and systems

Services (Education/Health)	▪ Concussions and fatal head injuries. ▪ Inaccessibility to schools and hospitals	▪ Disrupted education culminating to general illiteracy and inability.
Markets	▪ Disrupted business operations, leading to lost revenue and productivity	▪ Disrupted business operations, leading to lost revenue and productivity
Transportation	▪ Reduced visibility and, sometimes, flooded roadways.	▪ Economic losses due to disruption of transfer of services and goods
Communications	▪ Destruction of communication lines. Loss of power	▪ Loss of revenue or income because communication by means of mobile networks and internet is disrupted
Ranking	4	

Hazard: Epidemics, pests and diseases		
	Direct Impacts	Indirect Impacts
Natural Resources		
Land/Soil	▪ Saturation of soil systems with microbes rendering them infertile	▪ Loss of agricultural livelihood hence poverty
Pasture	▪ Pests destroy pasture	▪ Weakening or killing of livestock
Water (domestic)	▪ Spread of waterborne diseases among households	▪ Weakening human resource and deaths
Water (livestock)	▪ Spread of waterborne disease among livestock	▪ Weakening livestock and deaths
Forests Wetlands Lakes	▪ Threatening of ecosystem services ▪	▪ Effect on County's biosecurity and socio economy
Livelihood/Productive Activities		
Livestock (Herd)	▪ Low production and Death of livestock	▪ Threat to various aspects, including food security, nutrition, health, livelihoods, biodiversity, and ecosystem services
Agriculture	▪ Crop mortality resulting from pest infestations poses a biosecurity risk. Insect pests, diseases, weeds, nematodes, and certain vertebrates can significantly challenge the potential productivity of agricultural and horticultural crops.	▪ Loss of livelihood, hunger and poverty
Trade/Small Business	▪ Inability to trade due to infections and restrictions	▪ Poverty due to lack of cash flow
Domestic and Household	▪ Spread of diseases	▪ Prolonged illnesses and Deaths
Fisheries	▪ Affects fish breeding	▪ Loss of livelihood linked to fishing, hunger and poverty
Infrastructure and Services		
Buildings	-	-
Services (Education/Health)	▪ Hindrance to quality education due to illnesses and strain on health services	▪ Illiteracy, Poverty and deaths
Markets	▪ Scarcely utilised markets	▪ Disruption of sale and purchasing powers, decreased

		economic activities hence poverty
Transportation	▪ Inability to travel	▪ Slower diffusion of knowledge, skills and goods hence slower economic growth.
Communications	▪ Impaired ability to communicate	▪ Loss of opportunities to improve lives
Ranking	5	

Hazard: Thunder and Lightning		
	Direct Impacts	Indirect Impacts
Natural Resources		
Land/Soil	▪ Damage to forests affects soil properties leading to loss of nutrients through erosion.	▪ Loss of agricultural livelihood hence poverty
Pasture	▪ Destruction areas of pasture land for natural animal care	▪ Loss of pasture leading to economic losses
Forests	▪ Destruction of trees hit by lightning	▪ Loss of revenue or income because communication by means of mobile networks and internet is disrupted ▪ Reduced renewable energy access for rural household that depends on wood
Wetlands	▪ Destruction of wetlands	▪ Water quality and wildlife in wetland ecosystems
Livelihood/Productive Activities		
Livestock (Herd)	▪ Killing or maiming of animals ▪ Failure in safety equipment, such as temperature controllers in poultry farms.	▪ Loss of livelihoods due to death of animals.
Agriculture	▪ Destruction of crops	▪ Loss of food and livelihoods
Trade/Small Business	▪ Disruption of trade	▪ Slower economic growth
Domestic and Household	▪ Killing or maiming of human beings	▪ Deaths and hence trauma of loss, poverty from losing or incapacitating breadwinners
Infrastructure and Services		
Buildings	▪ By fires caused by lightning ▪ Destruction of buildings hit by thunder	▪ Loss of possessions and livelihoods
Services (Education/Health)	▪ Disruption of health and education services due to fear or actual fatalities	▪ Increase in illiteracy levels and escalation of health conditions, otherwise preventable ▪ Mental health to the affected

Markets	▪ Disruption of market activities due to fear	▪ Slower economic growth and losses due to not trading
Transportation	▪ Decreased visibility and accidents	▪ Loss of lives
Communications	▪ Destruction of communication and power lines	▪ Loss of revenue or income because communication by means of mobile networks and internet is disrupted
Energy	▪ Flood affect the energy supply chain can impact energy infrastructure.	▪ Economic losses due to energy supply disruption. ▪
Ranking	6	

3 CHAPTER THREE: KISII COUNTY FUTURE CLIMATE SCENARIOS

3.1 Downscaled climate change projections

3.2 Overview of Kisii County climate

Kisii County has a highland equatorial climate, which is characterized by a bimodal rainfall pattern and an average annual rainfall of 1,600mm. The long rainy season occurs from March to May (MAM), while the short rainy season takes place from October to December (OND). The months of January and February are relatively dry.

In terms of temperatures, the County experiences maximum temperatures ranging from 21°C to 30°C, while minimum temperatures range from 13°C to 20°C.The combination of high and relatively consistent rainfall patterns, along with moderate temperatures, creates favorable conditions for cultivating crops such as tea, coffee, pyrethrum, maize, beans, and bananas. Additionally, these climatic conditions are conducive for dairy farming.

3.2.1 Kisii County Rainfall distribution Zones

There are three Rainfall distribution zones in Kisii County; Zone 3 receives highest amount of rainfall of 1700-1900mm annually, followed by zones 2 which receives rainfall of 1600-1700mm annually and finally zone1 which receives annual amount of rainfall of 1400-1600mm respectively as shown in figure 3-1.

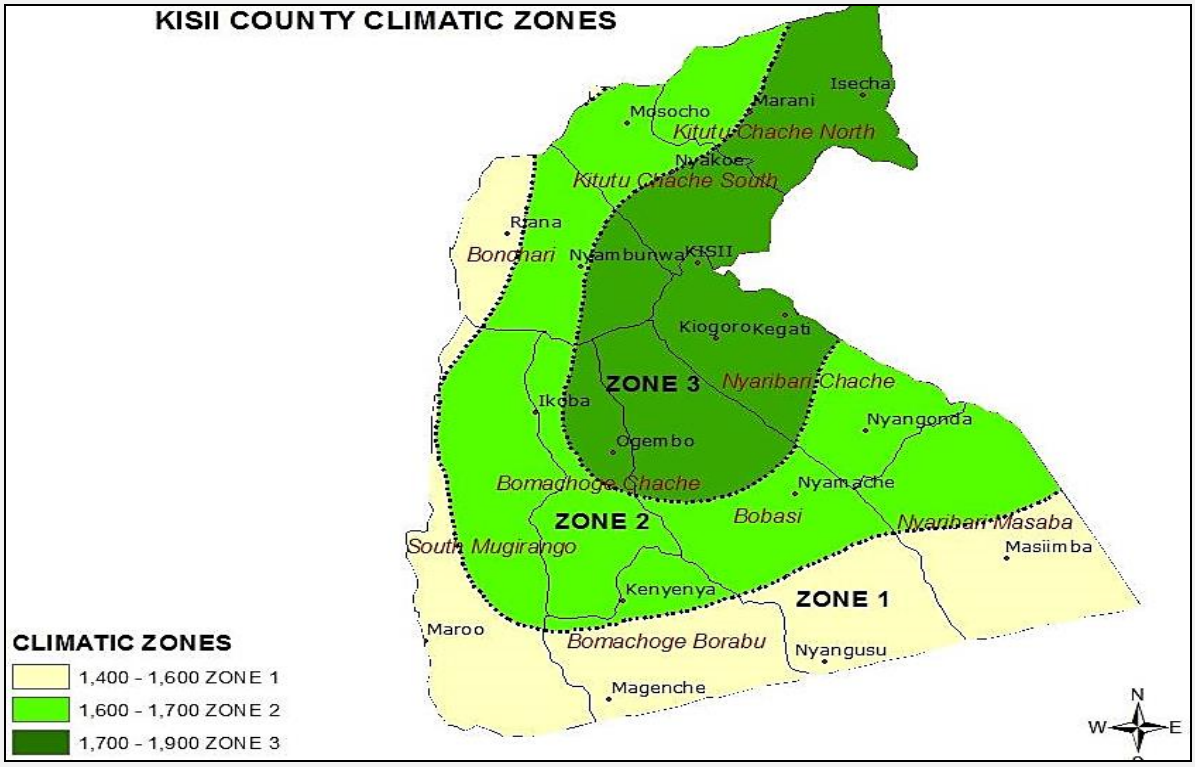


Figure 3-1: Climatic Zones of Kisii County

3.2.2 **Mean annual rainfall and temperature trend**

Seasonal maximum and minimum rainfall and temperatures in Kisii County have been increasing over the years.

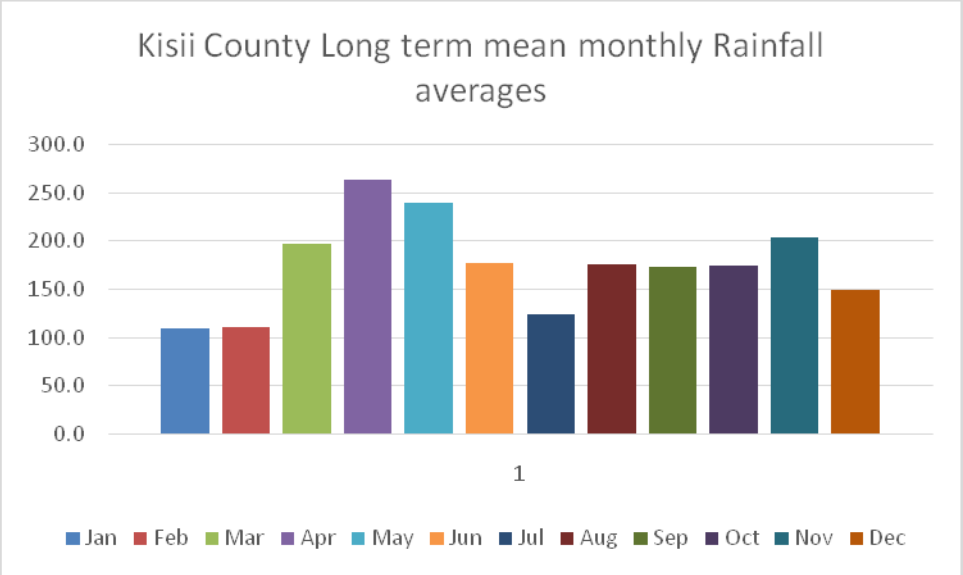


Figure 3-2: The long-term average monthly rainfall in Kisii County over an extended period of time

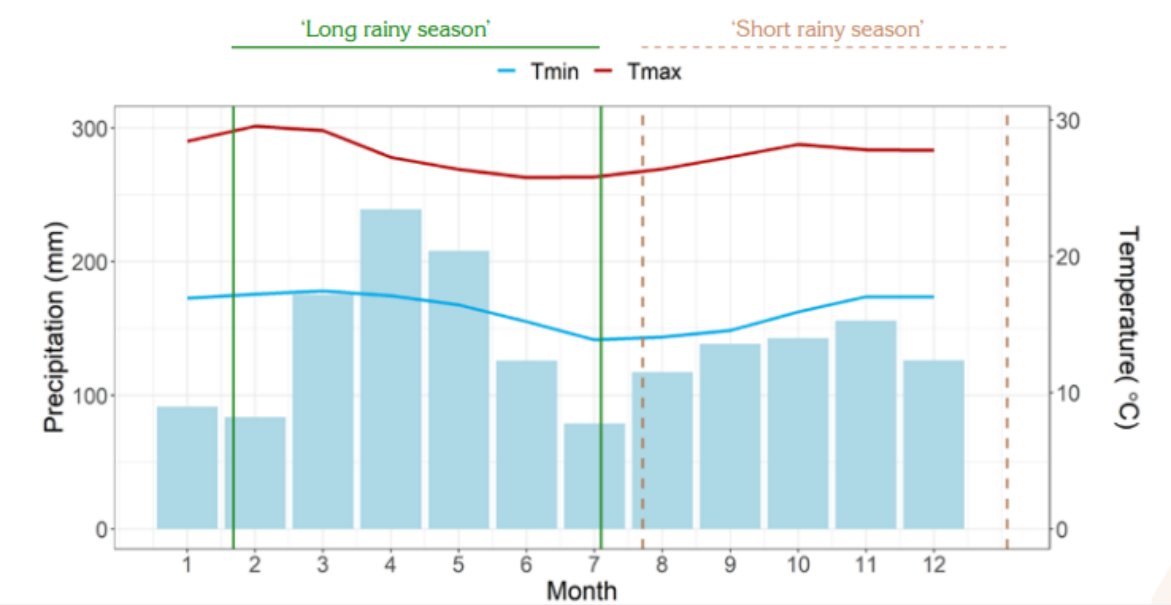
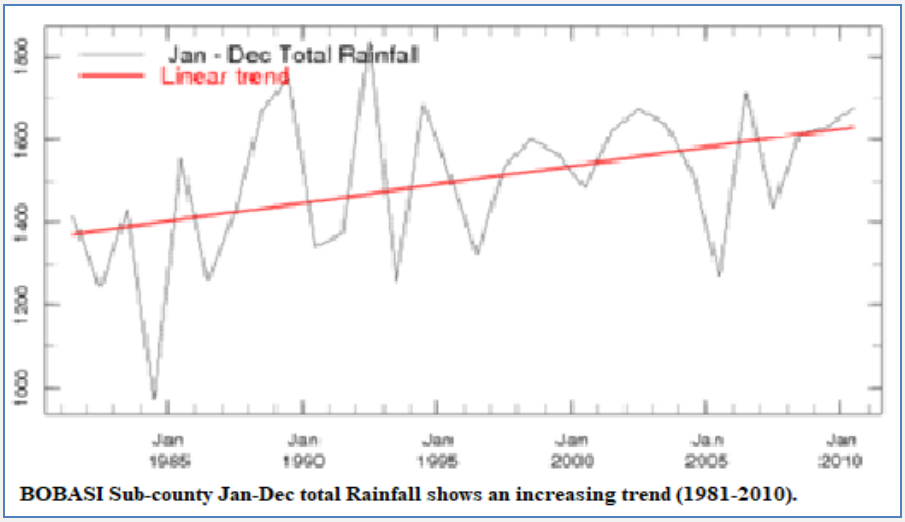


Figure 3-3: The average monthly temperature and precipitation levels in Kisii County over the past three decades.

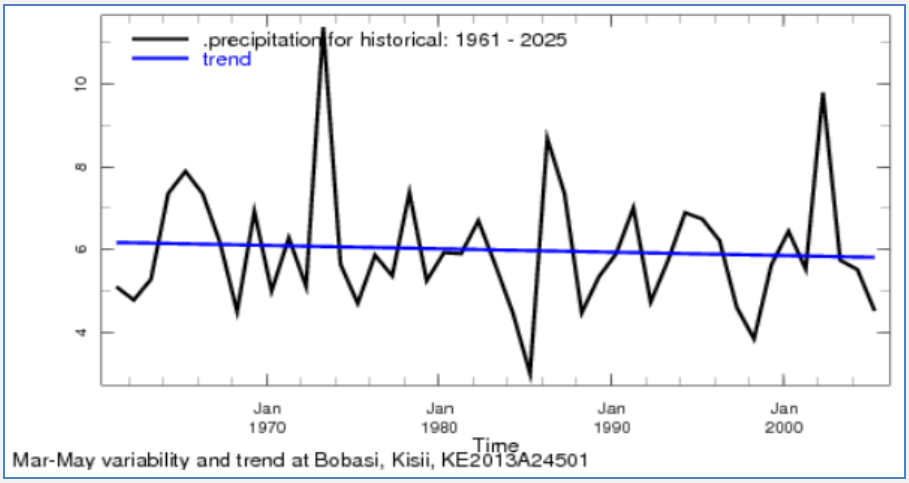
In Kisii County, the first long rainy season is characterized as the wettest period spanning 100 days from January to June. The second season, known as the short rainy season, also lasts for 100 days and occurs from July to December. Total monthly precipitation is depicted by bars in the data, while the maximum and minimum monthly mean temperatures are represented by red and blue lines respectively. (County Climate Risk Profile for Kisii County).

3.2.3 Sub-counties temperature & rainfall historical trends

1. Bobasi Sub-county

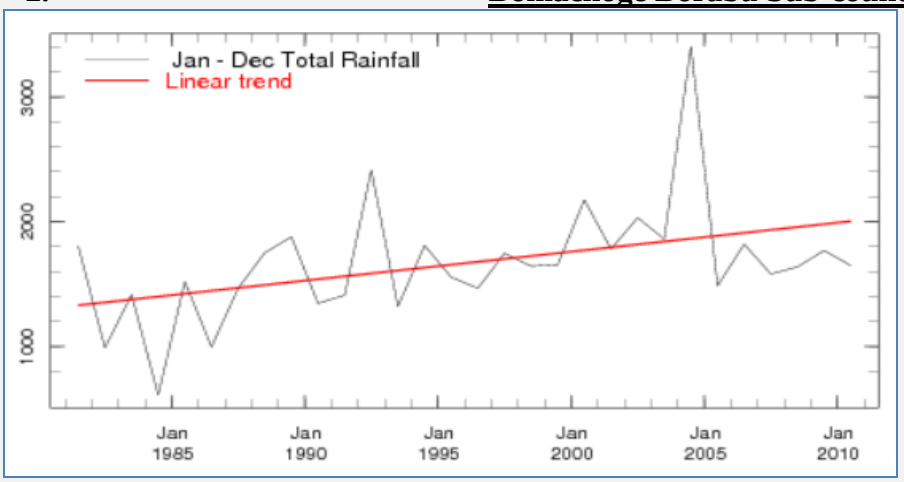


BOBASI Sub-county Jan-Dec total Rainfall shows an increasing trend (1981-2010).



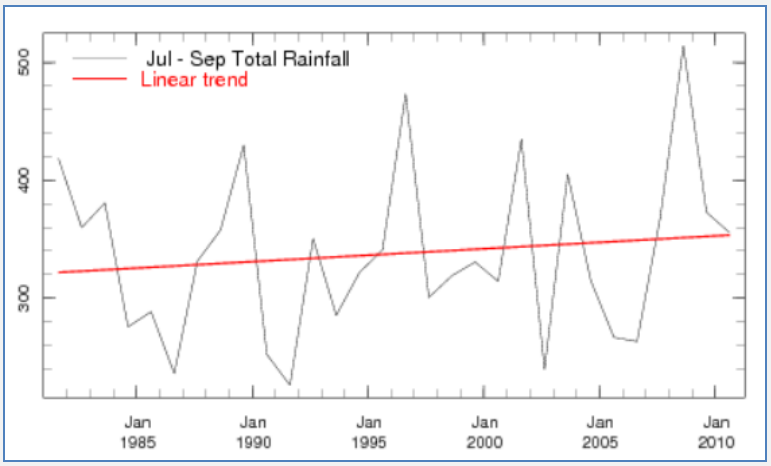
The March to May Precipitation for historical 1961-2025, variability& trend indicates decrease of rainfall in the past years in Bobasi Sub-County. It shows that the long rains have been decreasing gradually over the years.

2. Bomachoge Borabu Sub-county

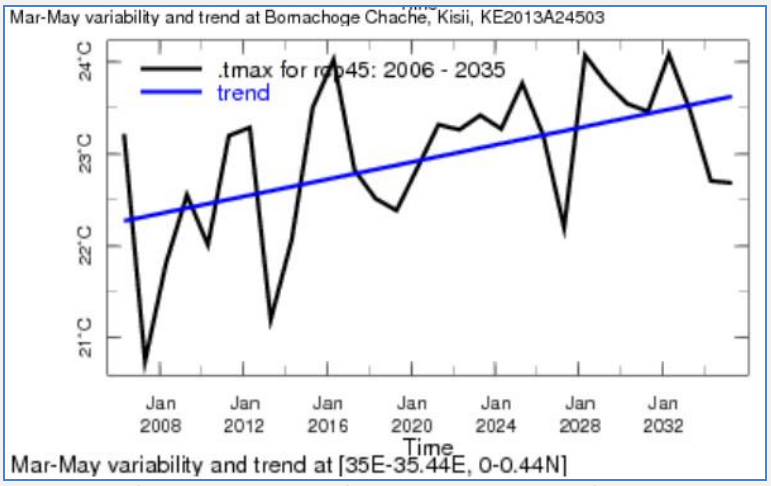


Bomachoge Borabu Sub-county depicts an increasing trend of the Jan-Dec total Rainfall (1981-2010)

3 Bomachoge Chache Sub-county

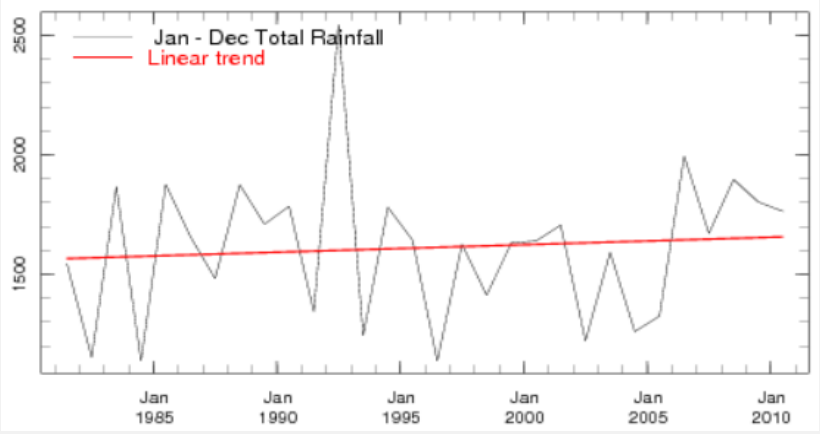


The seasonal climate analysis for Bomachoge Borabu Sub-county, Kisii July-Sept 1981-2010. The total Rainfall trend is increasing.

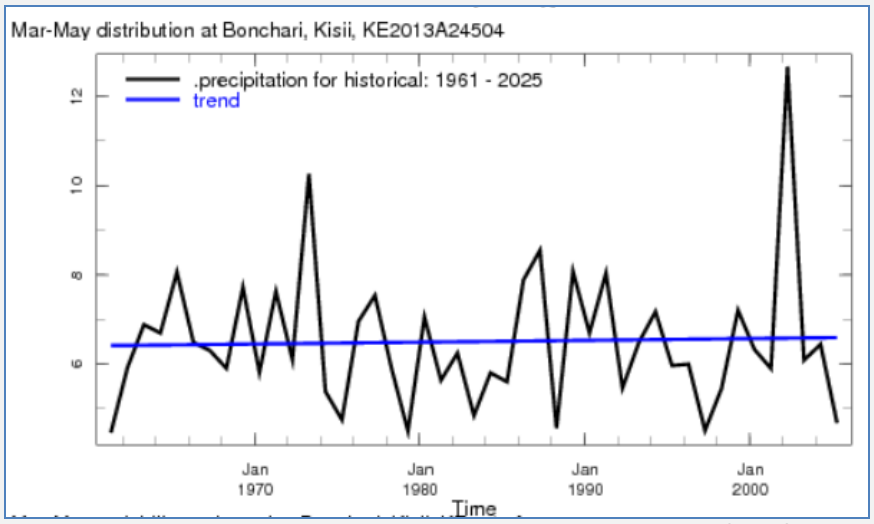


The seasonal change analysis of Max Temperature for RCP 4.5: 2006-2035 for Bomachoge Chache sub-county, March-May variability and trend indicates an increasing temperature trend.

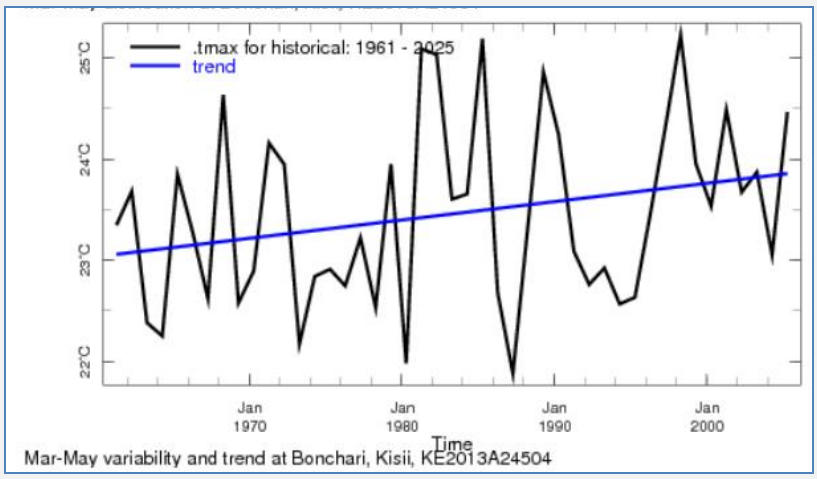
4. Bonchari Sub-county, Kisii, Kenya.



Bonchari Sub-county total rainfall trend analysis indicates that the Jan-Dec Rains of 1981-2010 is on an increasing trend.

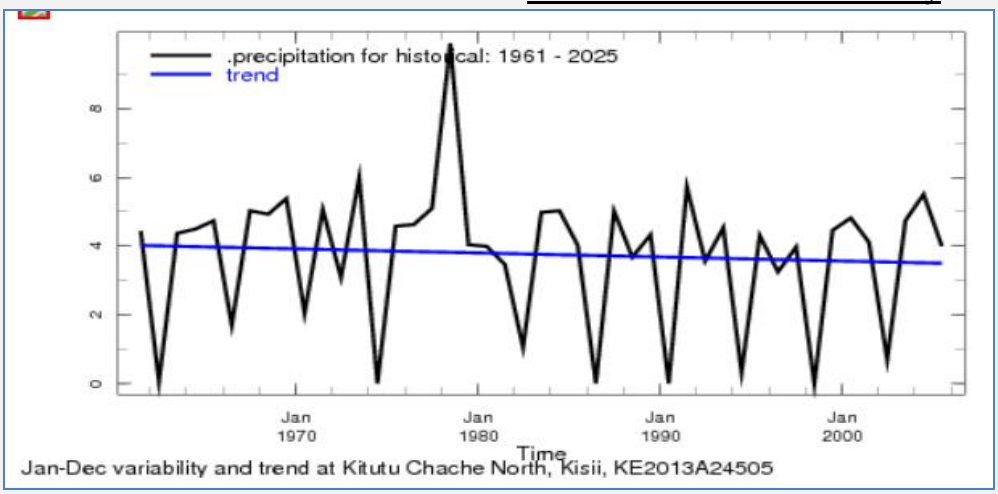


The March to May historical 1961-2025, variability & trend indicates slight increase of rainfall has been achieved in the past years in Bonchari Sub-County.

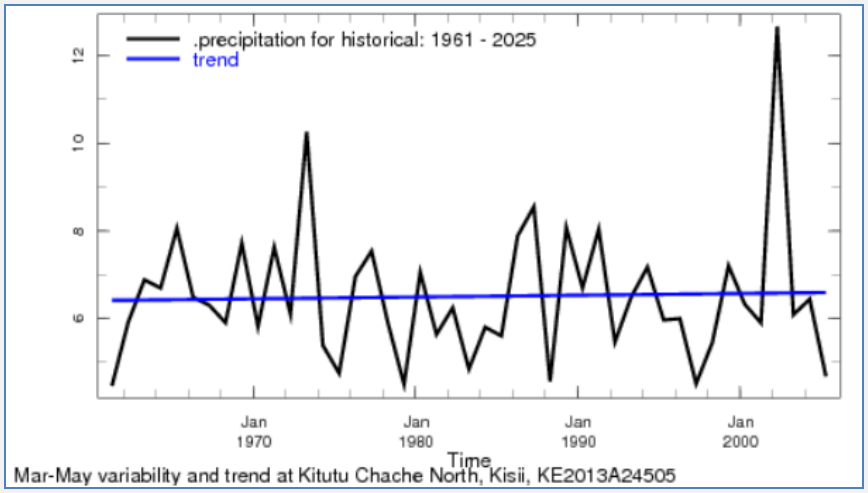


The temperature Max for historical; 1961-2025 for March-May variability and trend at Bonchari Sub-County, Kisii indicate that Max temp has been immensely increasing.

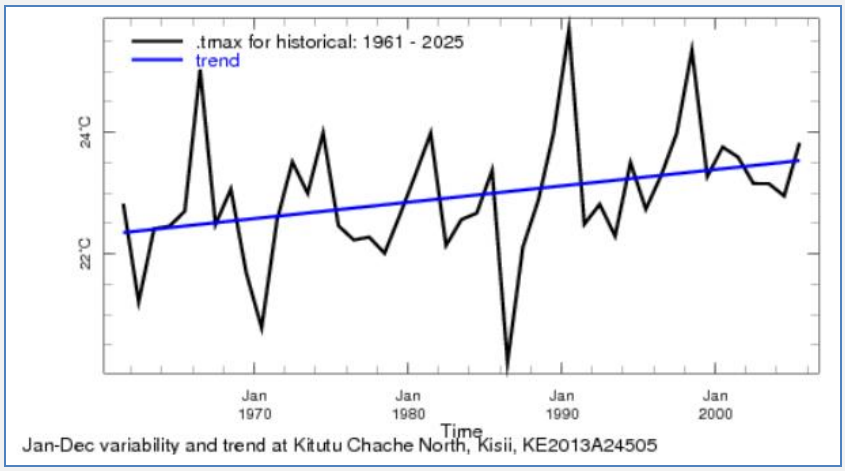
5. **<u>Kitutu Chache North sub-county</u>**



Kitutu Chache North Sub-County, Kisii, January-December variability and trend of rainfall for historical; 1961-2025 indicate a decreasing trend of rainfall.

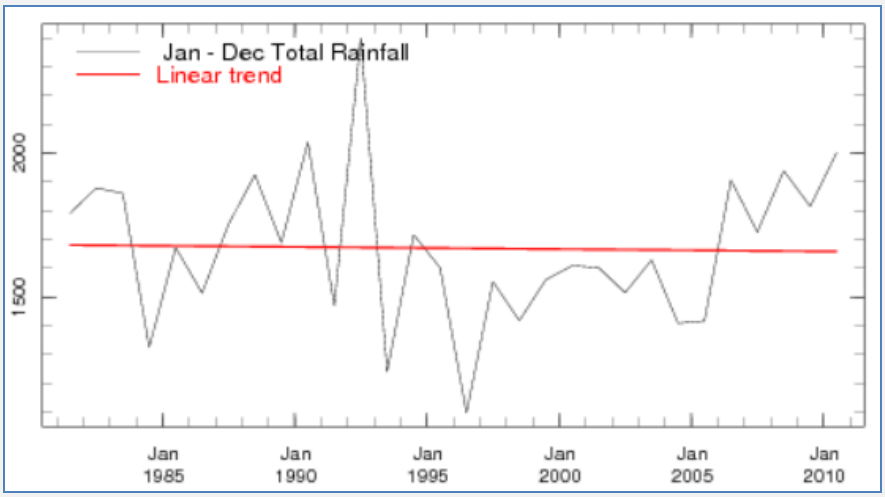


The precipitation for Historical; 1961-2025 during March to May long Rains Seasonal variability and trend at Kitutu Chache North Sub-County, Kisii indicate that rainfall is increasing insignificantly.

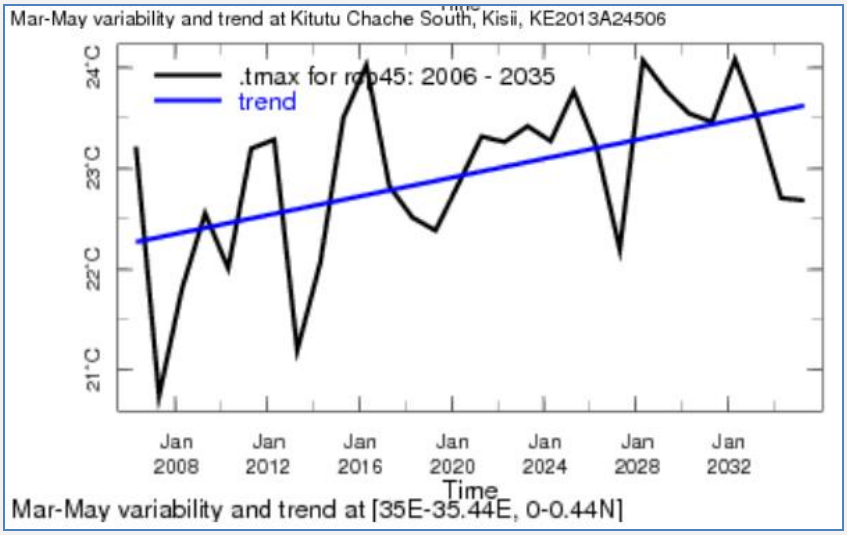


The temperature Max for historical; 1961-2025 for Jan-Dec variability and trend at Kitutu Chache North Sub-county, Kisii indicate that Max temp has been increasing.

6. Kitutu Chache south sub-county

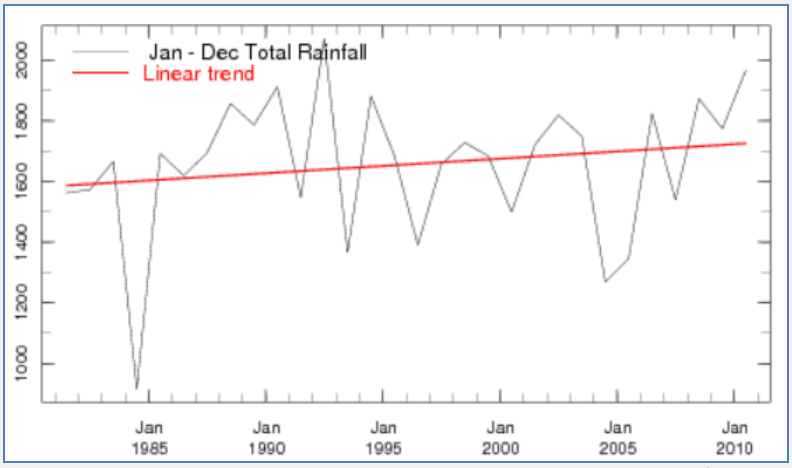


Kitutu Chache South sub-county analysis shows a gentle decreasing trend of annual total rainfall (1981-2010).

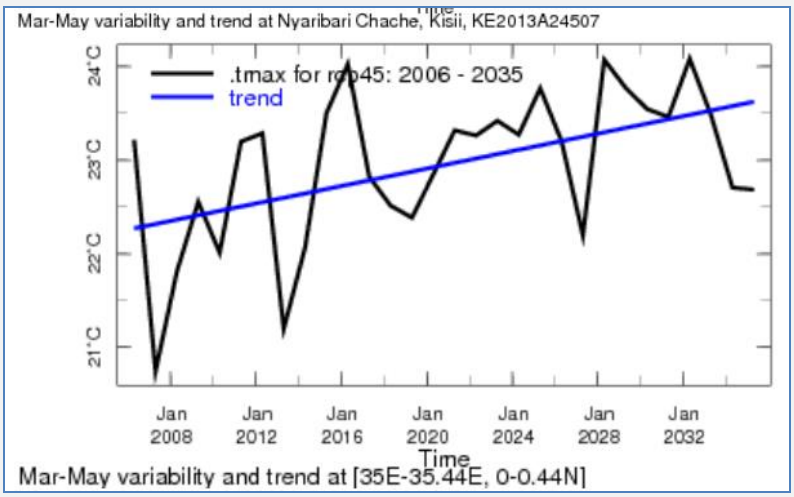


The seasonal change analysis of Max Temperature for RCP 4.5: 2006-2035 for Kitutu Chache South Sub-county, March-May variability and trend indicates an increasing Max temperature trend.

7. Nyaribari Chache Sub-county

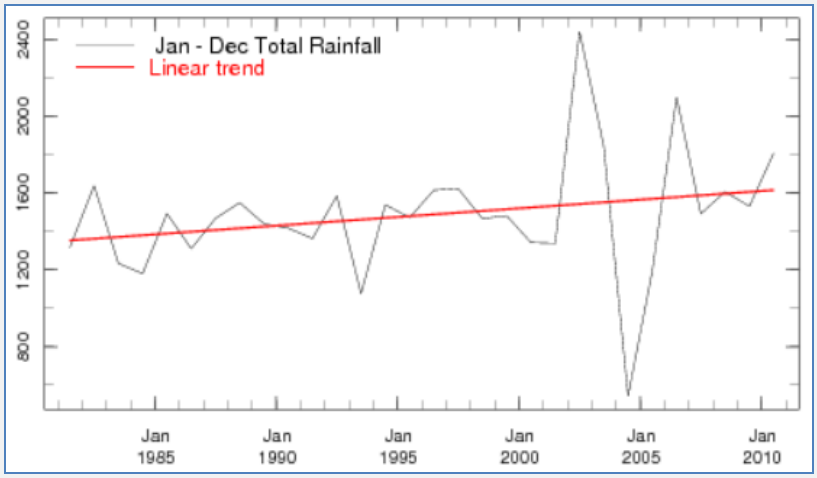


Nyaribari Chache sub-county, Kisii analysis shows an increasing annual total rainfall trend (1981-2010).

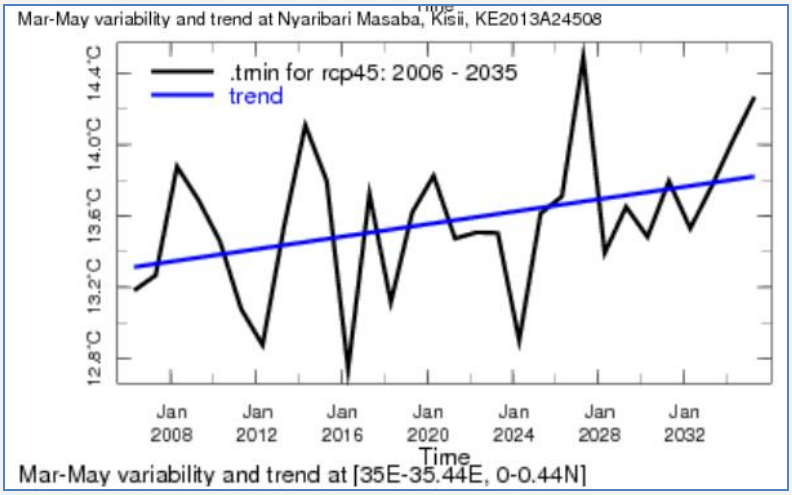


The seasonal change analysis of Max Temperature for RCP 4.5: 2006-2035 for Nyaribari Chache, Kisii Sub-county, March-May variability and trend indicates an increasing Max temperature trend.

8. Nyaribari Masaba sub-county, Kisii

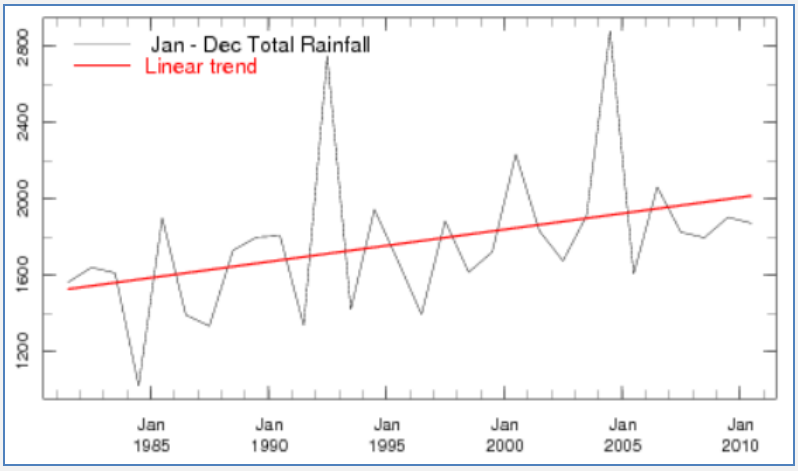


Nyaribari Masaba sub-county analysis shows an increasing annual total rainfall Trend (1981-2010).

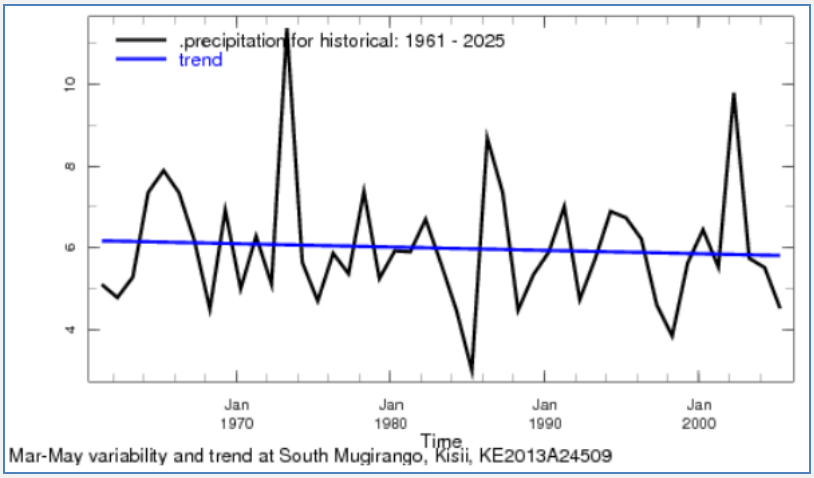


The seasonal change analysis of Min Temperature for RCP 4.5: 2006-2035 for Nyaribari Masaba, Kisii Sub-county, March-May variability and trend indicates an increasing Min temperature trend.

9. South Mugirango sub-county, Kisii



South Mugirango sub-county analysis shows an increasing annual total rainfall Trend of (1981-2010).



South Mugirango, March to May seasonal historical variability & trend shows a decreasing trend, 1961-2025.

3.3 Kisii county future climate scenarios (climate projections).

It is likely that warming will occur in Kisii County, with average temperatures expected to continue rising. Similarly to national trends, the number of hot days is projected to increase, while occurrences of cold nights are expected to become increasingly rare by 2050. As for rainfall patterns, there is a slight expected increase in average rainfall by 2031, particularly during the 'Short Rains' season. However, precipitation will continue to exhibit high variability, and extreme rainfall events are anticipated to become more frequent, intense, and prolonged.

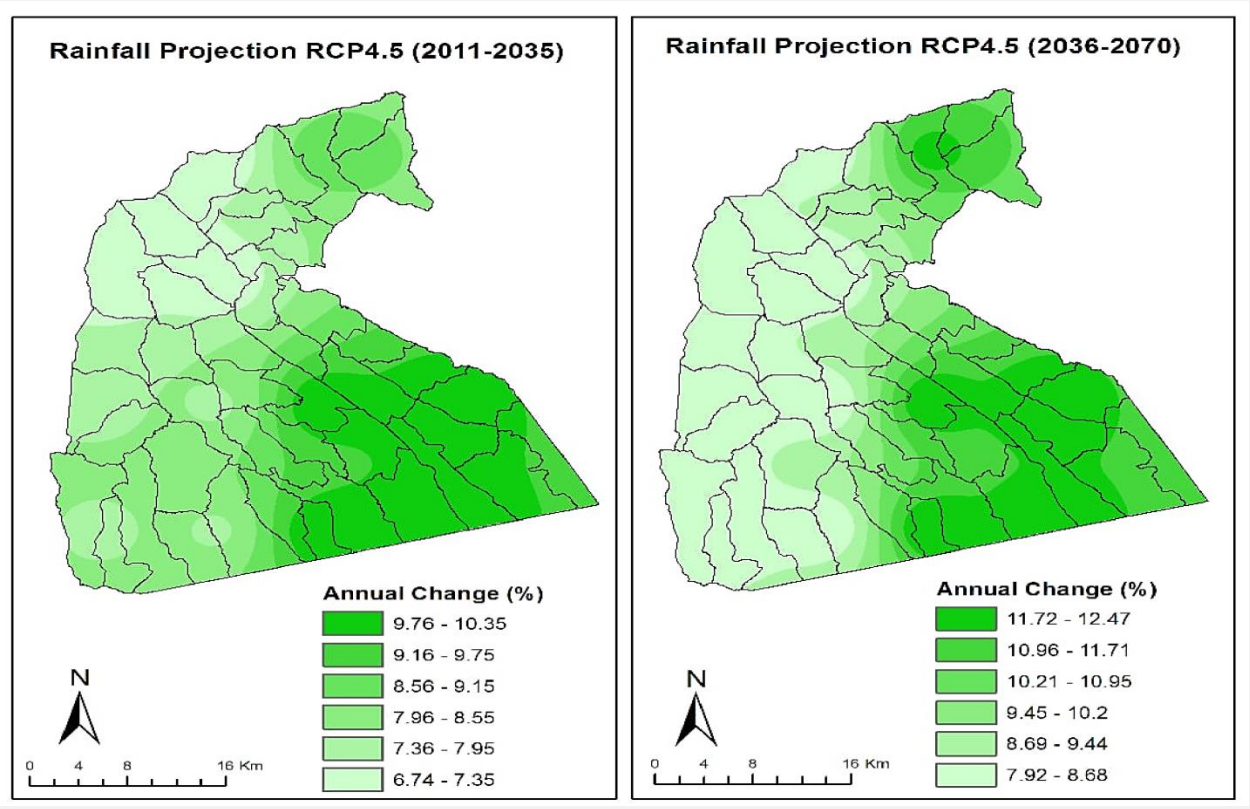


Figure 3-4: The projected rainfall RCP4.5 (2011-2035) and (2036-2070) depict % increase of annual rainfall Change in both scenarios.

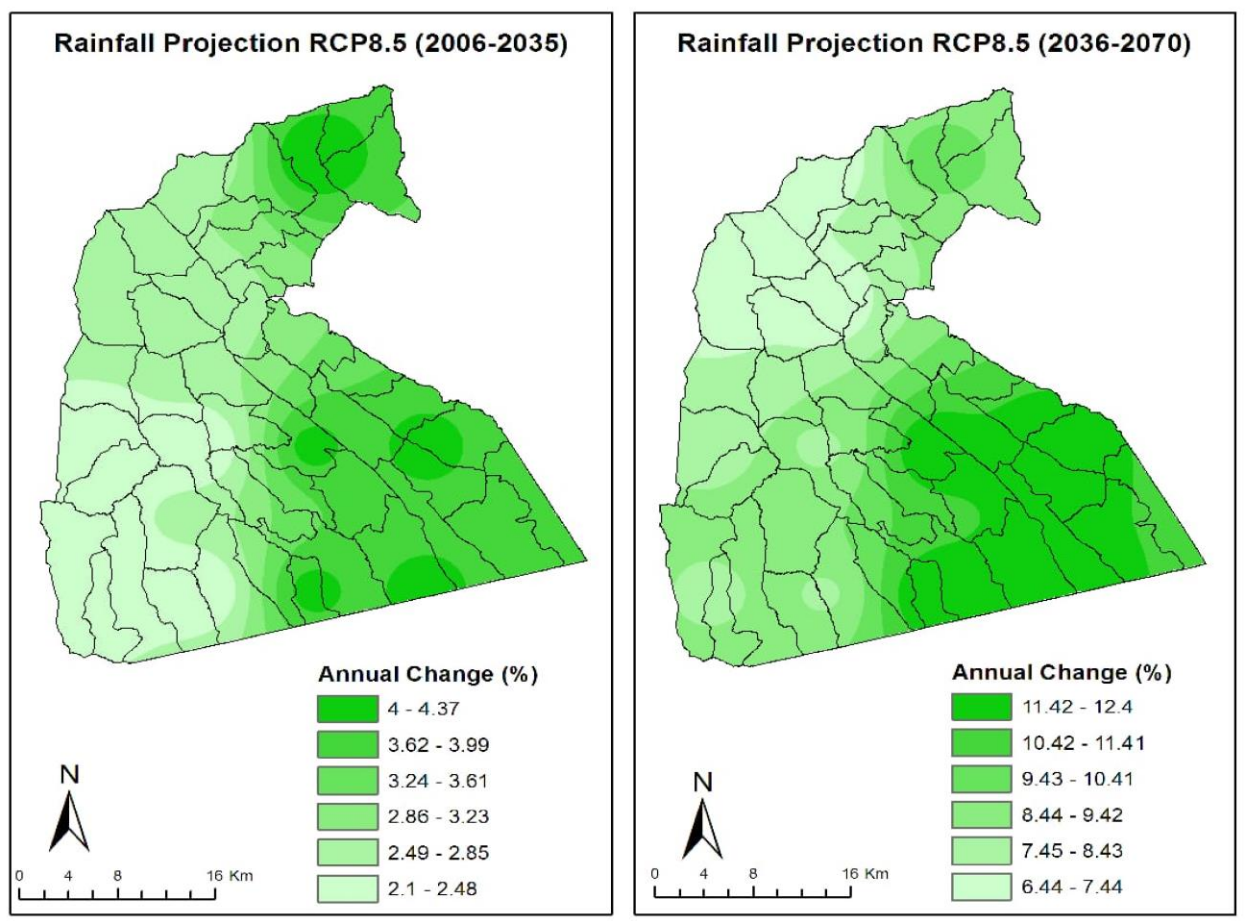


Figure 3-5: The projected Rainfall RCP8.5 (2006-2035) and (2036-2070) depict % increase of annual Rainfall Change in both scenarios.

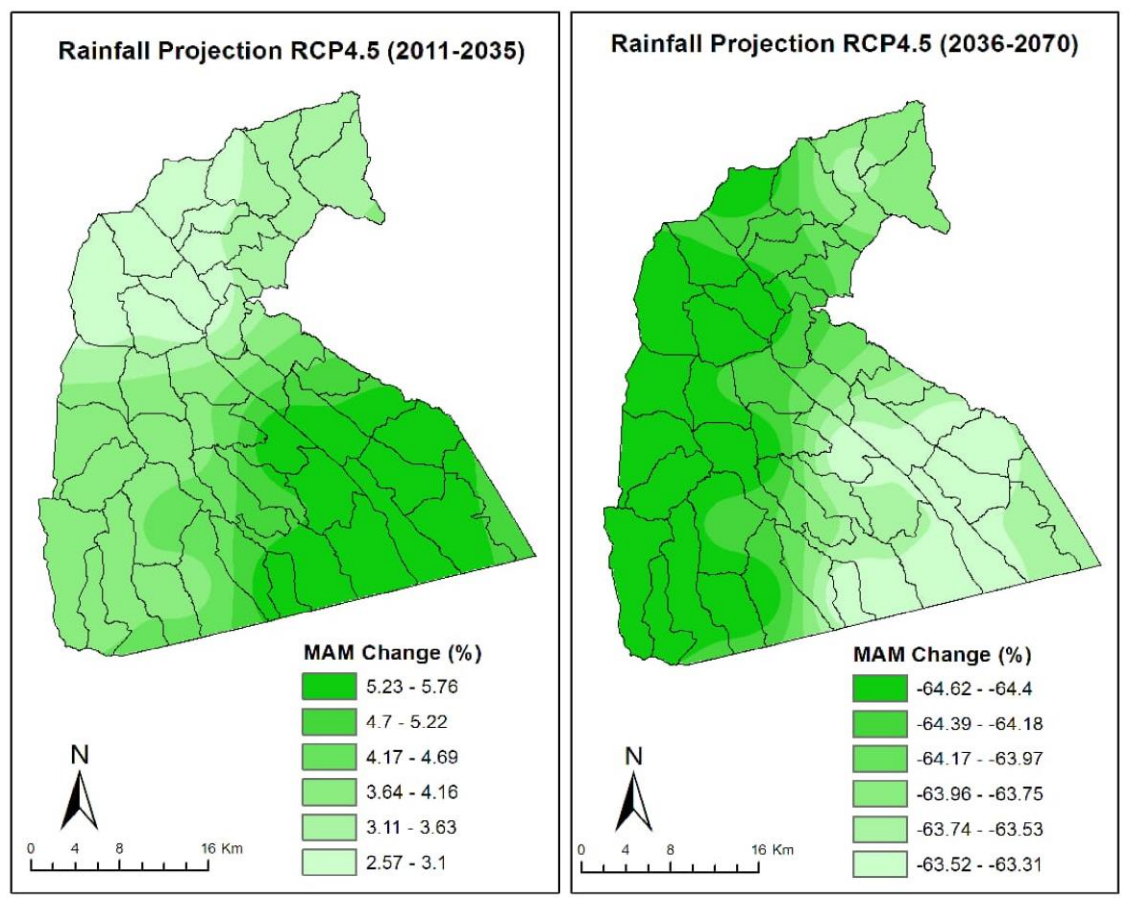
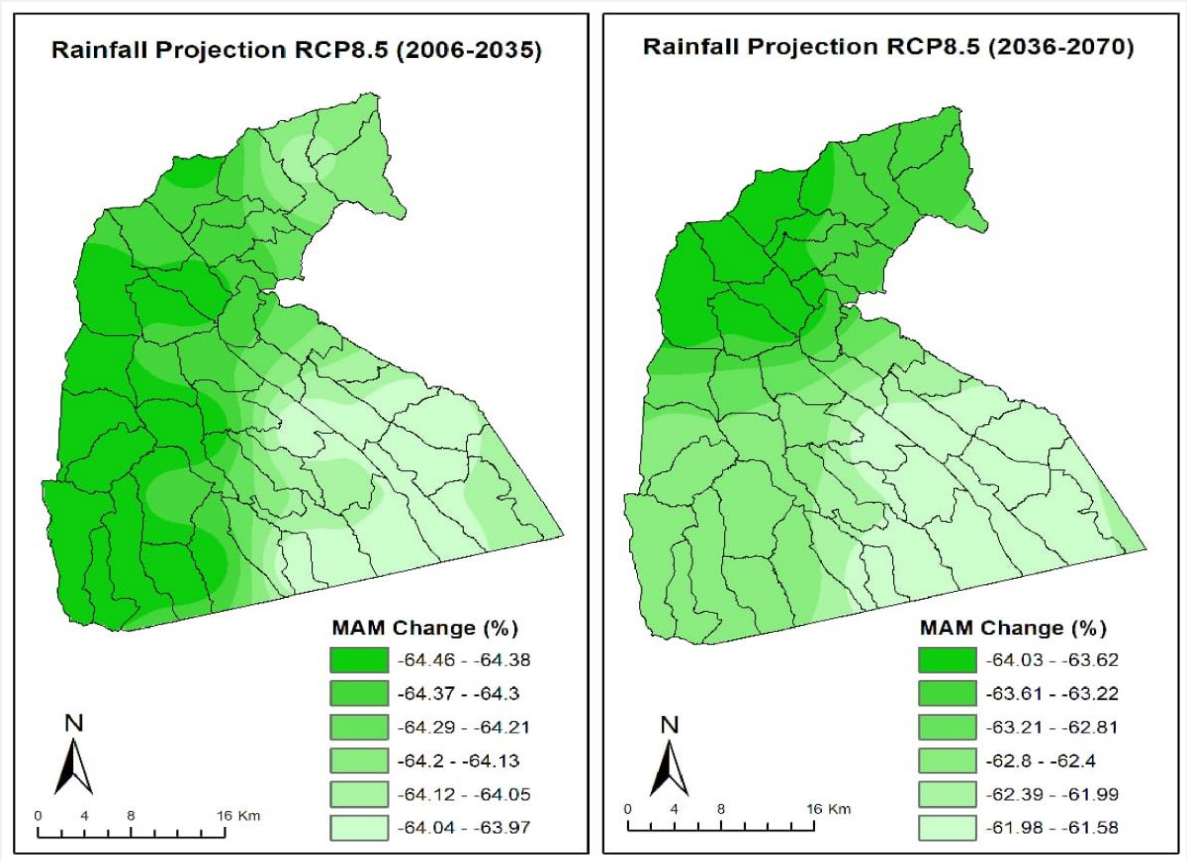
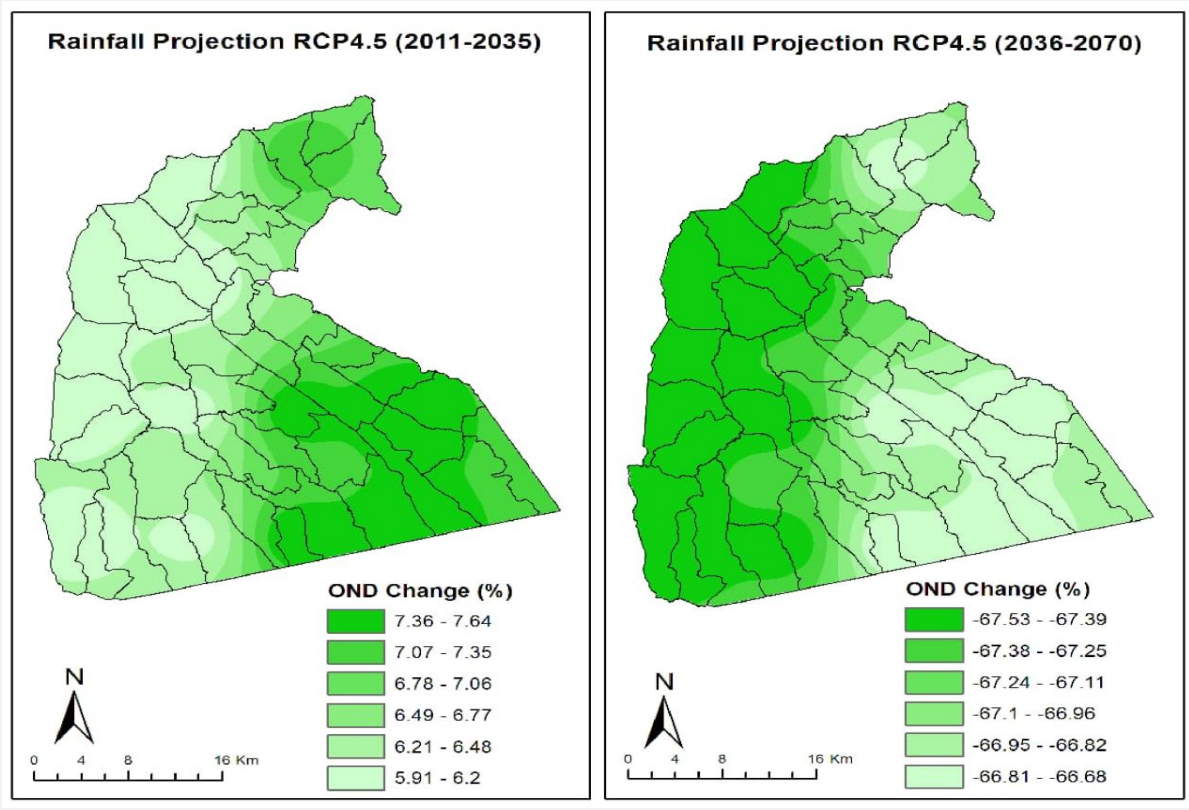


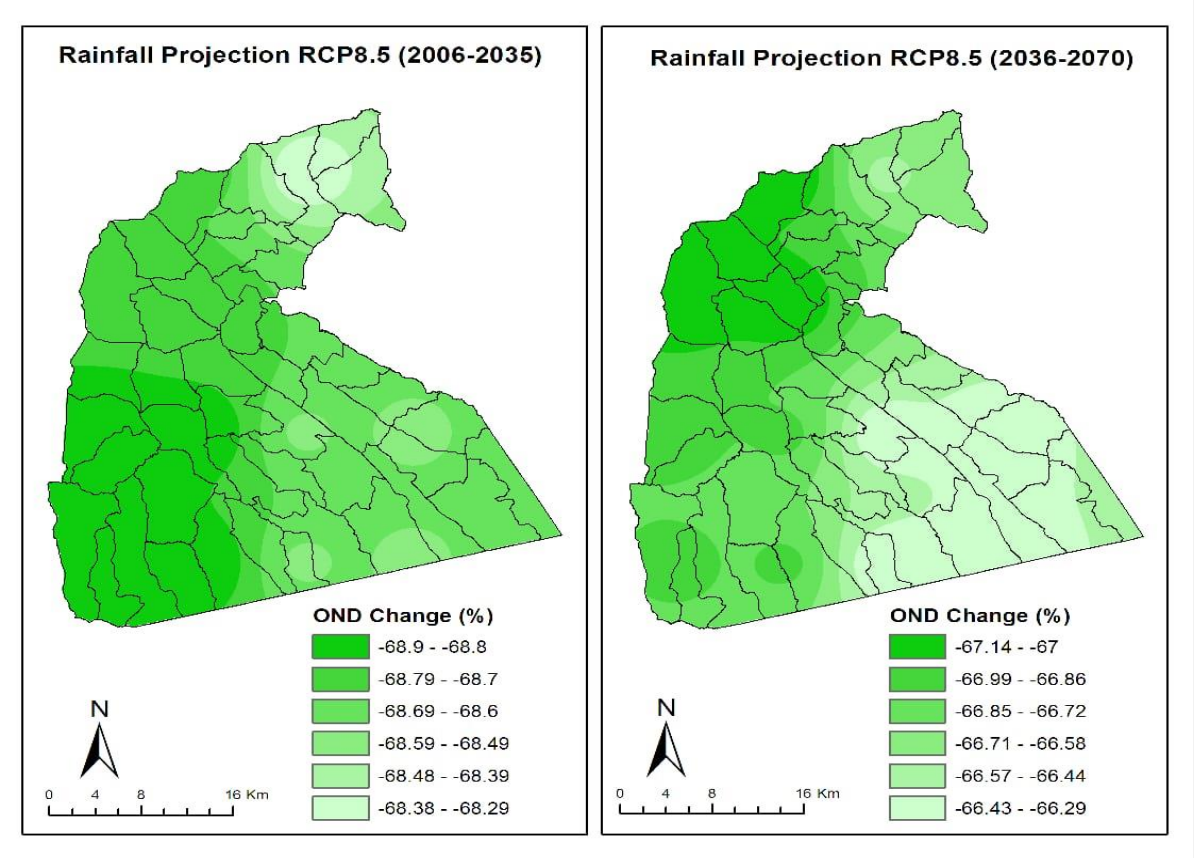
Figure 3-6: TheMarch to May (MAM) projected rainfall in RCP 4.5 (2011-2035) depict % increase in the MAM long rains seasonal rainfall, and a % decrease in the MAM projected rainfall RCP 4.5 (2036-2070).



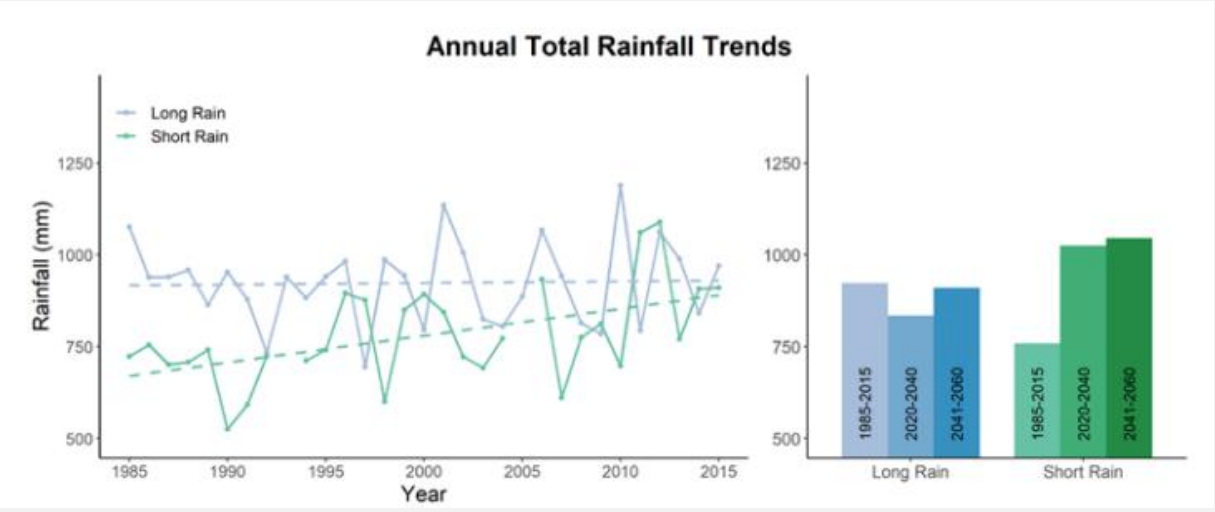
The two figures, that of MAM Rainfall Projection RCP8.5 (2006-2035) and that of (2036-2070) depict % Rainfall decrease in both scenarios.



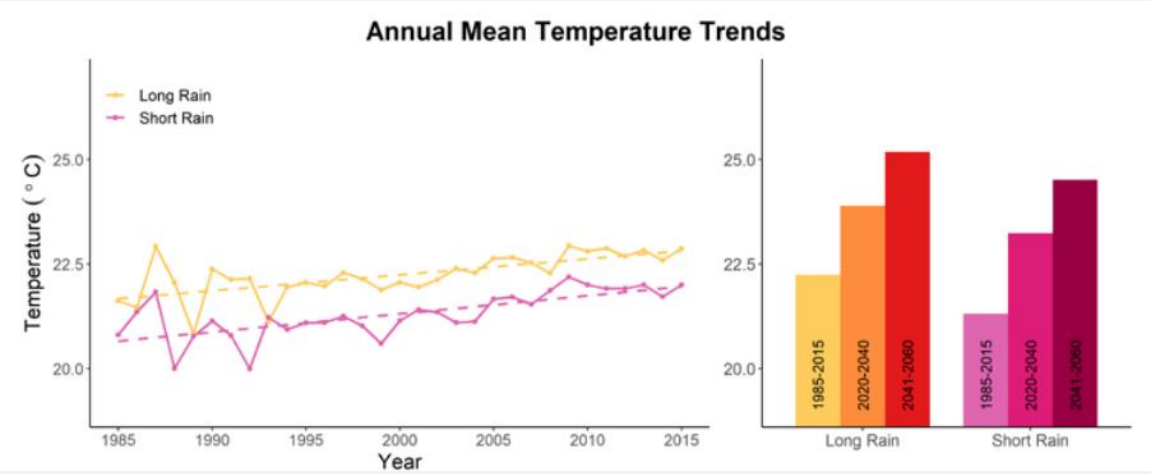
October to December (OND) rainfall projections RCP4.5 (2011-2035) shows increased % Rainfall Change, while, OND Rainfall Projection RCP (2036-2070) shows high % rates of decreased rainfall change.



OND projected rainfall RCP8.5 (2006-2035) and (2036-2070) in both scenarios depict high rates of % decrease of OND Rainfall Changes.



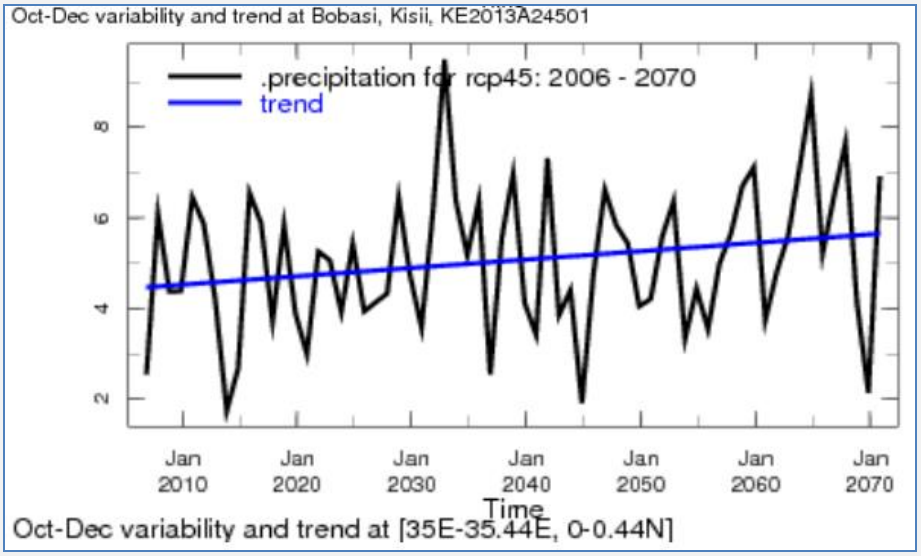
The depicted Figure illustrates the historical and projected annual total rainfall trends for both the long rains and short rains seasons. The historical data covers the period from 1985 to 2015, while the future projections span from 2020 to 2040 and from 2041 to 2060. This information is sourced from the Kenya County Climate Risk Profile specifically addressing Kisii County.



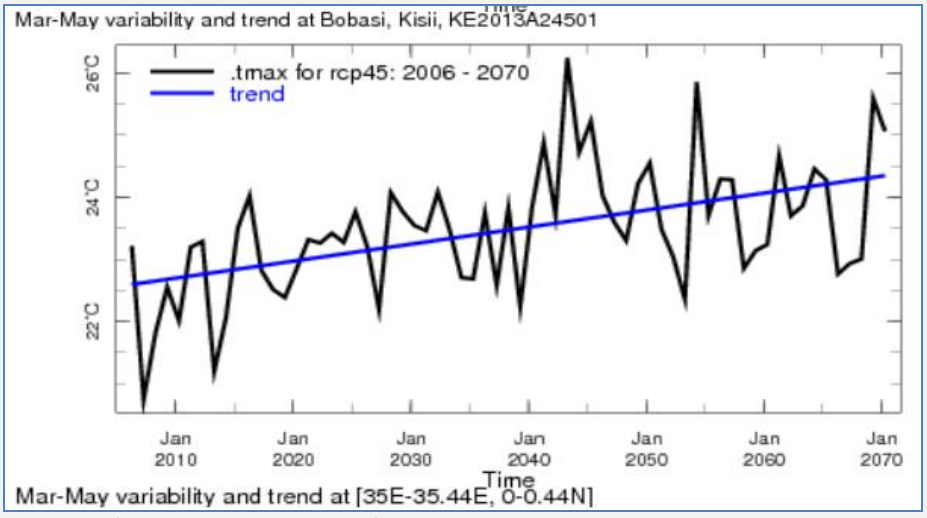
The presented Figure displays the historical and projected annual mean temperature trends for both the long rainy and short rainy seasons. The historical data covers the period from 1985 to 2015, while the future projections span from 2020 to 2040 and from 2041 to 2060. This information is sourced from the Kenya County Climate Risk Profile specifically addressing Kisii County.

3.4 Sub-counties climate projections

1. Bobasi Sub-county

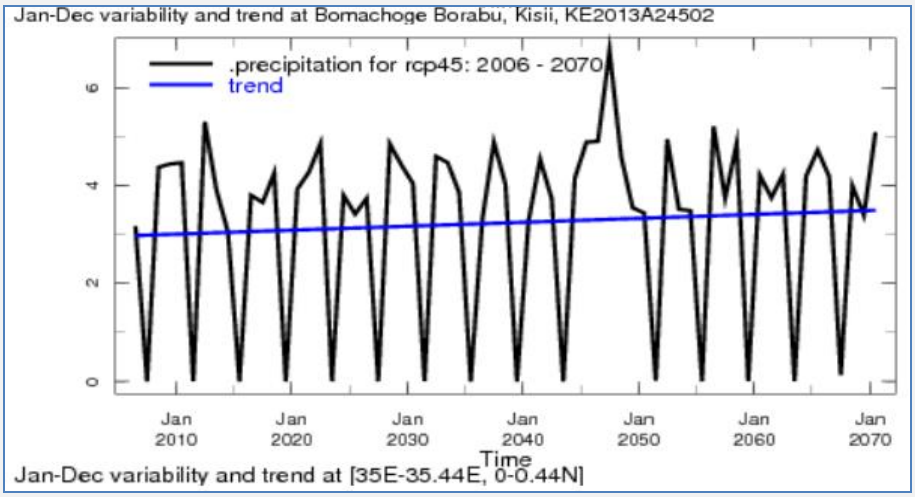


The precipitation for RCP4.5: 2006-2070 for Oct-Dec variability and trend at Bobasi Sub-County, Kisii indicate that precipitation will continue increasing.

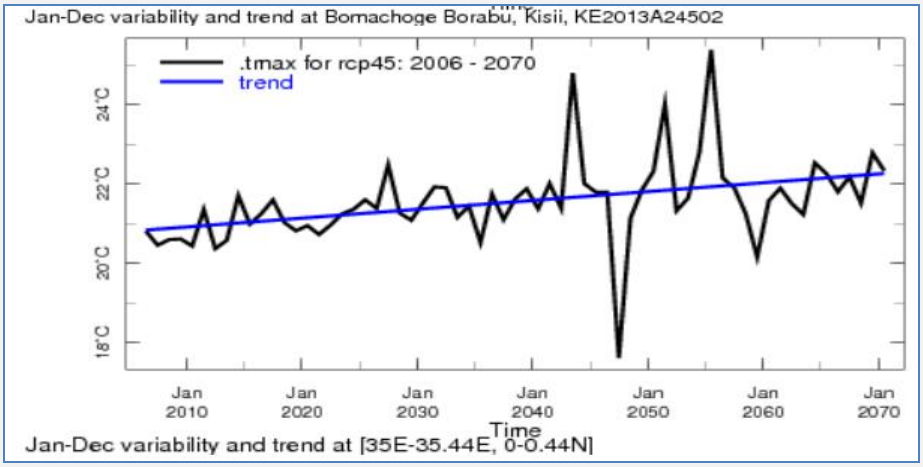


The Temperature Max for RCP 4.5: 2006-2070 for March-May variability and trend at Bobasi Sub-County, Kisii indicate that Max temp will continue increasing.

2. Bomachoge Borabu Sub-county

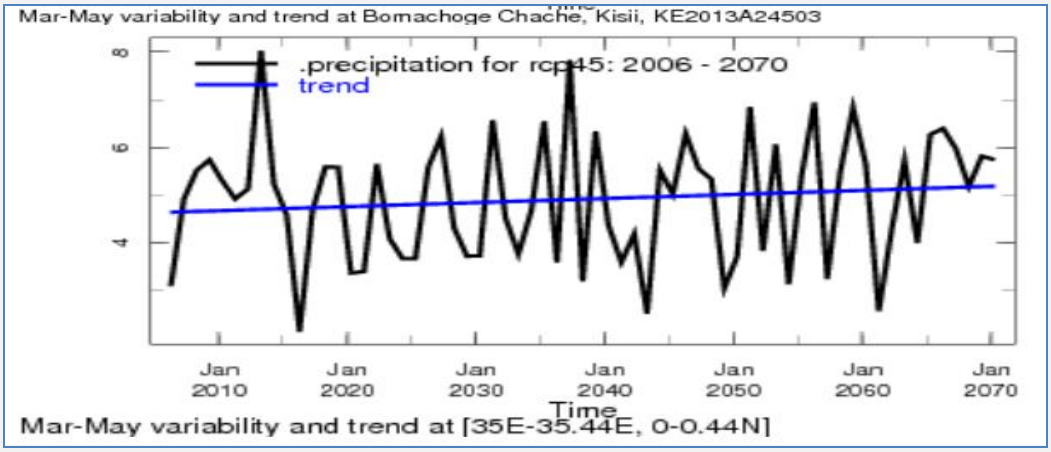


The Precipitation for RCP 4.5; 2006-2070 for Jan-Dec variability and Trend at Bomachoge Borabu Sub-County, Kisii indicate that the rains are expected to increase as indicated at the increasing trend.

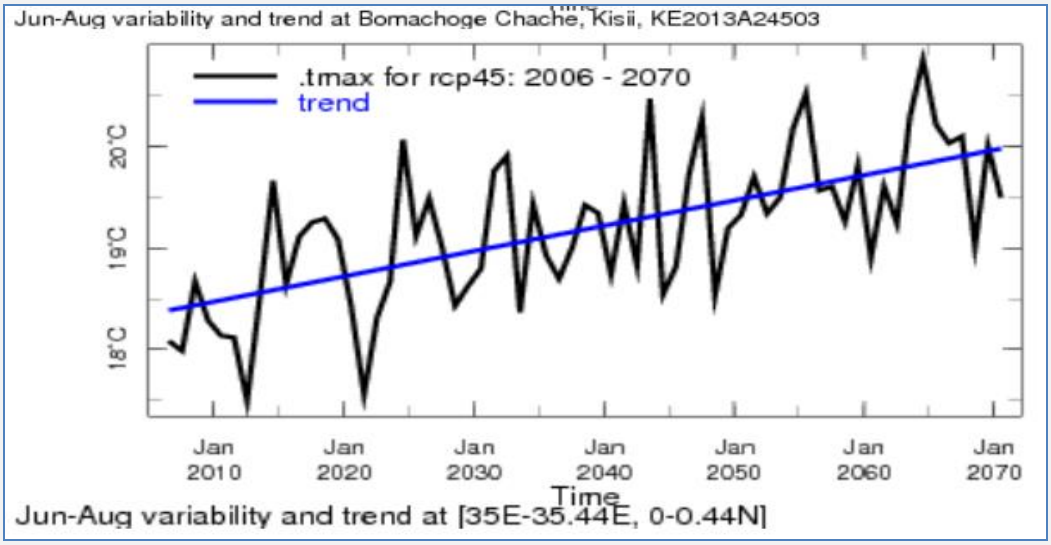


The Tmax for RCP 4.5: 2006-2070 during Jan-December variability and Trend at Bomachoge Borabu Sub-County, Kisii indicate that Tmax is in the increasing trend and higher temperatures will be experienced within the years 2043 and 2056, with very low max temperatures to be experienced in 2047 and 2060.

4 Bomachoge Chache Sub-county

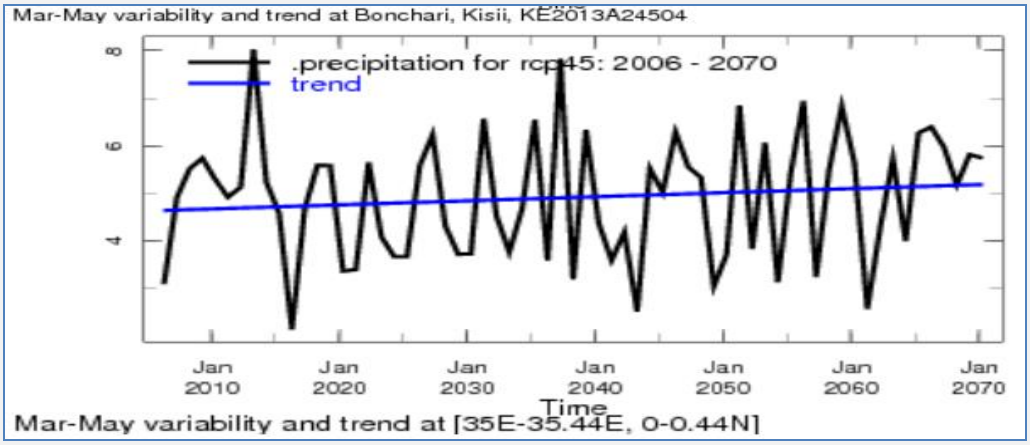


The Precipitation for RCP 4.5; 2006-2070 for Mar-May variability and Trend at Bomachoge Chache Sub-County indicate that the rains are expected to continue increasing.

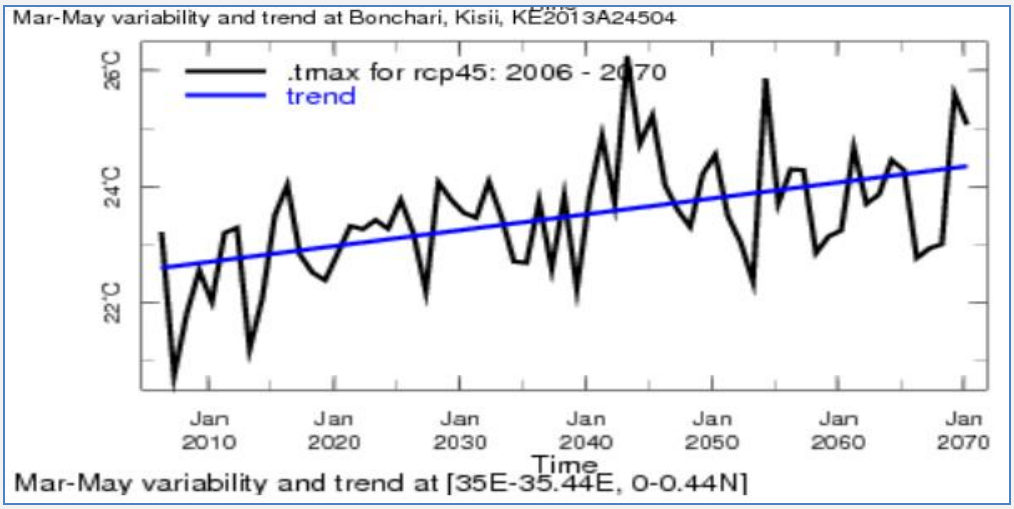


The Tmax for RCP 4.5: 2006-2070 during Jun-Aug variability and trend at Bomachoge Chache Sub-County indicate that Tmax is in the increasing trend.

5 Bonchari Sub-county

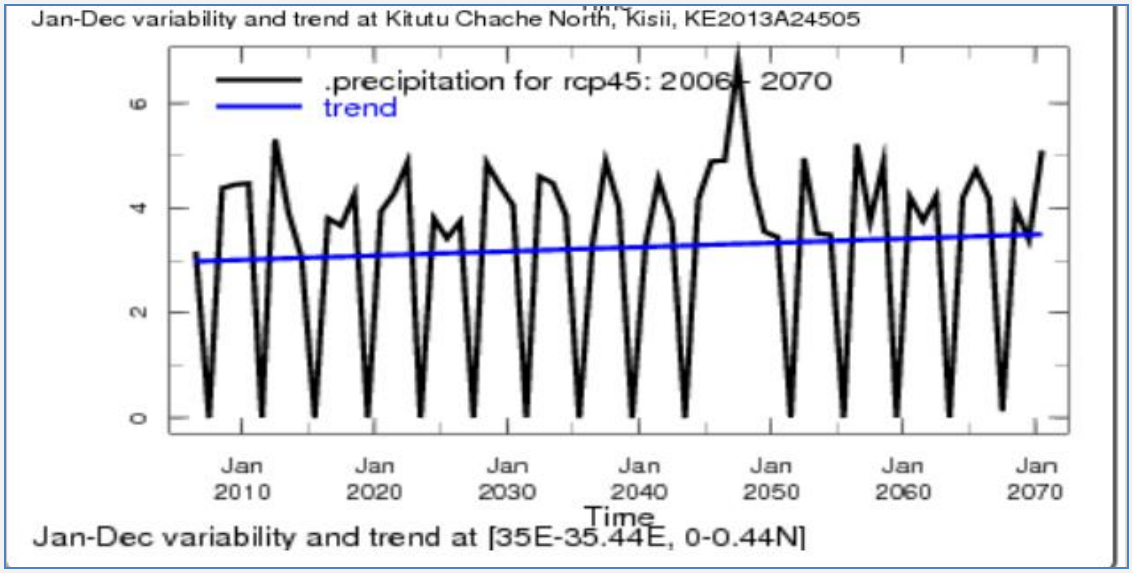


The Precipitation for RCP 4.5; 2006-2070 for March-May variability and trend at Bonchari Sub-County indicate that the rains are likely to increase as evidenced by the increasing trend.

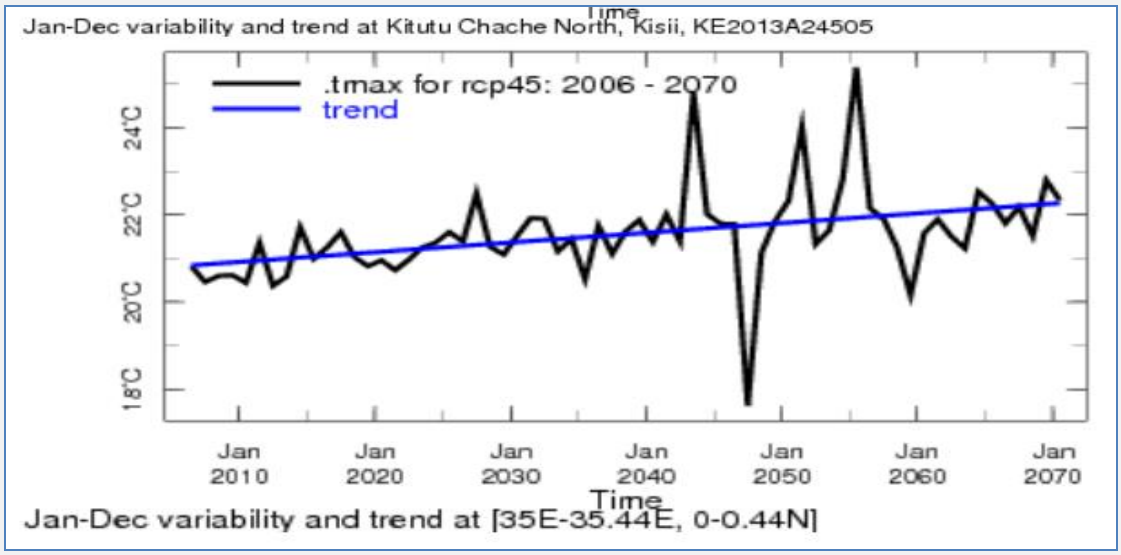


The Temperature Max for RCP 4.5; 2006-2070 for March to May variability and trend at Bonchari Sub-County indicate that Max temp is expected to rise consistently.

6 Kitutu Chache North Sub-county

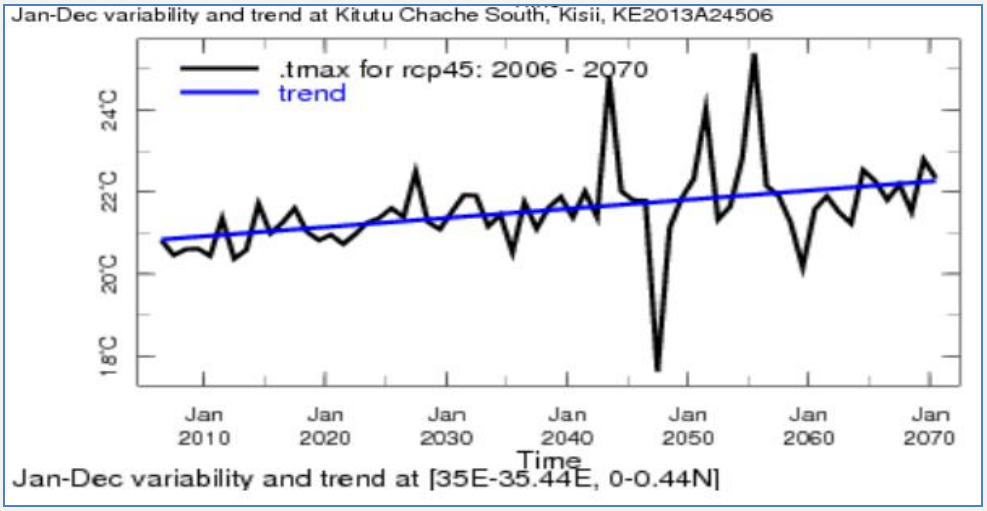


The precipitation for RCP 4.5; 2006--2070 during Jan-December variability and Trend at Kitutu Chache North Sub-County indicate that rainfall will be variable continuously increase with much rainfall expected around 2047 which looks like an El Nino year.

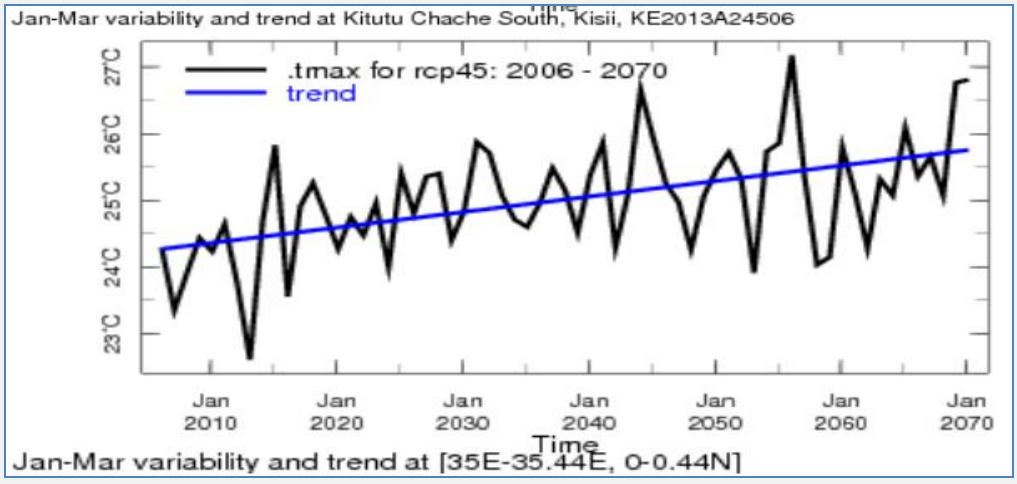


The temperature Max for RCP 4.5; 2006-2070 for Jan-Dec variability and trend at Kitutu Chache North Sub-County indicate that Max temp is expected to continue increasing at a high rate.

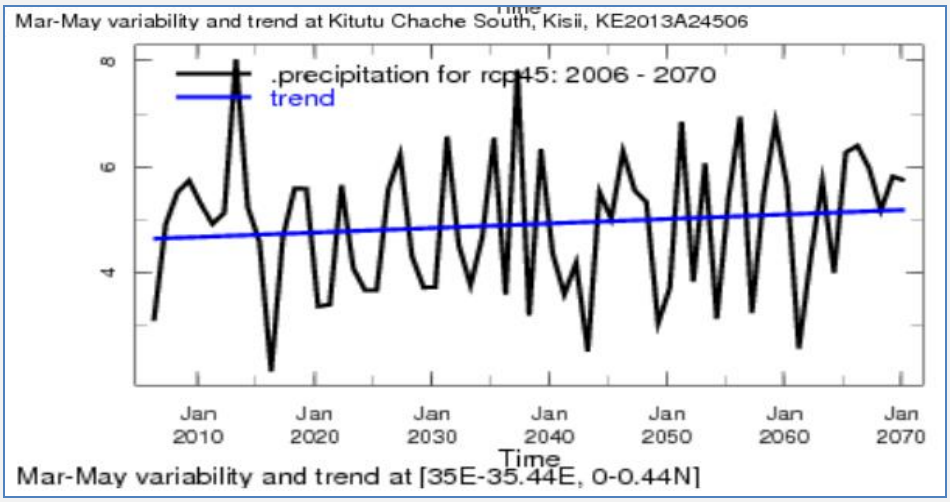
7 Kitutu Chache South sub-county



The temperature Max for RCP 4.5; 2006-2070 for Jan-Dec variability and trend at Kitutu Chache South Sub-County indicate that Max temp is expected to continue increasing at a high rate.

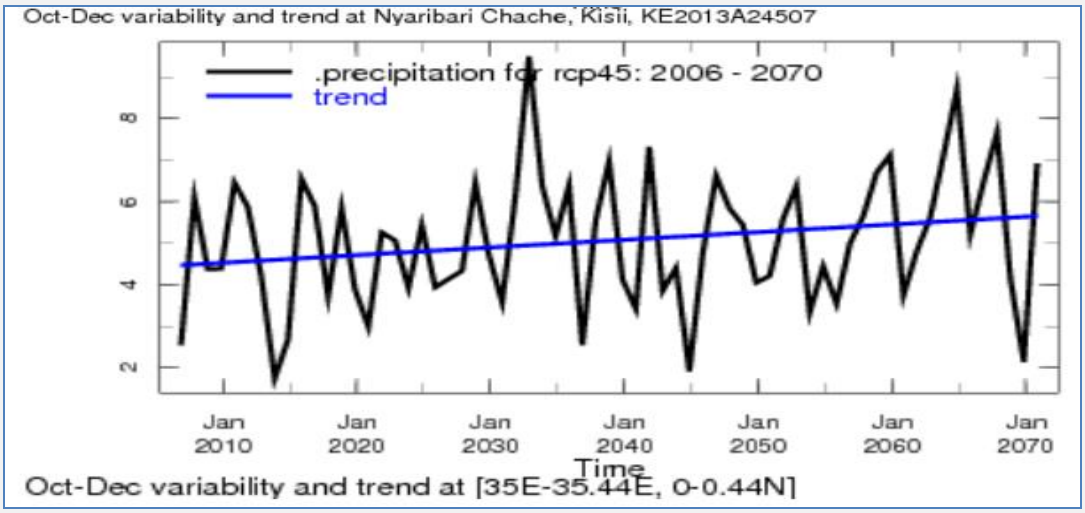


The Temperature Max for RCP 4.5; 2006-2070 for January-March variability and trend at Kitutu Chache South Sub-County indicate that Max temp is likely to increasing meaning night temps are going to be warmer and also day time temps will rise too, especially in the years 2045 and 2055 indicating a likelihood of heat waves in the Sub-County.

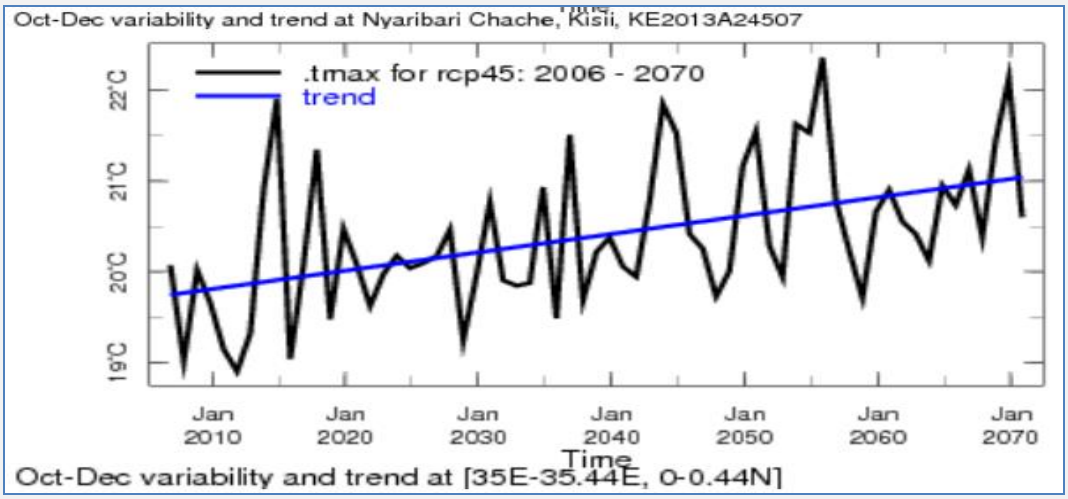


The precipitation for RCP 4.5; 2006-2070 for March-May variability and trend at Kitutu Chache South Sub-County indicate that the rains are likely to increase as evidenced by the increasing trend.

8 Nyaribari Chache Sub-county

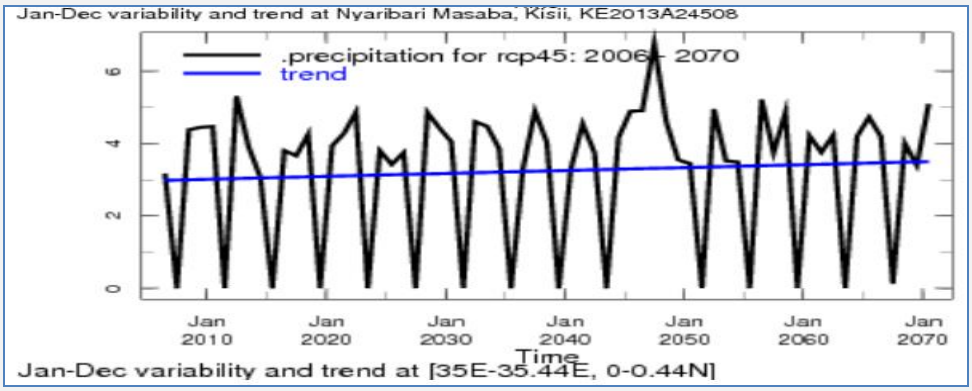


The precipitation for RCP 4.5; 2006-2070 for Oct-Dec variability and trend at Nyaribari Chache Sub-County indicate that the projected rains will increase.

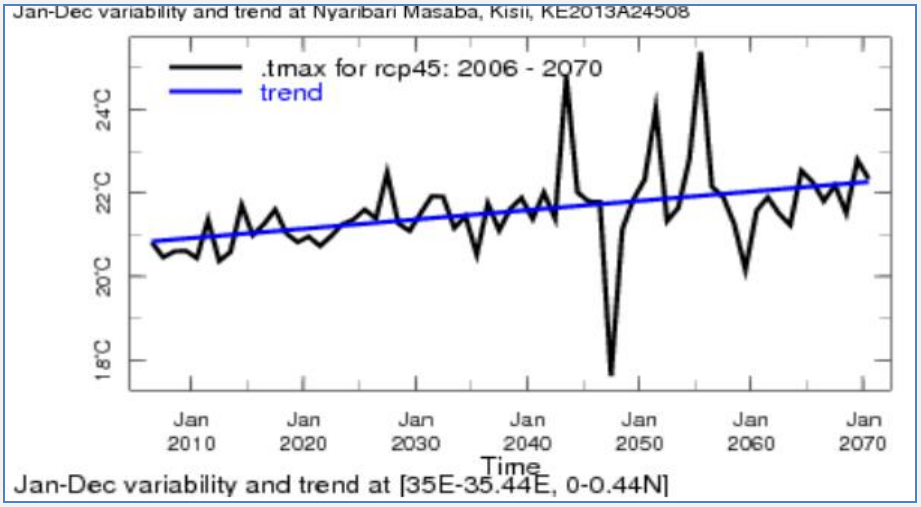


The Max Temp for RCP 4.5: 2006-2070 for Oct-Dec variability and trend at Nyaribari Chache Sub-County indicate that the projected Max Temp is expected to increase steadily.

9 Nyaribari Masaba Sub-county

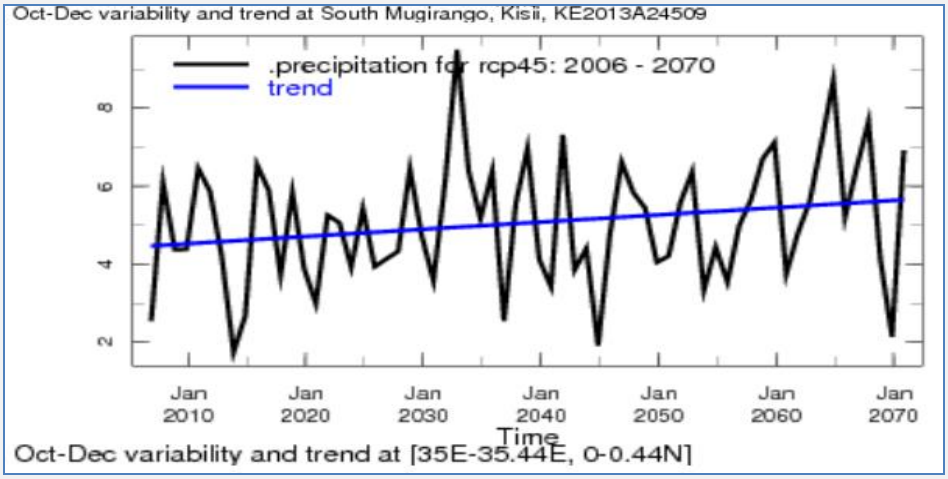


The precipitation for RCP 4.5; 2006-2070 for Jan-Dec variability and trend at Nyaribari Masaba Sub-County indicate that the projected rains are likely to increase slightly as evidenced by the increasing trend.

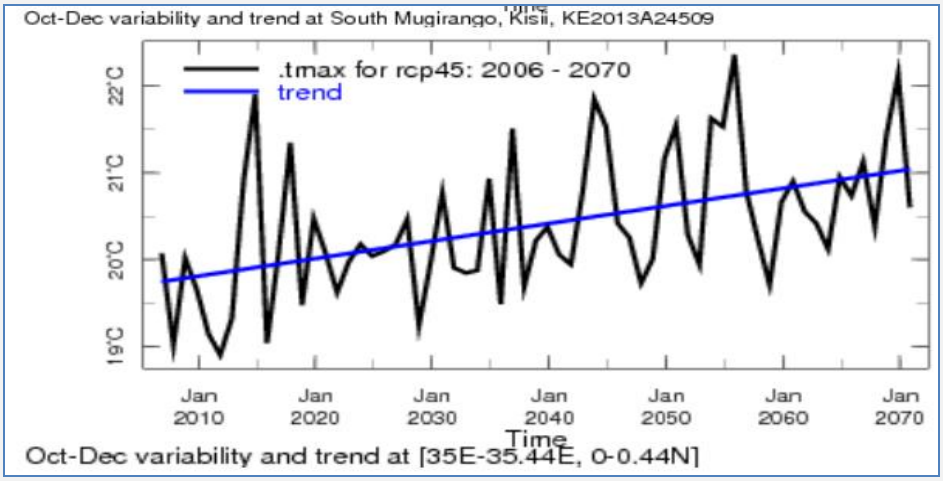


The temperature Max for RCP 4.5; 2006-2070 for Jan-Dec variability and trend at Nyaribari Masaba Sub-County indicate that Max temp is likely to continue increasing

10 South Mugirango Sub-county



The precipitation for RCP 4.5: 2006-2070 for Oct-Dec variability and trend at South Mugirango Sub-County indicate that Rainfall will continue increasing.



The Max temperature for RCP 4.5; 2006-2070 for Oct-Dec variability and trend at South Mugirango Sub-County indicate that Max temp is likely to continue increasing.

3.5 Likely future Impacts

3.5.1 Overview

The projected weather extremes are likely to cause more floods, destruction of infrastructure, increased soil erosion, increase in pests and diseases, increased incidences of malnutrition cases and displacement of people, water shortages, loss of lives, destruction of crops and property, increase in farming costs, direct and indirect effects on the health of animals and plants both terrestrial and aquatic, high incidences of food insecurity, For example, changes in animal dietary availability impact not only on herbivores but all other creatures in their food webs. Some of the negative future extreme climate impacts include vulnerable systems and sectors described in the following sub sections.

3.5.2 Health

While increased temperatures may bring localized benefits, such as enhanced food production in specific regions, the overall health effects are expected to be predominantly negative. Several social and environmental determinants of health are anticipated to face negative impacts due to various factors, including climate change. These impacts can affect access to clean water, air quality, food security, housing conditions, and overall socio-economic stability, all of which have significant implications for public health. Malaria cases will be more with the increase of temperatures; the mosquitoes have now moved in and are infecting many humans with the malarial pathogens. In Kisii, Climate extremes (droughts, temperature, storms and floods) will be more frequent and will lead to a rising prevalence of individuals lacking access to safe drinking water, increased cases of malnutrition and food insecurity and also increased exposure to diseases.

3.5.3 Infrastructure

The Changing Climate and variability will in future bring about increased flooding, generation of more severe storms, more frequent lightning strikes, and increased whirl/strong winds which will cause much more damage/ loss of infrastructure in the County.

3.5.4 Education

The sector will be severely hit by negative impacts of extreme weather events especially due to flooding/flash floods, droughts and extreme high temperatures which will bring about more loss of livelihoods, destruction of infrastructure and notable reduction in school attendance and increase in the rates of dropout. Increased temperatures and instances of strong winds and extremes of cold events will likely lead to increased cases of respiratory diseases among school students.

3.5.5 Trade, tourism and industry

Climate variability is expected to result in heightened intensity and prolonged duration of extreme weather phenomena such as rainfall, loss of indigenous knowledge and products and water scarcity which will bring brought about increased

destruction of infrastructure (roads and bridges) making it difficult for goods to reach the market and other facilities that will cause risk to workers' health and safety, loss of lives and property, increased water borne diseases and loss of livelihoods, culture erosion and increased water borne diseases such as malaria and typhoid among other diseases. Small scale traders that depend on farm produce will have little or none to sell because of low agricultural produce in the farms.

3.5.6 Environment Natural Resources and Energy

Due to the expected extreme weather and climate events, dry months will be much drier in Kisii County making forest fire instances inevitable particularly during the months of January and February. As a result, there will be a rise in greenhouse gas emissions loss of biodiversity and animal extinction due to wetland decimation which are habitats for some species of endemic animals like newts, toads, snails, snakes, porcupines, ant bears, among others and loss of medicinal plant sources. Increase in warming/temperatures will lead to prolonged drought instances causing decrease in forest productivity which will restrict fuel wood availability and scarcity of water and medicine among other benefits.

3.5.7 Agriculture

Weather/Climate extremes further expected will alter the life cycles of plants and animals in the county. Weather patterns are changing leading to shifts in planting, low agricultural productivity due to crop failure and post-harvest losses. Exposure to invasive and parasitic species and pathogens and increased drought occurrences due to the changing weather patterns will bring about low livestock and crop production, reduced fish production, increase livestock deaths due to reduced pasture and the ability to obtain water, and due to excessive heat strain.

The alterations in weather and climate will result in shifts in disease patterns and the potential resurgence of climate-related diseases and pests, which will have an impact on livestock and crops. For example, one such pest is the fall armyworm. Changes due to temperature rise will cause reduced water table and levels leading to scarcity of water, crop failure, reduced livestock production and reduced fish production in Kisii County.

Kisii County will encounter difficulties associated with change and variability of climate. These challenges will involve the occurrence of delayed and unpredictable rainfall, as well as the premature cessation of seasonal rains. These changes in rainfall patterns will have an impact on the timing of crucial activities such as preparation of land, planting, and harvesting. Additional challenges will arise from skewed distribution and intensity of rainfall, leading to more frequent hailstorms and occurrence of exceedingly high rainfall which will contribute to heightened soil erosion and increased risks of flooding, particularly in areas prone to flooding such as along the Gucha River and other flood-prone regions.Beans, among other crops, will be adversely affected by the increased frequency of hailstorms, particularly during crucial stages such as flowering and harvesting (ASDSP, 2014).

The escalating temperatures will contribute to a higher prevalence of pests and diseases that pose a significant threat to agricultural production. According to ASDSP (2014), approximately 41% of farmers have reported encountering new insect pests or diseases. Examples of these emerging pests include the fall armyworm and the Maize Lethal Necrotic Disease, which predominantly affects maize crops.

3.5.8 Gender related effects and vulnerable groups

The weather and climatic changes in Kisii County are anticipated to contribute to heightened gender inequality, impacting women's financial independence. With the increased need to search for firewood and water from drying wells and distant water points, women will have limited time and opportunities to engage in income-generating activities. Consequently, their ability to achieve financial autonomy will be reduced. Moreover, the overall social and political rights of women, particularly in an agriculturally dependent economy like Kisii, will suffer as a result of these challenges.Furthermore, pregnant women are expected to be particularly vulnerable to the effects of weather extremes. As their immune systems are weakened during pregnancy, they will face a heightened risk of contracting human diseases associated with projected weather extremes. This highlights the need for increased support and healthcare interventions to safeguard the well-being of pregnant women in the face of climate change impacts.

The anticipated increased rains will lead to soil erosion and destruction of farms which will bring about high frequencies of food insecurity. This will negatively impact on the elderly due to inadequate food and nutrition. Likewise, the elderly will be highly vulnerable to incidences of human diseases particularly, malaria and water borne diseases due to their reduced immune system.

4 CHAPTER FOUR: ANALYSIS OF EXISTING RESILIENCE/ADAPTATION STRATEGIES TO CURRENT AND FUTURE CLIMATE RISKS

4.1 An examination of the current adaptation and resilience strategies in place to address climate risks and their level of effectiveness.

While all households in a community face climate change risks and negative impacts, certain groups, such as youths, individuals with disabilities, older people, and women, are particularly more vulnerable. Vulnerability to climate change is influenced by various factors, including recurring droughts, food insecurity, land degradation, poverty, reliance on rain-fed agriculture, and inequitable distribution of land. Moreover, sociocultural factors like beliefs, values, and practices can also undermine the ability to adapt and exacerbate vulnerability at the household level. Challenges associated with limited access to natural resources such as water and land, restricted market opportunities, inadequate social services, insufficient infrastructure (including storage facilities and roads), political marginalization, lack of information and skills, environmental degradation, limited access to credit services, loss of employment opportunities, and weak institutional arrangements further contribute to vulnerability.

Table 4-1: Existing adaptation strategies

Hazard	Impact	Local response	Effectiveness	Sustainability
Prolonged dry spells	Hunger and famine; Drying of water catchment areas; Sell of property to get food; Drop of businesses due to lack of farm produce Hardship may cause girls to exchange sex for food	Relief food	0	0
		Ritual-call on rains	0	0
		Plant trees	++	+++
		Selling of soapstone.	+	+
		Going to the nearest towns for employment.	+	+
		Indulgence in criminal activities for most youth	0	0
		Marring off young girls to old men	0	0
Floods	Loss of lives; Destruction of crop-low yields; Vector-borne diseases-malaria; Displacement; Soil erosion; Water pollution; Destruction of road and structures;	Awareness creation Moving to higher grounds	++	++
		Building of gabions	+++	+++
		Mulching	++	+
		Boiling water, terracing	++	++
		By-passes	+	+
		Moving to safe areas	++	
		Harvesting the remnants or immature crops	++	+
		Seek medical attention	+++	+
Land slides	Loss of lives Loss of livestock Injury to people and animals Displacements of people and animals Loss of fertile soil Destruction of property and structures Increased repair and replacement costs	Awareness creation in quarries	++	++
		Use of indigenous knowledge in weather forecasting and preparedness.	+	+
Epidemics	High mortality rates (death); Stress leading to hypertension; Mental effects e.g., the cerebral	Seeking medical advice	+++	+++
		Hygiene and sanitation practices such as hand washing at four critical hours	+++	+++

	malaria and nuisance; Loss of energy leading to low productivity thus leading to poverty; Impaired sight in case of eye infections; Disabilities; Increased cost of seeking medical advice; Mental effects; Loss of energy-low productivity	Use if traditional methods-ash and herbs	++	+
		Facing situations with ease (for hypertension)	+	0
		Reduce consumption rate of salt and fat	+	+
Hailstone, thunderstorms and lightning	Death of humans and livestock Injury to humans and livestock Destruction of trees and forests thereby destroying biodiversity. Interference with power and communication	Early harvesting before destruction	++	
		Staying indoors or housing the livestock		
		Covering small crops and fruits		

4.2 Effectiveness of adaptation and resilience strategies in addressing future climate risks

As climate change continues to pose increasing challenges, it is crucial to assess the effectiveness of adaptation and resilience strategies in mitigating and managing future climate risks. Here is an evaluation of the effectiveness of these strategies:

1. Robust planning and governance: Effective strategies will require comprehensive planning and strong governance frameworks at various ward levels. This includes integrating climate change considerations into local policies, Kisii County development plans, and regulatory frameworks. Adequate coordination, stakeholder engagement, and institutional capacity are crucial for successful implementation.
2. Science-based decision-making: Strategies based on sound scientific evidence and climate projections are more likely to be effective. Understanding future climate scenarios, vulnerabilities, and risks enables the development of targeted and context-specific adaptation measures.
3. Climate-smart agriculture: Adoption of climate-smart agricultural practices, including sustainable farming methods, crop diversification, and precision farming, can enhance resilience in the face of changing climatic conditions. These strategies have demonstrated positive outcomes in improving productivity, soil health, and resource efficiency. However, their effectiveness relies on access to resources, knowledge dissemination, and support from agricultural institutions.
4. Ecosystem-based approaches: Preserving and restoring natural ecosystems, such as wetlands can provide multiple benefits in terms of climate change adaptation and resilience. Ecosystem-based approaches, including watershed management have proven effective in reducing the impacts of extreme weather events and enhancing ecosystem services.
5. Early warning systems and disaster preparedness: Strengthening early warning systems and disaster preparedness can significantly reduce the vulnerability of communities to climate-related hazards. By providing timely information and enabling preparedness measures, these systems enhance resilience. Their effectiveness depends on robust infrastructure, efficient communication networks, and community engagement.
6. Socio-economic considerations: Effective adaptation strategies should also address socio-economic factors such as poverty alleviation, access to resources, social protection measures, and gender equality. Integrating these considerations into adaptation planning and implementation can enhance overall effectiveness and ensure equitable outcomes.

It is important to note that the effectiveness of adaptation and resilience strategies may vary depending on local contexts, socio-economic conditions, and the dynamic nature of climate change. Continual monitoring, evaluation, and adaptive management are essential to ensure the ongoing effectiveness of these strategies in the face of evolving climate risks.Table 4-2 below list some of locally driven strategies for building climate resilience.

Table 4-2: Effectiveness of adaptation/resilience strategies to future climate risks

Risk/Hazard	Livelihood/Economic System	Climate resilience strategies	Stakeholder group applying the strategy	Gender and social inclusion information
Prolonged dry spells	Agriculture sector	▪ The key components for addressing dry spells include the monitoring and observation of dry spell occurrences, planning and preparedness for dry spells, predicting and forecasting dry spells, effectively communicating and reaching out to the public and affected sectors, and conducting interdisciplinary and applied research on topics relevant to the sectors impacted by dry spells. ▪ Soil and water conservation structures ▪ Climate smart agriculture ▪ Protection and rehabilitation of riparian land ▪ Adoption of improved irrigation technology ▪ Conservation and protection of water sources ▪ Planting riverine vegetation ▪ Enhanced extension services and capacity building on pasture development. ▪ AI services for drought tolerant livestock breeds. ▪ Establishing crop cover and Agroforestry ▪ Land rehabilitation ▪ Timely dissemination and Application of	▪ Ward Climate Change Committees ▪ Smallholders Farmers ▪ National Drought Management Authority	▪ Children ▪ Women ▪ PLWDs ▪ Elderly

		Climate information. ▪ Combination of conservation and Convention Agriculture		
	Energy sector	▪ Use of energy savingStoves ▪ Use alternative sources of energyCarbon trading ▪ Capacity building Sensitization of community on clean energy Funding	▪ Communities ▪ Ward Climate Change Committees ▪ Kenya Forest service	▪ Elderly ▪ Children ▪ Women ▪ PWDs
	Water Sanitation and Hygiene	▪ Increase water harvesting ▪ Structures ▪ Rehabilitation of existing water structures	▪ Department of Water ▪ Communities ▪ Ward Climate Change Committees ▪ Kenya Forest service	▪ Children ▪ Women ▪ PLWDs ▪ Elderly
Floods	Agriculture/Farmlands	▪ Drainage Water Management ▪ Water Gates ▪ Flood Barrier Socks ▪ Modular Flood Prevention ▪ On-Farm Weather Stations for Early warning systems ▪ Riparian or saturated buffers, or increased planting of perennials. ▪ Community Participation - strategies like contour farming, agroforestry, and cover cropping. Farmers and landowners need access to suitable land areas for implementing erosion control practices. Collaboration with local farmers, landowners, and agricultural cooperatives	▪ Smallholders Farmers ▪ Non-state Actors such as Red cross ▪ County Disaster response Department ▪ Communities ▪ Ward Climate Change Committees ▪ Ward agriculture committees	▪ Children ▪ Women ▪ PLWDs ▪ Elderly

		can facilitate the allocation of land and ensure the engagement of stakeholders. ▪ Monitoring and Evaluation Systems - This includes the collection and analysis of data, development of monitoring indicators, and periodic assessments. Adequate resources for monitoring and evaluation activities ensure adaptive management and the refinement of strategies over time.		
	Houses, Schools, and infrastructures such as roads and bridges Food storage and processing facilities Water supply systems	▪ Funding from climate sources to support the construction of new infrastructure, such as dams, levees, bridges, and culverts. ▪ Ensuring the regular upkeep and maintenance of existing infrastructure. ▪ Implementing measures at the individual level to protect properties from flooding. ▪ Enhancing transportation access to improve mobility during flood events. ▪ Conducting surveys to assess properties for flood risks. ▪ Implementing controls in land use planning to guide development away from high-risk flood areas. ▪ Enforcing regulations and codes for flood-resistant building and development practices. ▪ Utilizing catchment flood modelling to analyze and understand flood patterns in a	▪ Physical Planning department ▪ County Disaster response Department ▪ Communities ▪ Ward Climate Change Committees	▪ Children ▪ Women ▪ PLWDs ▪ Elderly

		particular area.		
Land slides	Houses farms Roads	▪ Enhancing the drainage system to improve water flow and prevent water accumulation that can destabilize slopes. ▪ Decreasing the slope angle to reduce the risk of gravitational forces and potential slope failure. ▪ Conducting excavation at the top of the slope to alleviate pressure and reduce the weight on the slope. ▪ Constructing a protective berm or wall at the bottom of the slope to provide support and prevent soil movement or erosion.	▪ Physical Planning department ▪ County Disaster response Department ▪ Communities ▪ Ward Climate Change Committees ▪ Public Health Department ▪ National Environment Management Authority ▪ Schools management	Women Children Elderly Person living with disability Orphans and Vulnerable Children Vulnerable farmers
Epidemics	Health sector	▪ Water treatment of water sources ▪ Surveillance of water sources ▪ Disease surveillance ▪ Establishment of Treatment facilities in all major community water sources ▪ Community health outreach ▪ Awareness creation ▪ Vaccination of vulnerable groups ▪ Medical outreaches during prolonged dry spells and floods		
	Education-School absenteeism	▪ Enhanced preventive health education in communities and schools. ▪ Sensitization on preventive health Vaccination of children below the age of five Promotion of hygiene		

	Malnutrition Nutrition	▪ Fortification of foods with vitamins ▪ Food supplements ▪ Kitchen gardens		
	Poverty due to medical bills; straining of health resources	▪ Increased hospital staffing ▪ Increase of health facilities ▪ Medical insurance (UHC)		
Hailstone, thunderstorms and lightning	Impacts on grid Energy supply	▪ Lightning protection system (lightning storm detector system) in prone locations ▪ Early warning systems including proper thunderstorm and lightning safety procedures or guidelines be contained in an emergency action plan	▪ Communities ▪ Ward Climate Change Committees ▪ Public Health Department ▪ National Environment Management Authority ▪ Schools management	▪ Women ▪ Children ▪ Elderly ▪ Person living with ▪ disability ▪ Orphans and ▪ Vulnerable Children

Table 4-3: Sectoral Adaptation Strategy

No	Sector	Climate Change risk	Resultant impacts	Prioritized Adaptation Strategies
1	Agriculture and livelihood	• Changing weather patterns	• Shifts in planting seasons • Low agricultural productivity due to crop failure • Post-harvest losses	▪ Crop Diversification: Encourage farmers to diversify crops to reduce dependence on a single crop and enhance resilience to changing weather patterns. ▪ Irrigation Systems: Promote the use of small-scale irrigation systems to ensure consistent water supply for crops. ▪ Climate-Resilient Varieties: Promote the adoption of climate-resilient crop varieties that are better suited to changing conditions. ▪ Weather Forecasting: Improve access to weather information and early warning systems to help farmers make informed decisions. ▪ Renewable Energy: Promote the use of renewable energy sources, such as solar and wind, to reduce reliance on fossil fuels and enhance energy security. ▪ Energy Efficiency: Encourage energy-efficient technologies and practices to reduce energy consumption and greenhouse gas emissions.
		• Exposure to invasive and parasitic species and pathogens	• Low livestock and crop production	
		• Increased prolonged dry spells occurrences	• Reduced fish production • Livestock deaths due to decline in pasture and access to water and heat stress • Changes in disease patterns, and potential for re-emergence of climate related diseases and pests that affect livestock and crops e.g. fall armyworm	
		• Reduced water table and levels	• Water scarcity • Crop failure • Reduced livestock production • Reduced fish production	
		• Deforestation	• Soil erosion • Reduced soil moisture • Reduced soil fertility •	
		• Extreme land fragmentation/subdivision	• Encroachment to riparian lands • Low agricultural productivity • Loss of wetlands • Loss of biodiversity	
2	Environment, natural resources, and	• Forest fires	• Increased greenhouse gas emissions • Loss of biodiversity • Loss of medicinal plant sources	▪ Forest Conservation: Implement strict measures for the conservation of forests, including protection against illegal logging, tree planting

	energy	• Prolonged dry spells and water scarcity	• Decline in forest productivity, which restricts availability of fuel wood • Water scarcity • Natural resources conflict that exacerbates gender inequality and gender-based violence • Environmental degradation. • Desertification	initiatives, and promoting sustainable forestry practices. ▪ Wetland Restoration: Restore and protect wetlands, which are critical for water storage, purification, and as habitats for wildlife. Proper management can reduce the risk of flooding and enhance ecosystem services. ▪ Biodiversity Conservation: Develop and implement conservation programs to protect the county's rich biodiversity. This includes the preservation of endangered species and their habitats. ▪ Land Use Planning: Establish land use plans that take climate change into account, ensuring that development is carried out in a way that minimizes environmental degradation and reduces vulnerability to climate impacts. ▪ Soil Management: Promote sustainable soil management practices to maintain soil fertility and prevent erosion. Techniques such as terracing and agroforestry can help in this regard. ▪ Water Resource Management: Manage water resources effectively, including sustainable groundwater use, protection of water catchment areas, and the development of water storage infrastructure. ▪ Waste Management: Implement improved waste management systems to reduce pollution and enhance environmental health. Promote recycling and proper disposal of waste to prevent contamination of water bodies. ▪ Renewable Energy: Promote the use of renewable energy sources, such as solar, wind, and hydropower, to reduce reliance on fossil fuels and mitigate greenhouse gas emissions.
		• Landslides/mudslides	• Loss life and property • Loss of arable land • Environmental degradation	
		• Emergency of alien species	• Destruction of indigenous plants • Emergence of new pests and diseases	
		• Increased solid waste generation	• Increase in air pollution • Increased greenhouse gas emissions • Global warming due to rising temperatures • Water pollution from the spillage of waste into rivers • Increased disease-causing pathogens, insects and rodents	
		• Loss of genetic material	• Extinction of indigenous plants and animal species • Establishment of a gene bank	
		• Lightning strikes	• Loss of lives and property	

				▪ Energy Efficiency: Implement energy-efficient practices and technologies across all sectors, including households, industries, and public institutions. This reduces energy consumption and associated costs. ▪ Rural Electrification: Expand access to electricity in rural areas, which can improve living standards and reduce dependence on traditional, unsustainable energy sources. ▪ Off-Grid Solutions: Invest in off-grid and decentralized energy systems to provide power to remote communities, improving their resilience and reducing their vulnerability to energy shortages. ▪ Energy Access for Cooking: Promote clean cooking technologies, such as improved cookstoves and biogas, to reduce indoor air pollution and decrease the demand for wood fuel. ▪ Energy Conservation: Educate the public on energy conservation practices, such as turning off lights and appliances when not in use and using energy-efficient appliances.
3	Trade, tourism and industry	• Increased intensity and duration of extreme weather events such as rainfall	• Destruction of infrastructure and facilities • Risk to workers' health and safety • Loss of lives and property • Increased water borne diseases • Loss of livelihoods	**Trade Sector** ▪ Diversification of Products: Encourage diversification of products and markets to reduce dependence on climate-sensitive goods and trading partners. Promote non-agricultural exports and explore value addition opportunities. ▪ Climate-Resilient Supply Chains: Build climate-resilient supply chains by identifying vulnerable points and implementing measures to ensure the continuity of trade activities, even during extreme weather events. ▪ Market Information Systems: Establish market information systems to provide traders with real-time weather and market data, enabling them to
		• Loss of indigenous knowledge and products	• Culture erosion	

				make informed decisions. ▪ Insurance Schemes: Promote climate risk insurance for traders and businesses to help them recover from climate-related losses. **Tourism Sector** ▪ Diversify Tourism Offerings: Diversify tourism offerings beyond wildlife safaris to include cultural, adventure, and eco-tourism experiences that are less climate-dependent. ▪ Infrastructure Resilience: Ensure that tourism infrastructure, such as hotels and roads, is built to withstand extreme weather events and flooding. ▪ Community Involvement: Engage local communities in sustainable tourism practices and revenue-sharing arrangements to create incentives for conservation and adaptation efforts. ▪ Promotion of Responsible Tourism: Promote responsible tourism practices, including waste management and reduced carbon emissions, to minimize the sector's environmental impact. ▪ Weather Forecasting: Provide tourists and tour operators with timely and accurate weather forecasts to help them plan and adjust their itineraries accordingly. **Industry Sector** ▪ Resource Efficiency: Promote resource-efficient practices within industries to reduce waste, water usage, and energy consumption. This can lead to cost savings and reduced environmental impacts. ▪ Green Technologies: Encourage the adoption of green technologies and processes in industrial operations, including renewable energy sources and energy-efficient equipment. ▪ Supply Chain Resilience: Strengthen supply chain

				resilience by diversifying sources of raw materials and ensuring business continuity planning in the face of climate-related disruptions. ▪ Disaster Preparedness: Develop and implement disaster preparedness plans to safeguard industrial facilities from extreme weather events, such as floods and storms. ▪ Access to Financing: Facilitate access to climate finance and funding mechanisms for industries to support the adoption of climate-resilient technologies and practice
4	Education	• Flooding/ flash floods	• Loss of livelihoods • Destruction of infrastructure	▪ Climate Education: Integrate climate change education into the curriculum at all levels of the education system to raise awareness and build climate literacy. ▪ School Infrastructure: Ensure that schools have climate-resilient infrastructure to withstand extreme weather events and provide a safe learning environment.
		• Prolonged dry spells	• Declines in school attendance, and rising dropout rates	
		• Extreme high/low temperatures	• Increased cases of respiratory diseases • Reduced learning hours • Non-attendance of schools	
5	Infrastructure	• Climate variability (Flooding, Thunderstorms, Strong winds, Whirl winds and lightning strikes)	• Damage/ loss of infrastructure.	• Resilient Roads and Bridges: Design and construct infrastructure, such as roads and bridges, to withstand extreme weather events like floods and landslides. • Urban Planning: Incorporate climate-resilient urban planning practices to minimize flood risks in urban areas. • Erosion Control: Implement erosion control measures, such as planting vegetation and installing retaining walls, to protect infrastructure.
6	Health	• Climate extremes (Prolonged dry spells, temperature and floods)	• Increased number of people without access to clean drinking water • Increased cases of food insecurity and malnutrition • Increased exposure to diseases such as asthma, malaria and other respiratory diseases.	▪ Disease Surveillance: Strengthen disease surveillance systems to monitor and respond to climate-sensitive diseases such as malaria and waterborne illnesses. ▪ Health Education: Conduct community health education campaigns on climate-related health

			• Rising risk of workers' safety and health • Increase of water borne diseases such as malaria, typhoid etc.	risks and prevention measures. ▪ Healthcare Infrastructure: Improve healthcare infrastructure to handle increased cases of climate-related health issues.

5 CHAPTER FIVE: PRIORITIES FOR CLIMATE STRATEGIC ADAPTATION INVESTMENT AND ACTION IN KISII COUNTY

5.1 Hazard based priority adaptation investment

This section provides a comprehensive outlook, considering multiple sectors, and emphasizes the strategic investment priorities aimed at enhancing the resilience and adaptive capacity of critical livelihood, social, and economic systems in Kisii County. The strategies are formulated based on the input and involvement of key stakeholders in the Participatory Climate Risk Assessment (PCRA). The table below illustrates the identified priorities.

Table 5-1: Priority investments in Kisii County

Hazard	Priority of investment
Prolonged dry spell	Catchment protection through afforestation/reforestation, Rehabilitate and gazette wetlands, Gazette county forests, Develop participatory forest management plans, upgrade and expand water treatment facilities Water harvesting and awareness Crop/property insurance Agroforestry Use of prolonged dry spells tolerant varieties Climate smart agriculture practices
Floods	Upgrade and expand sewerage network, Storm water drainage infrastructure, Building gabions, planting vetiver grass Climate proof road networks (by construction enough culverts, Bridges, side drains etc.) Investment in community disaster managed risk reduction Early warning early action and early action protocol Capacity building on river bank restoration Improve drainage system in towns; Supply water purification chemicals, treatment of destroyed plants
Landslides	Protecting catchment areas by implementing afforestation and reforestation initiatives. Embracing sustainable farming practices and techniques. Seeking support from governmental entities and other collaborative partners. Diversifying livelihoods to reduce vulnerability and enhance resilience. Incorporating indigenous knowledge in weather forecasting and preparedness activities.
Thunderstorms, hailstones and lightning	Radio-active detection and ranging (RADAR) Installation of lightening arrestors Hail observation and monitoring

	Dissemination of forecast on the hazards Awareness creation
Epidemics	Government of Kenya (GoK) to support the community with medical supplies especially in times of floods. Supply preventive and curative solutions e.g., mosquito nets and drugs Increase the number of health facilities in the areas Deploy more medical staff to the facilities The GoK in collaboration with other NGO do mobile toilets Medical outreaches during prolonged dry spells and floods
Erratic weather patterns	Improve weather monitoring network, Develop early warning systems (climate information services), Enhance the reach of RANET radio network for weather related broadcasting to all wards, Plant early maturing and drought resistant crop varieties

5.2 Sector-specific climate adaptation actions and priorities

These sector-specific climate adaptation actions and priorities should be integrated into Kisii County's broader climate change adaptation plan, and implementation should involve collaboration among government agencies, local communities, NGOs, and other stakeholders. Regular monitoring and evaluation of these actions are essential to assess their effectiveness and make necessary adjustments in response to evolving climate conditions.

5.2.1 Agriculture and Food Security

- Crop Diversification: Promote the cultivation of climate-resilient and drought-tolerant crop varieties to reduce reliance on single crops and enhance food security.
- Irrigation Expansion: Invest in small-scale irrigation schemes to ensure consistent water supply for crops during dry spells.
- Capacity Building: Provide training to farmers on climate-smart agricultural practices, soil conservation, and pest management.
- Weather Information: Improve access to weather information and early warning systems for farmers to enable timely decision-making.

5.2.2 Water Resources Management

- Water Harvesting: Encourage the construction of rainwater harvesting systems for domestic and agricultural use.

- Wetland Conservation: Protect and restore wetlands to maintain water quality, regulate water flow, and support biodiversity.
- Sustainable Groundwater Use: Promote sustainable groundwater management to ensure the availability of clean and reliable water sources.
- Infrastructure Resilience: Retrofit and build resilient water infrastructure to withstand extreme weather events.

5.2.3 **Health and Public Health**

- Disease Surveillance: Strengthen disease surveillance systems, particularly for climate-sensitive diseases like malaria, and develop rapid response mechanisms.
- Health Education: Conduct community health education campaigns on climate-related health risks and preventive measures.
- Healthcare Infrastructure: Upgrade healthcare facilities to handle increased cases of climate-related health issues and ensure the availability of essential medicines.

5.2.4 **Infrastructure and Urban Planning**

- Climate-Resilient Roads and Bridges: Design and construct climate-resilient roads, bridges, and drainage systems to withstand flooding and landslides.
- Urban Planning: Incorporate climate resilience into urban planning, including zoning regulations and floodplain management.
- Erosion Control: Implement erosion control measures to protect critical infrastructure and public spaces.

5.2.5 **Livelihoods and Employment**

- Alternative Livelihoods: Support the development of alternative livelihoods, such as eco-tourism, beekeeping, and sustainable forestry, to reduce dependence on climate-sensitive activities.
- Microfinance and Skill Development: Facilitate access to microfinance and skill development programs for climate-resilient livelihoods.
- Market Access: Strengthen market linkages and value chains for locally produced goods and services.

5.2.6 **Education and Awareness**

- Climate Change Education: Integrate climate change education into the curriculum at all education levels to raise awareness and build climate literacy.

- Teacher Training: Provide teachers with training on climate change topics to effectively deliver climate education.
- Community Awareness: Conduct awareness campaigns on climate change adaptation and mitigation among community members.

5.2.7 **Energy Sector**

- Renewable Energy: Promote the adoption of renewable energy sources, such as solar and wind, to reduce greenhouse gas emissions and enhance energy security.
- Energy Efficiency: Encourage energy-efficient practices and technologies to reduce energy consumption in households, industries, and public institutions.

6 CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Comprehensive Participatory Climate Risk Assessment conducted across all 45 wards of Kisii County has been a pivotal step towards understanding and addressing the unique climate challenges and vulnerabilities faced by our communities. Through active engagement, local knowledge, and collaborative efforts, key climate risks and adaptation opportunities have been identified that will inform the development of resilient strategies. This inclusive process not only empowers our communities but also lays a strong foundation for a more climate-resilient and sustainable future for Kisii County.

6.1.1 Hazard profile

Kisii County has recently experienced climate change, such as unpredictable rainfall patterns, untimely onset and cessation of seasonal rainfall, frequent and prolonged dry spells, increased daytime temperatures, extreme rainfall events, and the disappearance of natural water sources. Following the analysis of the hazard map and seasonal calendar, the representative community members identified, prioritized and ranked the following hazards across the county in the following order of impact and magnitude; prolonged dry spells, floods, landslides, hailstones, epidemics (livestock and human diseases), thunderstorms, water pollution and strong winds. The community described the differentiated impacts of the past and current climate trends and risks on the different key interest groups in the county, with a particular focus on women, youth, ethnic minorities, people living with disabilities and other marginalized and vulnerable groups.

6.1.2 Likely Future Impacts

The projected weather extremes are likely to cause more floods, destruction of infrastructure, increased soil erosion, increase in pests and diseases, increased incidences of malnutrition cases and displacement of people, water shortages, loss of lives, destruction of crops and property, increase in farming costs, direct and indirect effects on the health of animals and plants both terrestrial and aquatic, high incidences of food insecurity including household energy insecurity. It is widely reported that dry spells, extreme rainfall, moisture stress, and heat stress are the climatic hazards in Kisii County that will affect agricultural value chain commodities in the County as the main risk.

6.1.3 Existing Adaptation and Resilience Strategies

Although all households in a community are exposed to risks and adverse impacts associated with climate change and could be rendered vulnerable, some households or individuals are most at risk: people living with disabilities, youths, women, and older people. Although the causes of vulnerability to climate change impacts are multi-dimensional, the most important include food insecurity, poverty, recurrent droughts, land degradation, inequitable land distribution, and dependence on rain-fed agriculture. Other issues noted to also undermine adaptive capacity and thus exacerbate vulnerability at the household level, like sociocultural factors such as

beliefs, practices, and values. Related problems include a lack of access to important natural resources such as land and water; inadequate social services; a lack of markets; poor infrastructure, including roads and storage facilities; insufficient access to information, including skills, knowledge, and data; suboptimal access to credit services; weak institutional arrangements; a lack of empowerment to participate in political processes: environmental degradation; and the loss of employment opportunities.

6.1.4 Hazard ranking

Following the analysis of the hazard map and seasonal calendar, the representative community members identified, prioritized and ranked hazards across the county in the following order of impact and magnitude as prolonged dry spells, floods, landslides, hailstones, epidemics (livestock and human diseases), thunderstorms, water pollution and strong winds.

6.2 Challenges

- Limited Awareness and Climate Knowledge: Many community in Kisii County have limited awareness and understanding of climate change, making it challenging to engage them effectively in the PCRA process.
- Resource Constraints: Limited financial and human resources may hinder the implementation of PCRA activities, including training, data collection, and community mobilization efforts.
- Data Availability and Quality: Access to climate data, historical records, and local information is still limited. The County should ensure the availability of accurate and up-to-date data which is crucial adaptation response.
- Conflicting Priorities: Balancing climate adaptation efforts with other pressing community needs and priorities is challenging, especially in resource-constrained environments where County Governments of Kenya operates.

6.3 Opportunities

- Local Knowledge and Traditional Practices: Leveraging the local knowledge and traditional practices of communities provides valuable insights into climate impacts and adaptation strategies.
- Community Ownership: Engaging communities in the PCRA process has fostered a sense of ownership and empowerment, increasing the likelihood of successful adaptation strategies.
- Climate Finance and Partnerships: Through the outcome of PCRA process, Kisii County can explore opportunities for accessing climate finance mechanisms and forming partnerships with NGOs, research institutions, and development agencies to support PCRA efforts.
- Integration with Existing Plans: Integrating PCRA findings into existing development plans, such as county development plans (2023-2027) or agriculture and water resource management strategies, can help ensure that adaptation measures are prioritized and implemented.
- Data Technology: Utilize advancements in data technology, such as Geographic Information Systems (GIS) and remote sensing, to improve data collection and analysis processes.

- Awareness Campaigns: Conduct climate change awareness campaigns to inform and educate communities about the importance of PCRA and climate adaptation.
- Ecosystem-Based Approaches: Kisii County can explore ecosystem-based adaptation strategies that leverage the natural environment to enhance resilience, such as reforestation and wetland restoration in Nyamataro, Gucha and Mogonga etc.
- Knowledge Sharing: Encourage knowledge sharing and learning among communities and stakeholders to facilitate the exchange of best practices and lessons learned.

6.4 Cross cutting County level recommendations

The participatory Climate Risk Assessment conducted in Kisii County has provided valuable insights into the climate vulnerabilities and adaptation needs of the region. To address these challenges effectively, it is essential to consider cross-cutting county-level recommendations that can guide climate action and resilience-building efforts. Addressing these challenges and capitalizing on the opportunities will be critical for the successful implementation of PCRA in Kisii County. An inclusive and community-centered approach, combined with strategic partnerships and targeted capacity building, can help overcome challenges and maximize the benefits of participatory climate risk assessment.

- Agriculture, Health and Energy sectors are the priority sectors for climate action investments.
- Mainstream Climate Adaptation: Integrate climate adaptation considerations into all county-level development plans, policies, and strategies to ensure that climate resilience is a fundamental aspect of decision-making. County contingency plans should ensure that the main hazards identified in the exercise are incorporated in the Current County and sub-county development plan to be shared with key development partners working in the area.
- Capacity Building: Invest in capacity-building programs for county officials, community leaders, and stakeholders to enhance their understanding of climate change impacts and adaptation strategies. Formation of the CMDRR groups in all 45wards as it is vital for disaster management in these communities.
- Community Engagement: Promote continuous community engagement and participation in climate resilience efforts to ensure that adaptation measures are locally relevant and owned by the communities. All development/emergency partners working in the County should systematically ensure inclusion of all special interests' groups (persons with disabilities, people living with HIV and AIDS, drug users, other marginalized groups such as homosexual men and women) in their long-term programming. This would ensure that special needs are catered for and help in addressing stigmatization and disempowerment issues.
- Data and Information Management: Improve data collection, management, and dissemination systems to provide timely and accurate climate information to support decision-making at all levels. Early warning systems should be assessed

to ensure that key information is accessed by all people. The lead agency is the Kenya meteorological department.

- Ecosystem-Based Adaptation: Encourage the implementation of ecosystem-based adaptation (EbA) strategies, such as wetland restoration and afforestation, to enhance resilience while also benefiting biodiversity and ecosystem services.
- Infrastructure Resilience: Retrofit and design critical infrastructure, including roads, bridges, and water supply systems, to withstand extreme weather events and changing climate conditions.
- Climate-Resilient Agriculture: Promote climate-smart agricultural practices, crop diversification, and the use of drought-tolerant varieties to enhance food security and rural livelihoods. The Sub-counties livestock and agriculture offices in the area should encourage timely vaccinations; and support household food security through promotion of irrigation and cultivation of prolonged dry spells resistant crops. Prior to and during prolonged dry spells, continuous vaccination of animals should be encouraged to prevent disease outbreaks
- Water Resource Management: Implement sustainable water resource management practices, including watershed protection and groundwater monitoring, to ensure a reliable and clean water supply. Kenya Wildlife Service should closely work with communities prone to human wildlife conflicts and support the fencing of water points in the community. Alternative water points for wildlife should be created to minimize human/wildlife contact and KWS should explore special strategies to tackle situations of prolonged dry spells and flood which bring animals and humans closer together. KWS should investigate possibilities for education programmes for school-age children related to wildlife awareness.
- Healthcare and Public Health: Strengthen healthcare systems to cope with climate-related health issues and improve community health education on climate-sensitive diseases and prevention. Health partners should support the Ministry of Health in stocking of sufficient drugs for malaria and hold periodic malaria control campaigns in the community and distribute ALs to pregnant women and children especially during floods.
- Disaster Preparedness and Response especially for agricultural sector: Develop and regularly update disaster preparedness and response plans, ensuring coordination among relevant agencies and timely assistance to affected communities during climate-related emergencies.
- Cross-Sectoral Collaboration: Promote collaboration among various sectors, government agencies, NGOs, and development partners to leverage resources and expertise for climate resilience initiatives.
- Climate Financing: Explore opportunities for accessing climate finance mechanisms and grants to fund adaptation projects and capacity-building activities.
- Monitoring and Evaluation: Establish a robust monitoring and evaluation system to track the progress and effectiveness of climate adaptation initiatives, enabling adjustments as needed.

- Public Awareness and Education: Conduct climate change awareness campaigns and education programs to empower residents with knowledge and encourage climate-resilient practices.
- Policy Advocacy: Advocate for supportive national and regional climate policies that align with Kisii County's adaptation goals and priorities. Given the growing body of knowledge illustrating the receptivity of children to disaster risk reduction, efforts should be made to replicate successful schools DRR programmes.

REFERENCES

1. Dazé, A., Price-Kelly, H. & Rass, N. (2016). Vertical integration in National Adaptation Plan (NAP) processes: A guidance note for linking national and sub-national adaptation processes. International Institute for Sustainable Development (IISD). https://napglobalnetwork.org/wpcontent/uploads/2016/11/Vertical-Integration-in NAP-Processes-Guidance-Note.pdf
2. D'Alessandro, S., Caballero, J., Simpkin, S., & Lichte, J. (2015). Kenya agricultural risk assessment. *October. https://bit. ly/2RnCyhP*.
3. Dixit, P. N., Cooper, P. J., Dimes, J., & Rao, K. P. (2011). Adding value to field-based agronomic research through climate risk assessment: A case study of maize production in Kitale, Kenya. *Experimental Agriculture*, *47*(2), 317-338.
4. Kisii County Climate Change Policy, 2019.
5. Kisii County Climate Change Act, 2021.
6. Kisii County Climate Change Fund Regulations 2021
7. Kisii County Climate Change Adaptation Plan, 2021
8. Kisii County Integrated Development Plan 2023-2027
9. Kwena, K., Ndegwa, W., Esilaba, A. O., Nyamwaro, S. O., Wamae, D. K., Matere, S. J., ... & Kibue, A. M. (2015). Climate Change Adaptation Planning in Kenya: Do Scientific Evidences Really Count?. *Adapting African Agriculture to Climate Change: Transforming Rural Livelihoods*, 35-42.
10. Mugwika, P. K. (2019). *Assessment of the Impacts of Climate Change and Variability on Food Security in Kenya: A Case Study of Kisii County* (Doctoral dissertation, University of Nairobi).
11. Nyaiyo, N. M., Mamboleo, D. M., & Nyantika, D. (2021). Analysis of trends of temperature and rainfall variations and tea yields from 1995 to 2019 in Kisii County, Kenya. *Journal of African Studies and Ethnographic Research*, *3*(3).
12. Republic of Kenya. (2016). Kenya National Adaptation Plan 2015-2030. Enhanced climate resilience towards the attainment of Vision 2030 and beyond.
13. Republic of Kenya. (2016). The Climate Change Act.
14. United Nations Framework Convention on Climate Change (UNFCCC) (n.d.a). Introduction to climate finance. https://unfccc.int/topics/climate-finance/the-big-picture/introduction-toclimate-finance
15. United Nations Framework Convention on Climate Change (UNFCCC) (n.d.b). NDC spotlight. https://unfccc.int/process/the-paris-agreement/nationally-determined-contributions/ndcspotlight
16. United Nations Framework Convention on Climate Change (UNFCCC) (n.d.c). What do adaptation to climate change and climate resilience mean?
17. Van Aalst, M. K., Cannon, T., & Burton, I. (2008). Community level adaptation to climate change: The potential role of participatory community risk assessment. Global environmental change, 18(1), 165-179.
18. World Bank Climate Knowledge Portal-Kenya https://climateknowledgeportal.worldbank.org/country/kenya.